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NEW ECONOMIC GEOGRAPHY
AND ALTERNATIVE CONCEPTIONS
OF PRODUCTIONAL AGGLOMERATION

Abstract

Essence of the term «agglomeration» is considered. The paradigm of «new economic geography» is presented in the aspect of different agglomeration forms. The alternative theories of agglomeration are analyzed.

Key words:

Agglomeration, new economic geography, new trade theory, increasing returns, home market effect, circular causation, centripetal and centrifugal gravity forces, Porter's Diamond.

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Introduction

Global economic crisis shows vividly the problems of not optimal Ukrainian industrial structure of production. Today we observe closed mono-sectored domestic economy, which traditionally depends on the available natural re-

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sources. Just now there is a great need to create the new industrial structure that respond to current realities.

Economists' researches confirm that the most advantageous use of production factors is achieved under the conditions of agglomeration. But traditional forms of agglomeration are gradually losing their comparative advantage. Being rather «clumsy» structures, they are not always able to respond to rapid changes of global environment, which is especially noticeable in the light of the recent crisis events. Adverse conditions at the energy market have led to the bankruptcy of the large number of firms – centres of large agglomeration alliances. It set the poverty for many people living in monoidustrial mining or steel cities.

Obviously, Ukrainian industry has to create new cooperative network that would facilitate mutually beneficial cooperation, diffusion of innovation and the benefits of agglomeration. Therefore, this article aims to summarize the main theoretical portfolio devoted to the concentration of industrial activity that helps to understand in which direction to encourage the development of existing agglomerations.

1. Essence of agglomeration

A term «agglomeration» results from Latin «*agglomeratio*» (to join, to accumulate) and used in economic, technical and biological sciences. In economic literature an agglomeration is examined mainly in two aspects:

- **an urban agglomeration** is the compact territorial placing of city settlements, incorporated intensive economic, labour and cultural copulas [1]. An urban agglomeration can be monocentric (formed around one city-core), sometimes it acquires the hypertrophied form of megapolis (super-city); and can be polycentric (on the basis of a few connected equivalent cities). Such type of agglomeration without dominant core is also called «Conurbation» (from lat. *con* – together and lat. *Urbus* – city) [2];

- **an industrial agglomeration** is a territorial concentration of sectorial and diversified industrial centres on comparatively small area. [2] Like the previous form, industrial agglomeration could concentrate around one industrial unit (common for cities of the former Soviet Union or Scandinavian «bruks») or consists of a number of interrelated equal links.
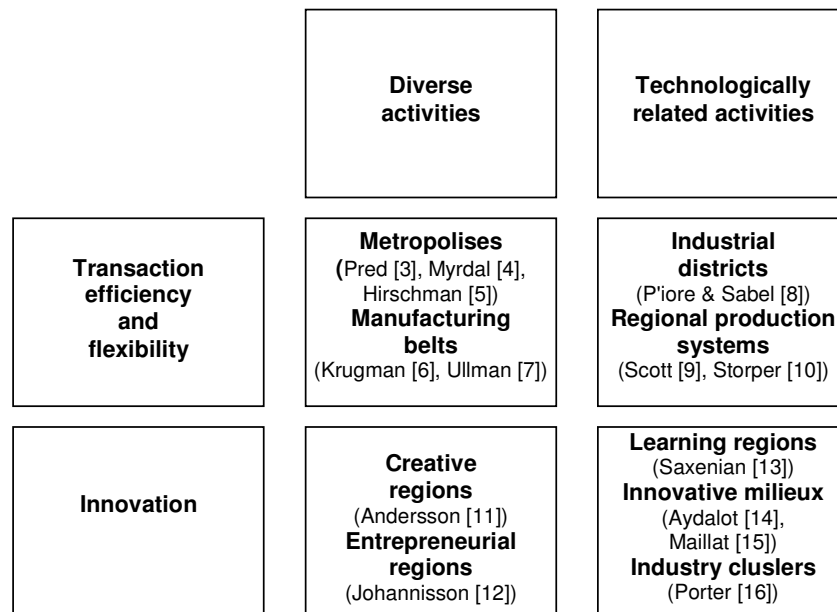
However, as it has been said before, advanced forms of agglomeration alliances have raised in recent decades. The main feature of them is visibly innovative orientation. These types of knowledge generation centres can occur in the form of clusters (localization effect) or technopolices (urbanization effect). It

should be noted that in the academic literature, there is a debate about whether specialized regions with clusters perform better, or whether diverse city-regions, offering a multitude of skills, technologies, political and academic institutions, cultural inspiration and so forth are more conducive to innovation and upgrading.

On Figure 1 the basic forms of agglomeration and their leading theorists are presented.

Figure 1.

Types of agglomeration forms

	Diverse activities	**Technologically related activities**
Transaction efficiency and flexibility	**Metropolises** (Pred [3], Myrdal [4], Hirschman [5]) **Manufacturing belts** (Krugman [6], Ullman [7])	**Industrial districts** (P'iore & Sabel [8]) **Regional production systems** (Scott [9], Storper [10])
Innovation	**Creative regions** (Andersson [11]) **Entrepreneurial regions** (Johannisson [12])	**Learning regions** (Saxenian [13]) **Innovative milieux** (Aydalot [14], Maillat [15]) **Industry cluslers** (Porter [16])

Source: [17, 18].

However in the real economy all these forms of agglomeration interlace closely, mutually complementing each other and exposing only the different sides of process of economic, social, scientific, cultural resources concentration. In Annex, the factors which conduce to appearance of such groupments have complex character; that is why development of theoretical models of urbanization, for instance, cannot be full without considering of an industrial concentration and vice versa. Taking into account abovementioned factors, in this article the author will examine agglomeration in more wide meaning, understanding

under it *the form of geographical concentration of production industries and various resources (labour, investments and information)*[19] and will try to present issues common for most theoretical models. However a basic accent will be devoted to the industrial agglomeration.

2. New economic geography

Presumably, the most integral paradigm which explains the origin of agglomeration is conception of «new economic geography» (NEG) which was formed in 1991 after the publication of two P. Krugman's works «Increasing Returns and Economic Geography» [20] and «Geography and Trade» [21]. Interestingly, that main issues typical for NEG, were presented in researches of A. Weber [22], W. Christaller [23] and A. Lösch [24] – the representatives of German school of economic geography – yet at the beginning of XX century (see Annex I). This fact leads to a little bit ironical phrase of Peter Neary in the Journal of Economic Literature: «New economic geography has come of age» [25]. But for the sake of justice, it is necessary to mark that conception of NEG evolved from the new theory of trade, but not from these early attempts of agglomeration's explanation.

Subsequent consideration of theoretical models of agglomeration will be carried out by means of analysis of five core NEG elements.

1. **Increasing returns to scale**. The stronger is the effect of increasing returns, the more stimuli to the agglomeration arises up. Firms try to decrease their costs by enlargement of production and placing alongside with major suppliers, that brings to the concentration productions in a few industrial centres; other territories become agrarian periphery. Increasing returns has complex nature; it is well illustrated at the table 1.

Internal economies arise from the larger size of a plant to better exploit fixed costs.

External economies are synonymous with «agglomeration economies», which include the benefits of localization (being near other producers of the same commodity or service) and urbanization (being close to producers of a wide range of commodities and services). [26] Empiric researches show that localization is more beneficial for development of heavy industry, and urbanization – for light [27].

Modern conception of agglomeration arose up from the combination of various models and paradigms on the basis of scale economies (it is necessary to mark, that NEG takes into account the internal effect of scale only). Basic directions of economists' researches and the key publications are presented in Table 2.

Table 1

A dozen economies of scale

Type of economy of scale			Examples
Internal	1. Pecuniary		Being able to purchase intermediate inputs at volume discounts.
	Techno-logical	1. Static techno-logical	Falling average costs because of fixed costs of operating a plant.
		2. Dynamic technological	Learning to operate a plant more efficiently over time.
External or agglomeration	**Localization** — Static	3. «Shopping»	Shoppers are attracted to places where there are many sellers.
		4. «Adam Smith» specialization	Outsourcing allows both the upstream input suppliers and downstream firms to profit from productivity gains because of specialization.
		5. «Marshall» labor pooling	Workers with industry-specific skills are attracted to a location where there is a greater concentration.
	Localization — Dynamic	6. «Marshall-Arrow-Romer» learning by doing	Reductions in costs that arise from repeated and continuous production activity over time and which spill over between firms in the same place.
	Urbanization — Statics	7. «Jane Jacobs» innovation	The more that different things are done locally, the more opportunity there is for observing and adapting ideas from others.
		8. «Marshall» labor pooling	Workers in an industry bring innovations to firms in other industries; similar to no. 6 above, but the benefit arises from the diversity of industries in one location.
		9. «Adam Smith» division of labor	Similar to no. 5 above, the main difference being that the division of labour is made possible by the existence of many different buying industries in the same place.
	Urbanization — Dynamics	10. «Romer» endogenous growth of	The larger the market, the higher the profit; the more attractive the location to firms, the more jobs there are; the more labor pools there, the larger the market — and so on.
	11. «Pure» agglomeration		Spreading fixed costs of infrastructure over more taxpayers; diseconomies arise from congestion and pollution.

Source: [26]

Table 2

Theoretical revisions on the basis of scale economies

Direction of research	Basic moments	To the key of publication
Theory of industrial organization 1970s	Increasing returns to scale and imperfect competition can be incorporated into formal economic models	Spence 1976 [28]; Dixit and Stiglitz 1977 [29]
Urban economics, 1970s	External economies within cities and systems of cities; different levels of agglomerations are related to city functions	Mills 1973 [30]; Diamond and Mirrless 1973[31]; Henderson 1974 [32]
New theory of trade 1980s	Increasing returns and imperfect competition explain intraindustry trade between countries with similar endowments; initial endowments may, through trade and specialization, influence the long-run rate of growth; trade unleashes forces of both convergence and divergence	Krugman 1980p. [33], 1981p.[34] Ethier 1982 [35], Helpman and Krugman 1985 [36], Grossman and Helpman 1995 [37]
New economic geography 1990s	Increasing returns-to-scale activities are characterized by agglomeration and imperfect competition, while constant returns-to-scale activities remain dispersed and competitive, helping to explain spatial distribution of economic activity and growth of cities	Krugman 1991 [20], Fujita, Krugman and Venables 1999 [38], Henderson 2000 [39]
Theory of endogenous growth 1980s	Perfect competition and knowledge-related or human capital–related externalities imply aggregate increasing returns and explain why growth rates may not fall over time and why wealth levels across countries do not converge	Romer 1986. [40], Lucas 1988 [41].
Theory of endogenous growth 1990s	Imperfect competition explains why the incentive to spend on R&D does not fall, and knowledge spillovers explain why R&D costs fall over time, resulting in more and better products that fuel growth	Romer 1990 [42], Grossman and Helpman 1991 [43], Aghion and Howitt 1992 [44].
Theory of endogenous growth 2000s	Imperfect competition and Schumpeterian entry and exit of firms, with entrants bringing new technologies, explain how a country's growth and optimal policies vary with distance to the technology frontier; knowledge accumulation in cities leads to growth	Aghion and Howitt 2005 [45], Rossi-Hansberg and Wright 2007[46], Duranton 2007 [47]

Source: [26]

Differences between the internal and external effect of scale are rather important because of the fact that under external economies a perfect competition is possible (influence of each firm might be so small, that it can be ignored in relation to average costs). Under internal economies a perfect competition is impossible. If industry consists of negligible quantity of large firms, there is strategic interdependence between them; firms realize that they can influence on prices, and consequently a model of internal effect of scale is the model of imperfect competition (it is the second of principle moment of NEG)

2. **Imperfect competition.** At the increasing internal returns to scales, marginal costs are lower, than average, and a perfect competition is impossible consequently because firms will not manage to cover the charges [48].

In economic geography among all forms of market structures the special attention is paid to monopolistic competition (alternative models are although developed). First conception of monopolistic competition is developed in 1933 by E. Chamberlin [49] and foresees four suppositions:

- Firms sell similar commodities which however are not perfect substitutes (commodities are differentiated);

- Each firm produces one variety of commodity at the terms of increasing returns and sets a price on it;

- The quantity of firms in certain industry is so large, that none of them has a sufficient influence on a general situation in industry;

- A free entrance and exit of firms, it means that profit equals a zero.

The ideas of Chamberlin got new life, when in 1977 Dixit and Stiglitz [29] managed to develop the mathematical model of general equilibrium which can be utilized in various economic researches. Actually involving the Dixit-Stiglitz framework of monopolistic competition to the conception of economic geography, P. Krugmanu succeeded to form integral logical model which explains appearance of agglomeration [20]

3. **Trade costs**. While selling goods or purchasing raw materials firm carry Annexal charges on transportation, pay tariffs and so on. Transporting of products in the model of NEG has a form of Samuelson's «iceberg». It means that from a unit of the transported commodity only the particle τ arrives to the destination ($\tau < 1$).

High transport costs (especially in combination with the weak increasing returns) force the producers to spread their firms according to the users' location. But such parameters were typical for economy before the invention of railway transport and before beginning of industrialization (for example, for Europe of XVI age). During that time the bulk of population was busy in agriculture, and small business and production enterprises took place in little cities, which had approximately a hexagonal form as in the models of German school representatives (Annex I) [20].

But with development of society, the particle of agrarian commodities and services in general charges becomes rather small, large enterprises are created, transport costs are diminished. All of these factors reduce attachment of production to the placing of users and conduce to agglomeration appearance. Territories which are not able to create favourable terms for the concentration of industry become the so-called «transit deserts».

4. **Endogenous firm locations.** Increasing returns means that firms have an incentive to select a single production site and serve most consumers at a distance. If plant-level fixed costs were negligible, the firm would replicate itself everywhere [48]/

Ingredients 1–4 all appeared in the new trade literature, and in particular gave rise to the «home market effects» identified in Krugman (1980) [33]. According to this conception, under the increasing returns, the production of the differentiated goods will grow relatively quicker, than demand, if a firm will be disposed in a region with the greater market size. It means that large countries or agglomeration alliances become the net exporters of the differentiated commodities, not by means of the comparative advantages (as in the neoclassical trade theory), but by means of increasing effect. In the real economy trade costs are constantly diminished because of transport and communication development. In Annex there is a permanent decline of tariffs because of entering of most countries into World Trade Organization. The home market effect is becoming even stronger with these assumptions; agglomeration can arise but only through the magnification of initial region size asymmetries. The key innovation of NEG relative to new trade is assumption 5. Without 5, symmetric initial conditions can be expected to lead to symmetric outcomes.

5. **Endogenous placing of demand.** Before the consideration of the last moment of NEG, it is necessary to mark, that elements which were analysed higher are general for the wide spectrum of modern literature, incorporated under the general name «*new trade theory*». But this last aspect became critical for NEG. With all five assumptions, initial symmetry can be broken and agglomerations can form through a process of circular causation [48].

Consequently, the key issue of new economic geography can be formed as follows: *if the symmetric territorial location of firms and population takes place, will be there a certain mechanism which would result in the spontaneous concentration of economic activity?* And if does it exist, what are the basic parameters that determine the appearance of such concentration? Under such conditions, actually geography does not play a key role.

In the model of NEG two mechanisms for the mobility of demand have been proposed: mobile workers who consume where they work and firms that require the outputs of their sector as intermediate inputs.

Krugman (1991) argues that a labour market characterised by a high enough level of interregional migration encourages firms and workers to cluster together during a process of integration and in the presence of IRS and trade

costs. However, this mechanism only seems to fit a scenario with regions belonging to one single country; with reference to the EU, it appears to be barely notable since the readiness of continental workers to move away is very low.

Venables (1996) finds that vertical links among industries can lead to geographic concentration. His paper employs a monopolistic competition market structure with upstream and downstream sectors and shows that the interaction of firms belonging to vertically linked industries can play an equivalent role to labour migration in Krugman in determining endogenously the pattern of location.

Puga (1999) confirms these results, combining in a general framework the interregional migration à la Krugman and the vertical links among industries à la Venables (1996), and Krugman and Venables (1995); the distribution of workers across sectors enters endogenously into the model. As the assumption of labour mobility is relaxed, the non-monotonic relationship between integration and agglomeration becomes U-shaped, implying that firms tend to be newly dispersed for low trade costs. Puga's results are in contrast with most of the literature, which finds a single critical value of trade costs, below which the manufacturing sector develops a core-periphery pattern across the two countries. According to the latter view, the diagrammatic relationship between trade costs and geographic concentration is bifurcate (Annex B).

Between considered higher the fourth and fifth elements of NEG there are tight forward and backward linkages:

- to minimize costs related to placing, firms choose location with high internal demand or with easy access to the large market («*backward linkage*»);

- great internal demand will exist in that place, where most firms are situated («*forward linkage*»).

If an agglomeration was already formed, there are forces which continue to retain it in integrity. Really, when consumers move into a region, they bring enterprises with them because of increased demand. As a result, agglomeration advantages accrue in the region, since enterprises can access intermediate products and consumer goods more cheaply because there are no transport costs. Falling prices mean real income increase, and this in turn leads to further immigration. The synergic effect of *«circular causation»* takes a place, presented on Figure 2. By analogy with the Myrdal's model [4], we can define «vicious» and «*benign*» circles – the region, where productive factors are accumulated initially, due to gravity forces becomes even more concentrated, other regions grow into agrarian periphery and «transit desert».

Figure 2.

Circular Causation through linkage effects
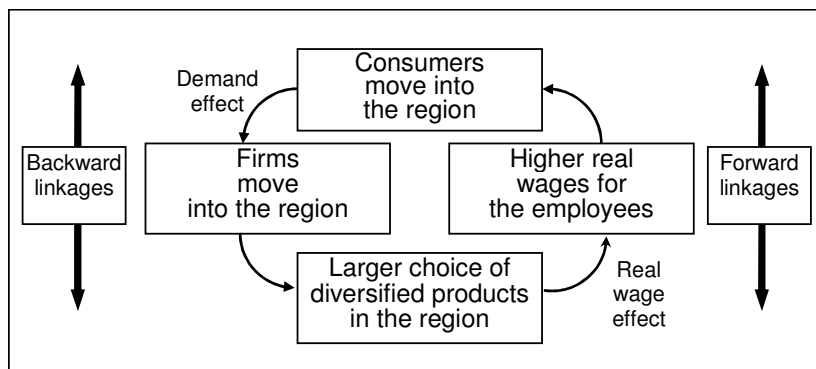
Source: [52]

Consequently, it is possible to select the followings gravity forces which influence on agglomeration's formation:

1. Centripetal forces – instrumental in the agglomeration of production:

- increasing returns;

- low trade costs;

- effects of market size (*backward and forward linkage*);

- agglomeration of labour-market (especially highly skilled workers);

- other advantages of concentration (the closeness of placing improves technological exchange).

2. Centrifugal forces – cause dispersion:

- weak scale economies;

- high trade costs;

- immobility of some factors (a production is forced to locate wherein there is needed land and natural resources, and sometimes even workers);

- land rent (if firms are concentrated on one territory, land demand grows increasing rent);

- other drawbacks of concentration (overpopulation, crime and so on) [52].

P. Krugman offered a simple schematic model which allows understanding better agglomeration processes. Let there are a few (for example, six) regions, each of which will be modelled as a point; and the world is one-dimensional, i. e., the regions are laid out in a line. As it will be desirable to maintain symmetry, P. Krugman assumes that regions are laid out in a circle (Fig. 3).

Figure 3.

Location of regions in the model of Krugman
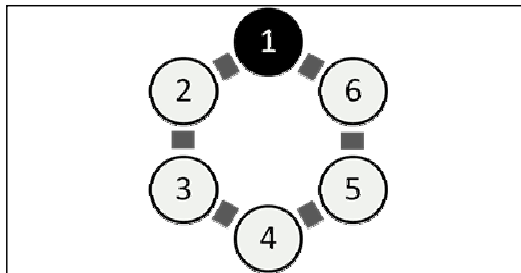
Source: [20].

Regions are characterized by identical tastes and technologies, each has one sixth of rural population (it is assumed that farmers are immobile between the regions), an industrial production can be carried out in any region. However when manufacture is shipped particle $(1-\tau)$ is lost on a way, thus, if a commodity is transported from, say, region 1 to 4, only the particle τ^3 arrives to destination.

How will a long-term equilibrium look like in this case? Obviously, production can be evenly spread among all regions. The second variant of development is reverse – all manufacturers are concentrated in a single «metropolis», as it is seen on Figure 3 (with a dark circle). However intermediate variants are also possible. Consider in particular a case, represented on Figure 4 (ignoring an arc for the moment). Two «centres» were formed in economy: regions 1 and 4, each of which has «hinterland» of two rural regions.

Which type of equilibrium will develop depends, evevidently, from the parameters of economy. Very low transport costs, e.t.c. result in a situation, represented on Figure 3; too high – to dispersion of production; intermediate parameters – to the intermediate variants.

Certainly, it is only caricature on the real economic geography; however Krugman managed to shed new light on an old question of economy. In particu-

lar what are the effects of economic integration, especially when a small country integrates with large? Neoclassical traditionally argues that benefit from trading in both commodities and factors get both countries. Critics, from F. Graham [53] (1923), prove that a small country will be flooded with commodities, made in sectors with the high level of increasing returns. A discussion became yet more vague because of uncertainly about how to model increasing returns.

Figure 4.

A symmetric concentration of production in two regions
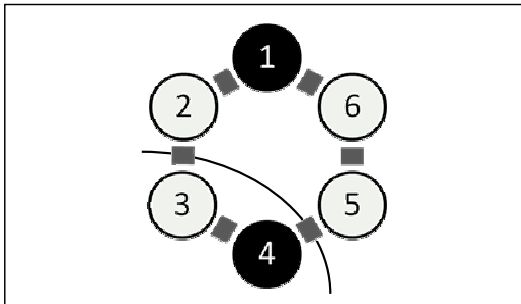
Source: [20].

P. Krugman however developed a model examines this problem under the new point of view. A small country is not consists, usually, from small regions, it consists of fewer regions. It is necessary only to find out as these regions will fit in a new economic group.

Consider Figure 4 again. Let six regions belong to two countries – the first country consists of regions 1, 2, 5, 6, and second from regions 3 and 4 (a border between countries on Figure is marked with an ark). Assume preliminary, that political situation and features factors mobility was folded so, that the regional structure of countries was formed independently. In a large country a metropolis was historically set in a region 1, and in small – in a region 4.

Assume now, that liquidation of trade barriers happened between countries. Two ways of development are possible. The first takes place according to the scenario of Graham (so-called «Canadian nightmare»): greater metropolis in a region 1 will attract all producers to itself, abandoning a small country agrarian periphery. Other variant of development – achievement of equilibrium as this is rotined on Figure 4. That the metropolis of small country will broaden as a result of integration due to access to new «hinterland».

# 3. Alternative theories of agglomeration

As it was already mentioned before, NEG is the basic theory of agglomeration; however it's impossible to take into account all the issues of such complex phenomenon. Each agglomeration form has its own features.

Actually, in the models of urbanization, the key question is effective use of land. In fact the amount of land rent differs considerably in the centre of mother country and in its periphery. It is important to take into account a lot of social aspects also, such as a struggle against poverty, overloading of transport ways, criminality and others. One of examples of «vicious circle» in an urbanization theory is that tendency of poor men to settle near one another (in so called ghetto) only strengthens their poverty.

Forming of innovative models of agglomeration (for example clusters) – a process is rather difficult and heterogeneous, that is why the separate aspects of their becoming can be explained various, often even by means of opposite theoretical conceptions. For better illustration of it, we will conduct the short theoretical analysis of cluster association in the cut of its life cycle stages (Fig. 5).

Figure 5.

Life cycle of cluster
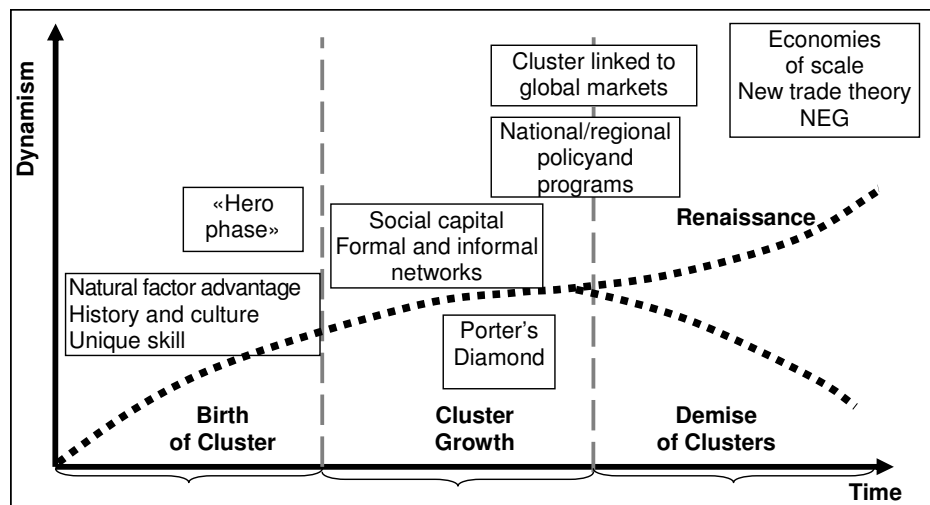
Source: formed by author on the basis of [17: 22].

A push for cluster creation can be given by certain natural advantages (beds of ore, transport ways, climate) or by presence of special demand or skills within the region [54]. Successful activity of separate enterprise can become other typical stimulus, so as early period is often marked by activity of only one or a few persons – so-called «heroes» of cluster. In the modern economy, the university often plays the role of the «brain trust» on which emerging clusters thrive. (especially typical for the USA). Clusters can be created as a result of governments' regional policy. In Dubai, Saudi Arabia, Korea, China, and other parts of the Middle East and Asia we can witness very visible government hands at work in cluster development, whereas in the Anglo-Saxon world it tends to be more invisible, at least as a direct cluster policy or program [17]. The early stage is fully written into the classic scopes of theory of comparative advantages.

Once the cluster reaches critical mass and starts to grow, there is often a strong cumulative process, or path dependence, that locks in the cluster. A cluster can consist of plenty of shallow companies, but more frequent there prevail one or few powerful firms («*anchor firms*»). For example, the kernel of Silicon Valley builds Intel, Hewlett Packard, Varian, Shockley Transistor and Fairchild, which created hundreds of branches. Porter Diamond concept plays important role in determination of cluster competitiveness on the stages of becoming and maturity (Figure 6).

Figure 6.

Porter Diamond
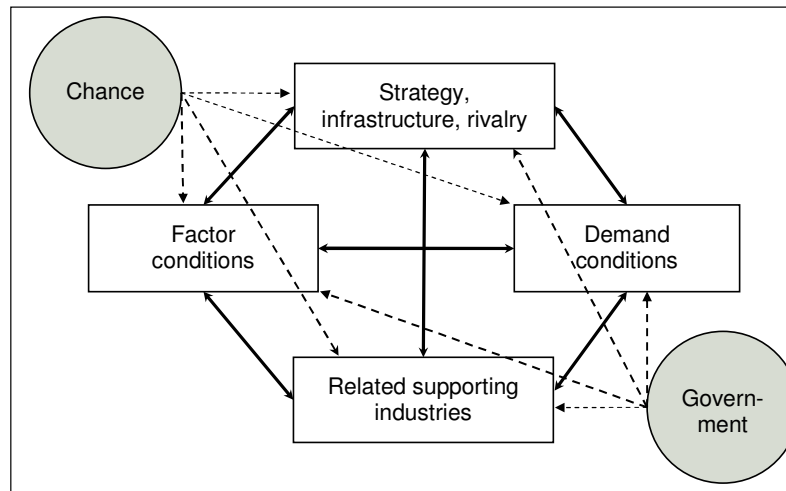
Source: [54].

While growing, cluster joins in the process of international competition at the market of factors (bringing in of new companies, labour force, and capital) and commodities. On this stage the effect of scale economies will play greater role, and consequently the paradigm of new economic geography is become central.

Now we will consider in thesis some other alternatives of NEG:

Natural advantages (see Ellison and Glaeser [55], [56]) – also known as «First Nature» (Krugman, 1993) and «locational fundamentals» (Davis and Weinstein, 2002) – take the geographic distribution of productive resources as exogenous and use it to explain the geographic distribution of production.

Human capital externalities models link the return to skill in a location to the number of skilled workers there. High skill areas tend to attract larger numbers of employers of skilled workers. Marshall [57], Formal models were developed by Krugman and Helsley and Strange [58]. Human capital externalities are central in Lucas' (1988) theory of economic development [41].

Technological externalities/Knowledge spillovers: Producers benefit from spatial proximity of their counterparts in the same industry via flows of productive knowledge [48].

From the materials presented above it is possible to understand how rapidly modern spatial economic theory is developing. Not strange that P. Krugman – the basic ideologist and populizator of such concepts – awarded in 2008 with a Nobel Prize. Each year the processes of economic agglomeration become more stronger, that is why in order to avoid bitter fait of «transit desert» it is necessary to take into account theoretical and practical recommendations of new economic geography concept.

Annex A

Evolution of NEG[1]

Presumably the first who consider economic geography (in 1826) was German squire J. von Thunnen, in whose model of the isolated state [59] it is possible to find a lot of elements which have the meaningfulness even today (concept of industrial centre, underlining of transport costs importance and others).

Weber (1909), though best known for his «location triangles», also laid out a general view of the evolution of a pattern of location in a nation. He thought of this as involving the sequential laying down of a series of «strata», increasingly divorced from the distribution of natural resources [22].

Later Chriscaller (1933) argued that the lattices of the second, third, etc. strata would form a hierarchy of central places, whose number would decrease but population increase as one went up the scale. Christaller documented the existence of such a hierarchy in southern Germany [23]. Losch (1940), in a famous contribution, pointed out that if the objective was to minimize transportation costs, then the lattice of central places on a featureless plain would form a series of hexagonal market areas [24].

All the theorists mentioned above Krugman listed to German school of economic geography. Representatives of American school (Hoover [61] and in particular Isard [60]) less attention spared to the geometry of localization.

Isard (1956) pointed out a key problem with German school. According to the Weberian story, the second stratum exists to service the first, the third to service the second, and so on. However, some of the demand for the second stratum's services will come, not from the first stratum, but from the second and higher strata themselves. This immediately raises the possibility of a process of circular causation: the location of higher strata depends on the distribution of demand, but the distribution of demand depends on the location of higher strata.

The representatives of third school of economic geography accent their attention on the role of externalities in uneven development of regions. Most influential articles of such type belong to Myrdal [4], Hirschmann [5], Perroux [62], Arthur [63]) and others like that.

We should also remember the theorists who were not directly engaged in spatial economy researches, but whose scientific revisions did considerable payment in development of economic geography paradigm. Above all these are articles on international trade of Linder [64], Vernon [65] et al, that manage to exceed scopes of general equilibrium approach; theory of industrial organization of Spence [28], Dixit and Stiglitz [29]. Works of the so-called «new international

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[1] Source: [20, 66]

economic theory» representatives (as Dixit and Norman [67], Krugman [33]) presented the expounded alternative to the traditional comparative advantages theory.

However at the beginning of 1990th a critical moment came – actually from this period it is possible to talk about new economic geography (NEG). An starting point was Krugman's article «Increasing Returns and Economic Geography» [21]. Based on the model of monopolistic competition an author finally succeeded to form an integral logical model which explains appearance of agglomeration.

Krugman, Fujita, Venables, Puga, Thisse and a lot of other scientists became the apologists of new economic geography of our time. Really, Krugman [21] laid the foundation for development of new economic geography, entering Dixit-Stiglitz framework of monopolistic competition in a model. Krugman and Venables [50] extended a model, involving an intermediate production. Puga [51] offered analytical explanation of model. Venables, Fujita, Krugman [38] engaged in a model the index of time. Ottaviano involved capital investments. A lot of empiric researches are constantly carried out also with the use of new economic geography tools.

Annex B

Location of firms under labour mobility[2]

Krugman shows that the mobility of some factors of production (especially labour) can generate a process of circular and cumulative causation able to boost the geographic concentration of economic activities. The result is that even countries/regions initially identical can endogenously differentiate in an industrialised core and a non-industrialised periphery.

In a model two regions are examined symmetric in providing with economic factors. A population consists of two groups: workers (industry) and farmers (agrarian sector), thus workers are characterized by spatial mobility and farmers no. Centripetal forces take place in the form of the usual backward and forward linkages, whereas the immobile factor, farmers, moves in the opposite direction.

The basic insight of the model can be seized in the following way. The location of a new firm increases local competition on both goods and labour markets; the effect is a reduction of local profits that discourages the choice of that country/region to organise production. At the same time, wider product differentiation, greater labour demand and a higher level of wages experienced 'in loco' attract new workers. This migration causes the local expenditure (demand link-

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[2] Source: [21, 69]

ages) to rise, reduces the competition in the labour market and makes local profits scale up, encouraging new firms to locate there.

All in all, one small change in the share of manufacturing in a country/region sets off a chain reaction boosting agglomeration.

Since workers are free to migrate towards locations that offer higher real returns, for low levels of economic integration there exists a single equilibrium (*Figure 7)* with the factor labour evenly distributed across regions. As trade costs get lower, three equilibrium take place in the pattern of industrial location: one unstable, with workers equally spread out, and two stable, with employees concentrated in one single region.

At the intermediate level of integration (all of points around B) centripetal forces are too weak to disbalance an initial symmetric equilibrium. But the more consumers prefer to purchase a wider variety of the same product, the greater will be the speed at which firms will cluster together during a process of regional integration.. Each firm strengthens its market-share so as to smooth out local competition; this, in turn, encourages agglomeration.

Figure 7.

Integration and choice of location (Krugman's «Tomahawk»)
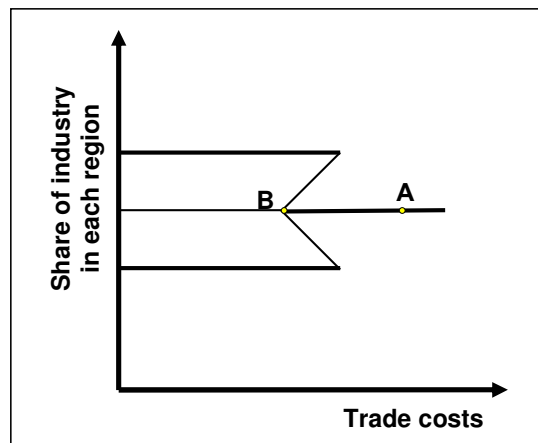
Annex C

## Location of firms under labour immobility[3]

Assume countries to be a priori identical, with labour endowments kept fixed. The absence of interregional labour migration does not allow real wage equilibrium across locations.

Figure 8 depicts that economic integration as a gradual process rather than a discontinuous one as in *Figures 7.* Namely, at high levels of trade costs, firms organise production close to their purchasers and distribute symmetrically across regions. As integration reaches a deeper stage, cost and demand linkages lead economic activities to cluster into the core but, because of labour immobility, agglomeration opens up wage differentials (in a centre wages are higher because of greater demand on labour force).

Lastly, when trade costs fall to low values, the entrepreneurs prefer to organise production where immobile factors (labour) are cheaper. This process generates an inverse core-periphery shift, leading firms to a new industrial dispersion across regions.

Figure 8.

Economic integration and location of firms in absence of labour mobility (Puga's «Bell»)

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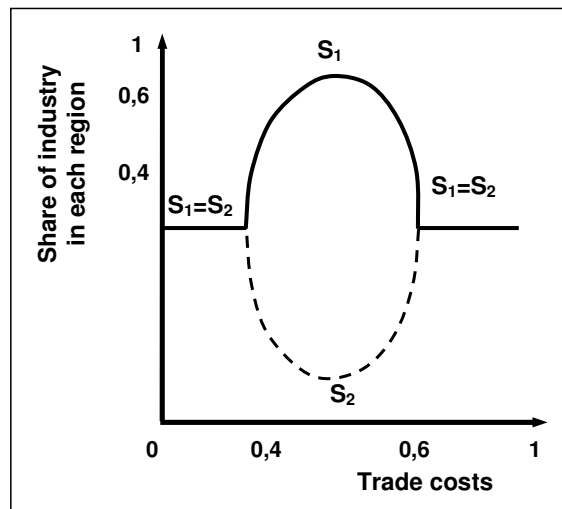
[3] Source: [51, 69]

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