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What Have We Already Learned On Regional Specialisation? Regional Science And Economics Perspectives.[1]

Abstract: This paper clarifies the well-known phenomenon of regional specialisation. It provides a conceptual map of this term, identified diachronically on the basis of economic theories and regional science. The relationship between agglomeration, concentration and specialisation is explained and challenged against its measurement. We introduce the mechanisms of regional specialisation to explain better its driving forces. They are based on competitiveness, innovation and territory and are the catalysts of proximity-driven agglomeration economies, sectoral concentration economies or territorial uniqueness. We prove that spatial determinants of regional specialisation are crucial in explaining the foundations of territorial development change.

JEL Code: R12, R32, L16, D30

Key words: spatial agglomeration, concentration, agglomeration economies, proximity, regional specialisation mechanisms

Introduction

The explanation of the mechanisms of regional specialisation on the ground of social sciences is determined by at least three basic research issues. Firstly, it is important to define the concept of regional specialisation deriving it from the main stream of economic theories. Here, it is critical to handle the relationship in the terminology in literature with regard to spatial and economic dimensions. Secondly, one must define the categories of factors that determine regional specialisation, bearing in mind their multiplicity and diversity described in theory and possible interactions between them (see Martin, 2005). The third issue is the difficulty and complexity of its measurement. It results from the structure, dynamics and degree of uniqueness of the regional economies, as well as data availability (Duranton & Overman, 2005; Marelli, 2004). In consequence, this requires a deeper insight in defining and organising regional specialisation measures, recognising the absolute and relative processes that describe the regularity of social and economic changes in space. The answer to the question about the consequences of regional specialisation for growth and regional development (Fujita & Thisse, 2013) sets up the basis background of the paper.

Having the above-defined challenges of regional specialisation analysis, the aim of this paper is as - postulated by Capello (2014) - systematisation of the conceptual framework to explain the phenomenon of regional specialisation on the ground of economics and regional

science (Isard, 1960). We intend to organize the key concepts that are used in its description and measurement, i.e. the agglomeration and concentration, as well putting emphasis on determining the importance of spatial factors in its identification. We introduce the main types of mechanisms for regional specialisation resulting from the agglomeration economies, sectoral concentration economies or territorial uniqueness.

The first part of the article explains the theoretical framework relevant for the concept of regional specialisation. In the second part of the study, we define components of regional specialisations, agglomeration and concentration, giving their interpretations in absolute and relative dimensions. Part three focuses on the mechanisms of regional specialisation and its associated measurement. The conclusions of the work indicate that, compared to known studies, there is an underestimation of the importance of spatial determinants of regional specialisation resulting from the agglomeration of economic activity.
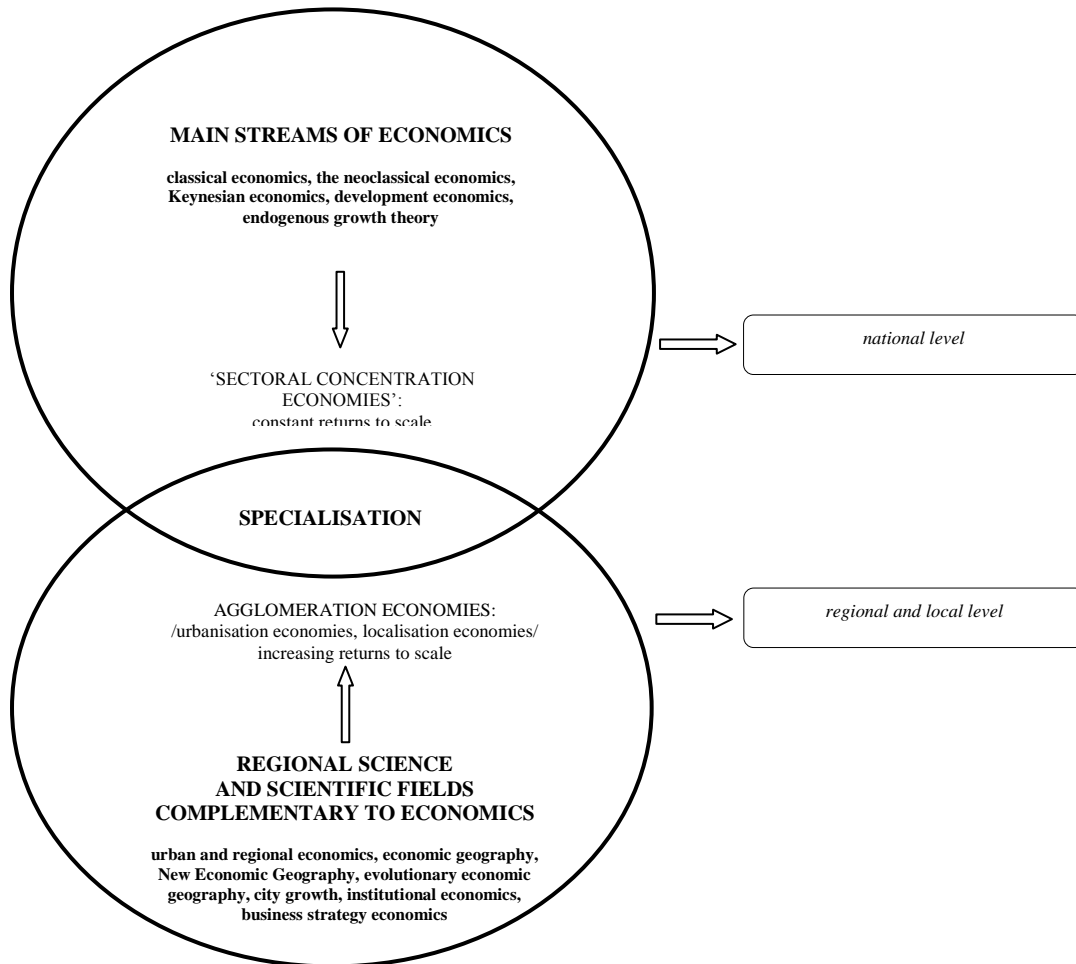
1. The origins of specialisation in economic sciences – theoretical background

Specialisation, initially understood as a specialisation in the production of certain goods or services on individual territories, is a part of various trends in economic studies. "...(S)pecialisation is usually combined with the concentration of industry, where the latter has to do with the size of the geographical distribution of production" (Aiginger, 1999, p. 15). Since the beginning of the development of economic sciences. several theoretical trends such as: classical economics (Smith, 1776; Ricardo, 1815), neoclassical economics (Marshall), Keynesian economics (Keynes), development economics (Rostow, Myrdal), endogenous growth theory (Romer, Lucas) and new trade theory (Krugman), identified absolute and comparative advantages as key for the formation of specialisation at the national level. Complementary, scientific trends that take into account the analysis in local and regional perspective (still more focused on companies and their environment) and emphasize the specialisation are: Jacob's theory of city growth, inferred from sociological theory of the growth of the city, institutional economics (Coase, Williamson), business strategy economics (Porter) and evolutionary economics (Schumpeter). While economists' observations and explanations are focused on comparative and absolute advantages shaped at the national level - and related to concentration economies - the analysis in regional perspective identifies primarily agglomeration economies at local and regional level. Most theories in economy underscore the spatial determinants of specialisation that are based on two characteristics commonly found in economic life, namely distance and area (Blaug, 1985). The distance, through cost and time of transportation, affects the location of the factors of production and market prices. The area determined by the distance is directly related to the evolution of the market and its spatial range.

The impact of spatial determinants on social and economic processes is developed in a comprehensive manner in regional science, to which W.Isard is seen as the creator and promoter. The ideas derived from seminal works of Hoover (1936) and Isard (1960), positioned the regional science as an interdisciplinary platform for linking scientific theories, for which the common element is the use of regional analysis methods to explain economic and social phenomena. Its main streams are the economic geography, Krugman's New Economic Geography, as well as a number of concepts around urban and regional economics.

Therefore the identification of the mechanisms of regional specialisation requires combination of fundamentals of economics and regional science, with reference to spatial determinants. Figure 1 shows the genesis and specificity of the concept of specialisation that evolves from specialisation in the production of goods and services at the national level towards regional specialisation that is basically shaped by the specific characteristics of regional and local economies.

Figure 1: Theoretical foundations in identifying specialisation

MAIN STREAMS OF ECONOMICS

classical economics, the neoclassical economics,
Keynesian economics, development economics,
endogenous growth theory

national level

'SECTORAL CONCENTRATION
ECONOMIES':
constant returns to scale

SPECIALISATION

AGGLOMERATION ECONOMIES:
/urbanisation economies, localisation economies/
increasing returns to scale

regional and local level

**REGIONAL SCIENCE
AND SCIENTIFIC FIELDS
COMPLEMENTARY TO ECONOMICS**

urban and regional economics, economic geography,
New Economic Geography, evolutionary economic
geography, city growth, institutional economics,
business strategy economics

Source: own concept

The main stream of economic theories, including classical and neoclassical economics takes as the foundation the assumption on the perfect competition and the constant returns to scale. The impact of absolute and comparative advantages, synergy effects and the related sectoral concentration economies are of major importance to describe the processes of specialisation at the national level (with regard to trade between countries). However, for regional specialisation to exist, as defined on the ground of regional science, the necessary conditions are the agglomeration economies resulting from particular (perceived differently in the various theories) composition of economic entities, institutions or urban amenities located in the territory, as well as the increasing economies of scale. Additionally, regional specialisation measured and identified as on the national level (i.e. by location quotient or other cluster-based measures) therefore may be biased as the above-mentioned economies and regional specificity is not included (Kemeny & Storper, 2015). It means that the widespread dominance of analytical bias that favours relative comparisons without identifying the absolute (own) specificity of the territory should be subject to critical evaluation, as it often leads to "mixing apples and oranges".

For the classical economy, the economies of scale may arise in connection with the division of labour. The neoclassical economy places the source of economies of scale in relevant proportion to the factors of production in the form of labour and capital (i.e. factor endowments). So, different sets of factors of production of various productivity allow regions to specialise in the production and to export the labour-intensive or capital-intensive goods,

depending on which factors of production are abundant and cheap. Hereby, productive specialisation is well-founded by comparative advantage associated with sectoral concentration economies.

The Keynensian model of the state intervention which generates national multipliers can be adopted at a regional level. An increase in the public expenditure in a region stimulates an export which is based on external demand. It generates the regional multipliers, and in consequence leads to strengthening the regional competitiveness and promoting the specialisation (McCann 2001). Development economics indicates the economies of synergy, in which the cumulative impact of various developmental factors can differentiate countries. These differences can be even stronger due to flows of capital and population migration from less to more developed areas, what Myrdal (1957) calls the 'backwash' effects. Under these conditions, specialisation, and consequently regional specialisation, deepens the scale and sustainability of development divergence. On the other hand, in the endogenous development theory[2], the reasons for specialisation are in the differences in the technological development, as well as in the quality of social capital. These benefits are associated with the accumulation of knowledge that determine the level of productivity and the growth of nations. Thus, the advantages resulting from the accumulation of human and social capital are acknowledged as the basis for the development of productive specialisation. These theories are definitely useful in explaining the phenomenon of formation of productive specialisation at the national level.

In selected approaches, seen as complementary to mainstream of traditional economics, one can find much more explanation of regional specialisation phenomenon rather than that of productive specialisation. In particular, one should follow the concept of Jacobs (1969) that describes urbanisation economies as initial source of specialisation, or the concept of Porter (1990) that introduces industrial clusters. Here, the localisation economies describe the origin of productive specialisation in local and regional scale. So generally speaking, the causes of specialisation are seen in the economies of agglomeration that provide positive externalities arising primarily from a simple spatial proximity of companies ("*companies in neighbourhood*")[3]. However, agglomeration economies may be in this case supplemented by sectoral concentration economies.

The progress in spatial analysis resulted in an adaptation of traditional economic theories applied earlier to national economies to describe the processes at the local and regional level, as well as the emergence of new concepts. The overview of theoretical framework and research methods of regional science raises the question whether and to what extent the economies of agglomeration and of sectoral concentration can be the source of regional specialisation. In the New Economic Geography that develops this stream, regional specialisation is the result of spatial differentiation of economic activity, which is determined by technological progress and globalisation (Krugman, 1991). This approach emphasizes the role of the geographical space and the economies of agglomeration play important roles in determining economic processes of firms and regions. However, gradually in time the role of specific factors and their configuration has changed. Thus, if we make the assumption that regional specialisation follows the critical mass of the space-specific factors and processes, then the analysis of regional specialisation mechanisms should be considered as dynamic one (Kemeny & Storper, 2015). It should consider changes in the hierarchical settlement system (Capello, 2007) caused by mobility of development factors (Domański, 2005; Castells, 2009). Also we should not claim that only the above-average level of agglomeration or sectoral concentration can lead to specialisation (Boschma & Lambooy, 1999). The theory of growth poles (Perroux), the theory of growth centres (Hirschman), the model of the core and the

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[2] We refer here to the a-spatial, that is the primary understanding of endogenous growth model as compared to the so called new endogenous growth theory (see R. Martin, P. Sunley 1998).
[3] Not to exclude the benefits of focusing on one sector of economic activity or the production chain (see Porter, 1990)

periphery (Friedmann) indicate that the development of territories (originally: regions) is based on the phenomenon of polarisation associated with regional specialisation. This means that specialisation is shaped primarily in the centres *("poles")* that are often located in large cities and metropolitan areas[4]. Here, the processes that are initiated by the presence of the driving activities, what determines the agglomeration economies reverse relationships appear. The agglomeration processes which generate economies of agglomeration, over time can also be generated by socio-cultural ties. These interlinks shape and maintain the shared values and contribute to creating an institutional environment that facilitates the transfer and accumulation of knowledge in territorial systems (Asheim, 2000). These processes are the fundamentals for the concepts of the innovation milieu, learning regions and knowledge-based regions (Maillat et al., 1992; Camagni, 2002; Lundvall, 1992).

The above review shows that the phenomenon of productive specialisation in economic sciences stemmed mainly from the interpretation of constant economies of scale based on absolute and comparative advantages that determine the synergy effects linked to sectoral concentration economies. For the complementary approaches and mainly the mainstream of regional science, the focus shifts towards increasing economies of scale, to which a specific local / regional settings determine the benefits of agglomeration that can be obtained[5]. In this context, it would be much more desired to offer a fairly better systemic description and analysis, as well as the explanation of regional specialisation based on the interpretation of broadly understood 'distance'. Recent literature introduces here the promising concept of proximity (Rallet & Torre, 1999; Boschma, 2005; Capello, 2007; Stimson, 2014). We believe that this new approach makes it possible to identify and structure various details of mechanisms that underpin the regional specialisation (Table. 1). Moreover, it allows for the introduction of more than geographical features of space (Balland et al., 2015) that could pave the way towards the analysis of regional specialisation phenomena based not only on relatively[6] high level of spatial and sectoral density of entities (spatial agglomeration and sectoral concentration) but also to allow for the identification of absolute factors behind regional specialisation. The category of proximity is important for the description of agglomeration economies since, as argued by Capello (2007, p.18), returns to scale depend on the production output and are not necessarily spatially determined.

Table 1: Proximity as factor of agglomeration economies

TYPE OF PROXIMITY	MAIN CONTRIBUTORS	OBJECT OF INTEREST	THE PROXIMITY AS A STIMULI OF...	AGGLOMERATION ECONOMIES
Geographical proximity	Marshall, 1890 Arrow, 1962 Romer, 1986	Firms and economic sectors	The transfer of knowledge between companies, easier to achieve in a monopolistic situation	Localisation economies
	Porter, 1990	Firms and economic sectors	The transfer of knowledge between companies of a sector driven by local competition and allowing the triggering of innovation	Localisation economies (cluster benefits)
	Jacobs, 1968	Economic sectors and cities	Transfer and diffusion of knowledge between various companies boosting competition and stimulating innovation	Urbanisation economies
Socio-cultural proximity (and geographical proximity)	Becattini, 1979	Firms and districts	Production capacity easier to obtain by shared values and principles	Localisation economies (district benefits)

[4] Following Capello (2007, p.78), it may also apply to centres in smaller cities or "decompose" in the framework of polycentric networks of cities or towns
[5] It does not mean, however, that sectoral concentration should be excluded in analysis, as it can also influence regional specialisation.
[6] Relatively high as compared to other units of reference, i.e. for instance NUTS3 or NUTS2.

TYPE OF PROXIMITY	MAIN CONTRIBUTORS	OBJECT OF INTEREST	THE PROXIMITY AS A STIMULI OF...	AGGLOMERATION ECONOMIES
Relational proximity (and geographical proximity)	Camagni, 1991	Firms and millieu	New knowledge easier to get through the learning process in terms of cooperation between companies, between companies (customer-supplier) and providers of knowledge (local multi-stakeholder network) and local mobility of professionals/ skilled workers	Localisation economies (milieu benefits)
Organised proximity (and geographical proximity)	Rallet, 1993, Rallet & Torre, 1995	People and firms	The development of economic activities of companies, the knowledge sharing is easier as the contacts take place face-to-face. Similar routines exist in organisations (companies)	Localisation economies (organisational benefits)
Institutional proximity (and geographical proximity)	Ludnvall 1992, Cooke & Morgan, 1994, Asheim 1996, Malmberg & Maskell, 2002	Firms and institutional system	Innovation and competitiveness of companies is easier to achieve when the learning process (formal and informal) occurs as the interaction between companies and research institutions, between manufacturers and customers coming from the same social and institutional system (standards, codes, rules of behaviour).	Localisation economies (learning benefits)
Cognitive proximity (possible with geographical proximity)	Boschma, 2005 Capello, 2009	Knowledgeable actors	Gaining new knowledge, as a basis for innovation is easier when the actors cooperating cognitive abilities are sufficient to communicate, understanding and using knowledge, and its complementarity is sufficiently different to justify cooperation.	Localisation economies (variety of knowledge based benefits)

Source: own interpretation based on Capello R. 2014 [in:] R. Stimson w A. Torre & F. Wallet eds., p. 165 and continued

The category of proximity, according to Capello (2014) evolves in the studies that investigate the changes in the regions. First seen as a *geographic proximity*, the category has been particularly exposed in the 60s of last century. It was followed by the category of *socio-cultural proximity* and *relational proximity* (70s and 80s), *organized proximity* and *institutional proximity* (90s) and finally *cognitive proximity*, the importance of which has been indicated since after 2000. The relationship between proximity and location of firms, that is fundamental in shaping the regional specialisation, should be the subject of in-depth interpretation:

- Firstly, the companies located in a given space can benefit from economies of scale. This happens as a result of lowering the firm's unit costs of the production. Geographical proximity of branches of the company and its suppliers and service providers are the basis for these benefits.
- Secondly, when a number of companies located in a given area operate in the same sector, the location advantages appear. They result primarily from the space densely populated with firms belonging to a given economic sector or related to this sector. These advantages stem from a high scale of available specialised suppliers, qualified personnel, technical and economic knowledge. The scale and nature of the availability of these factors is conditioned by the various proximity types, including geographical proximity, relational, organisational, socio-cultural or cognitive (Paci, Marrocu & Usai, 2014).
- Thirdly, companies and sectors can profit from the advantages of urbanisation, which should be understood as a special case of the agglomeration economies. That means

there exist urban areas[7], with a high level transport and communications infrastructure, with diversified and differentiated product markets, as well as densely populated businesses areas. As in the case of location economies, the strength of the agglomeration economies is conditioned by any of the above-mentioned types of proximity.

Following Capello (2014), in the first case, spatial proximity provides internal benefits to the firm. In the second case, spatial proximity and availability of suppliers and a-spatial factors (non-spatial proximities) directly lower the production costs, which explains the benefits derived and the causes of funnelling/polarisation of companies in the space. In the third case, the availability of facilities for residents and businesses that are provided in a certain geographical proximity, deliver benefits in the form of agglomeration economies. In the second and third case specific factors determine the level of competition and/or innovative firms and sectors. This is another fundamental indication that offers a basis for analysis of regional specialisation with regards to the theory of regional development in economic terms (Martin, 2005; Aiginger & Rossi-Hansberg, 2005, 2006).

Thus, it should be noted that the explanation of the phenomenon of regional specialisation requires the co-identification (and measurement) of spatial agglomeration and sectoral concentration. Measuring the agglomeration of economic activity in space allows for determining the uniqueness of the conditions for the use of a proximity driver (described above). We believe it is essential in shaping the benefits and economies which are to determine the mechanisms that lead to the formation of regional specialisation. That measurement of spatial agglomeration seems, however, to be underestimated in previous studies on the phenomenon of regional specialisation and its methodology is incomplete. Well-developed measures of the sectoral concentration of economic activity can determine the uniqueness of the economic structure, both in terms of geographic and sectoral level. Thus, sectoral concentration of economic activities is seen as the basis of the traditional approach in defining the regional specialisation. Bearing in mind the common use of sectoral concentration measures, we acknowledge the challenges arising from the joint approach.

This paper further takes into account spatial agglomeration and sectoral concentration in identifying regional specialisation. Even if we believe that concentration will be of secondary importance[8] to the new approaches dealing with regional specialisation, there is a need to structure the definitional basis for the two terms: spatial agglomeration and sectoral concentration. Moreover, the terminology interrelations, explanation of their significance in shaping the mechanisms of regional specialisation and the identification of the specific nature of the measurement are with no doubt needed.

2. Regional specialisation – definition and conceptual relationships

Both in economic and geographical studies so far regional specialisation is most often understood as relative uniqueness of the region. It is identified through the analysis of the economic structure of the region in comparison with the economic structure of other regions or countries (Marelli, 2004; Aiginger & Rossi-Hansberg, 2006). In this case, regional specialisation means that the economic structure of the region deviates *in-plus* compared with an adopted reference system. The reference system can have two dimensions. The first one, spatial dimension, is based generally on territorial units as aggregates at the spatial level used in analysis. Unfortunately, this approach limits the details of findings and generates problems called in the literature a Modified Areal Unit Problem (MAUP) (Arbia 2001; Morphet, 1997; Marcon & Puech, 2009). The second one, sectoral dimension, is based mainly on the structure of business activities specified according to NACE classification. The degree of regional

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[7] Most often a large city or metropolitan urban agglomeration is indicated here; see for example Combes et al. (2012).
[8] See the case of Finnish Nokia

specialisation is determined by the scale of identified deviations. When measuring regional specialisation, there are three terms used and their measures: agglomeration, concentration and specialisation, but most researchers use only one of these terms. Others show that regional specialisation studies should be based on more precise features, including measurement of concentration and specialisation together (Aiginger & Rossi-Hansberg, 2006), sometimes with agglomeration (Franceschi et. al., 2009), which is very often seen in the literature as a synonym of concentration (Tian, 2013). However, current literature manifests kind of a freedom in defining the three above-mentioned terms - researchers use very different approaches, claiming even that all three terms can be seen as synonyms (Brülhart, 1998). All the cluster-based measures start with measure of economic activity in a given sector and region. When they relate it internally to other activities in a region, they mean specialisation, and when relating it externally to the same activities but in other regions (to external reference system) they mean concentration (Franceschi et al., 2009; Palan, 2010).

No doubt that the current state of discussion on regional specialisation terminology needs more transparency and a better arrangement of the terms. For the purposes of better understanding, it is worth focusing on different definitional approaches and ways of measurements of the structure of the economic activity of the region, used for analysis of the regional specialisation, that so far has been in the literature. It should be stressed that the same terms are used to define various processes, often measured by means of different methods. Table 2 offers the description of key regularities and differences.

Agglomeration – densification (polarisation) of economic activities in space. It is measured either indirectly or directly, what is conditioned to discrete or continuous space (Combes et al., 2008; Nakamura & Paul, 2009; Tian, 2013). In the case of discrete space, the agglomeration is the synonym of concentration, most often considered as a geographical concentration, referred to by some authors as relative concentration (Brülhart & Traeger, 2005) and cluster-based measures are applied. The measurement here is indirect and it identifies the level of economic activity in a given spatial unit as compared to levels in units taken as a reference. In the case of continuous space, the degree of agglomeration of economic activity is determined by direct measurement of the density, based on the location of firms in the geographic coordinate system. The distance-based methods are used, including Ripley's K-function and/or K-density function (Marcon & Puech, 2003, 2009, 2014; Duranton & Overman, 2005, 2008; Arbia et al., 2010; Mori & Smith, 2014). Agglomeration understood this way is sometimes called topographic concentration (Brülhart & Traeger, 2005) or the total regional industrial mass (Franceschi et. al., 2009).

Concentration – domination (polarisation) (of economic activities referred to sectoral structure. It is the most popular term in the literature used for identification of the rules concerning diversification of economic activity and using these differences for specifying the regional specialisation. Concentration of economic activity is analysed using geographical and/or sectoral approach. In the first case, the level of concentration is based on the measurement of size and structure of economic activity in the spatial units (regions) corresponding to the other units of territorial division (geographical or relative concentration) (Aiginger & Davies, 2004). In the second case, the share of the activity in the economic structure of the region is determined, sometimes additionally referring to the share in the reference system (absolute concentration) (Haaland et al., 1999; Zheng & Kuroda, 2013). Measuring the concentration, as explained in the two approaches, is very often based on cluster-based methods in which different set of indices are used. By transforming and selecting variables, the researchers adapt the methods to the needs of a particular analysis. The following indices are used in literature: LQ, the Gini index, the Theil index, the Isard index, the Herfindahl–Hirschman (HH) index, Krugman index, the Ellison-Glaeser (EG) index, the Maurel-Sedillot (MS) index (Gini, 1912; 1921; Florence, 1948; Herfindahl, 1950;

Isard, 1960; Hirschman, 1964; Theil, 1967; Krugman, 1991; Ellison & Glaeser, 1997; Maurel & Sedillot, 1999; Rosenthal, 2001; Holmes & Stevens, 2004; Bertinelli & Decrop, 2005).

Table 2. Agglomeration, concentration and specialisation: terminological relationship based on literature studies

TERM	THE WAY OF DEFINING AND MEASUREMENT SPECIFICS	BIBLIOGRAPHY
AGGLOMERATION	• densification (polarisation) of economic activities in space, • density of economic entities in continuous space (X, Y coordinates) • distance-based methods	Marcon & Puech, 2003, 2009; Duranton & Overman, 2005, 2008; Arbia et al., 2010; Mori & Smith, 2014;
AGGLOMERATION = "TOPOGRAPHIC" CONCENTRATION	• domination (polarisation) of economic activities in sectoral structure of economy, • share of economic activities in the total structure of economic activities • cluster-based methods	Tian, 2013;
AGGLOMERATION = GEOGRAPHIC CONCENTRATION (RELATIVE)	• domination (polarisation) of economic activities in sectoral structure of economy, • comparison of sectoral structure for instance of the region to the structure of a reference system and based on aggregates of territorial units, • cluster-based methods	Brülhart, 1998; Tian, 2013;
PRODUCTIVE CONCENTRATION (ABSOLUTE)	• domination (polarisation) of economic activities in sectoral structure of economy, • share of economic activity in the total economic structure, • cluster-based methods	Hannah & Kay, 1977; Tirole, 1988; Waterson, 1984; Scherer, 1990; Aiginger & Davies, 2004; Franceschi et al., 2009; Moga & Constantin, 2011;
GEOGRAPHICAL CONCENTRATION (RELATIVE)	• domination (polarisation) of economic activities in sectoral structure of economy, • comparison of sectoral structure for instance of the region to the structure of a reference system and based on aggregates of territorial units, • cluster-based methods	Brülhart, 1995; Kim, 1995; Molle, 1996; Ellison & Glaeser, 1997; Amiti, 1998; 1999; Haaland et al., 1999; Maurel & Sedillot, 1999; Midelfart-Knarvik et al., 2000; Brülhart, 2001; Duro Moreno, 2001; Rosenthal, 2001; Hallet, 2002; Aiginger & Davies, 2004; Aiginger, & Pfaffermayr, 2004; Holmes & Stevens, 2004; Bertinelli & Decrop, 2005; Brülhart & Traeger, 2005; Südekum, 2006; Beine & Coulombe, 2007; Brülhart & Torstensson, 2007; Ezcurra & Pascual, 2007;
ABSOLUTE SPECIALISATION	• a specific type of concentration, • comparison of actual sectoral structure of region's economy and the sectoral structure that results from a uniform distribution of activities in the sectors of the area, • cluster-based methods	Bahl, et al., 1971; Hackbart & Anderson, 1975; Wasylenko & Erickson, 1978; Attaran & Zwick, 1987; Smith & Gibson, 1988; Sapir, 1996; Davis, 1998; Krieger-Boden, 2000; Wolfmayr-Schintzer, 2000; Storper et al., 2002; Aiginger & Davies, 2004; Aiginger, & Pfaffermayr, 2004; Beine & Coulombe, 2007; Franceschi et al., 2009; Palan, 2010; Moga & Constantin, 2011;
RELATIVE SPECIALISATION	• a specific type of concentration, • comparison of actual sectoral structure of region's economy and the sectoral structure that results from an average distribution of activities in the sectors in the reference group aggregates based	Krugman, 1991; Brülhart, 1995, Kim, 1995; Molle, 1996; Amiti, 1998; 1999; Cuadrado-Roura et al., 1999; Haaland et al., 1999; Krieger-Boden, 2000; Midelfart-Knarvik et al., 2000; Landesmann, 2000; Wolfmayr-Schintzer, 2000; Brülhart, 2001; Duro Moreno, 2001; Hallet, 2002; Aiginger &

| TERM	THE WAY OF DEFINING AND MEASUREMENT SPECIFICS	BIBLIOGRAPHY
	on territorial units, • cluster-based methods.	Davies, 2004; Aiginger, & Pfaffermayr, 2004; Combes & Overman, 2004; Longhi et al., 2004; Brülhart & Traeger, 2005; Percoco et al., 2005; Ezcurra et al., 2006; Südekum, 2006; Beine & Coulombe, 2007; Brülhart & Torstensson, 2007; Ezcurra & Pascual, 2007; Franceschi et al., 2009; Palan, 2010; Palan & Schmiedeberg, 2010; Moga & Constantin, 2011; Cosar & Fajgelbaum, 2013

Sources: own concept

Specialisation is usually defined as a special form of concentration (polarisation) of economic activities that importantly distinguishes the area (region) compared to other areas (regions). The literature on specialisation sees it most frequently as a special form of concentration, the uniqueness of which is determined based on comparisons to the assumed distributions in a given reference system. The degree of specialisation is therefore identified with the level of "deviation" towards the assumed patterns in given reference system. It is related to either equal distribution of economic structure on a given area, what is called absolute specialisation, or to the average distribution in a reference system given by studied territorial units, which is called relative specialisation (Palan, 2010). This kind of specialisation is measured with cluster-based methods applied to the indices of economic activity, related to the reference system used in the study. In the literature there exist following indices: Hirschman-Herfindahl-Index, Shannon Entropy Index, Ogive-Index, Diversification Index, Absolute Gini-Index for absolute specialisation and Krugman Specialisation Index, Index of Inequality in Productive Structure, Relative Gini-Index i Theil-Index for relative specialisation (Gini, 1912; 1921; Tress, 1938; Shannon, 1948; Herfindahl, 1950; Rogers, 1957; Hirschman, 1964; Theil, 1967; Krugman, 1991; Cuadrado-Roura et al., 1999). The concept of specialisation meets various criticisms in the literature, focusing on two types of problems (Combes & Overman, 2004; Duranton & Overman, 2005; Ezcurra et al., 2006). The first problem highlights the natural differences in scale of economic activity, some firms (and sectors) are just bigger than others, what limits the reasonable referencing to the uniform distribution structure. The second problem notes that the approach is sensitive to the size of the study area. In means that the underestimation of specialisation in larger areas and overestimation in specialisation of smaller areas can occur, and again its relativisation of this measurement to the average values is under question. It leads to two conclusions. On the one hand there is a relationship between concentration and specialisation, which allows for determining even a low level of concentration (evaluated from the different perspective) as the basis for identification of regional specialisation (Aiginger & Rossi-Hansberg, 2006; Moga & Constantin, 2011). On the other hand specialisation and concentration are "two sides of the same coin" (Aiginger & Davies, 2004). In the paper we organise the definitions using terms of sectoral concentration and spatial agglomeration (See Table 3).

In order to systematize the relationship in terminology and its use to define the regional specialisation, we need some assumptions. Namely, we suggest defining and measuring regional specialisation consequently by means of spatial agglomeration and sectoral concentration of regional economic activities. The proposed integrated or complex approach is built upon the evidence of differences in between the two terms (agglomeration and concentration), despite obvious similarities as shown in literature. It is necessary to know the characteristics of agglomeration and concentration as they underpin the economies of agglomeration and concentration, what in turn can give a complete picture of regional

specialisation (see Midelfart-Knarvik et al., 2000; Aiginger & Rossi-Hansberg, 2006; Mora & Moreno, 2010,; Carlei & Nuccio, 2013).

At the same time, it is necessary to introduce well-known measurement properties, i.e. absoluteness and relativity, which are the two features commonly used in measuring agglomeration, concentration and specialisation. **Absoluteness** is understood in our paper as a measurement non-relativized to the internal or external system and it determines the features of a given region based on the analysis of its internal properties, for instance: the distribution of the economic activity in the space of the region or the share of activity in the total activity of the region. **Relativity** means that the measurement of the features in a given region and based on the level of phenomena identified within its border are referred to the level of phenomena in the given reference system. Thus, two perspectives can be offered: internal and external, both in the case of sectoral and geographical systems (see Fig. 2 and Table 3).

Figure 2: Agglomeration and concentration vs. regional specialisation
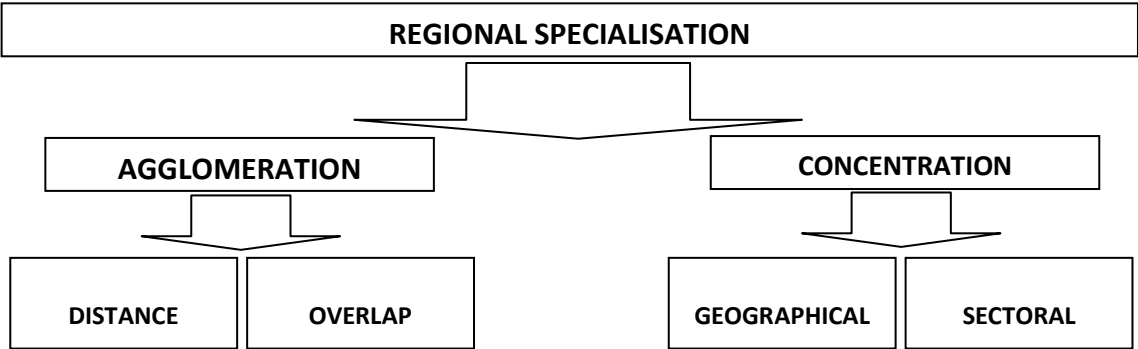
Source: own concept

Table 3: Terminology relationship in defining regional specialisation

| SPECIFICATION			WAY TO MEASURE		
			ABSOLUTENESS	RELATIVITY	
				Internal	External
REGIONAL SPECIALISATION	AGGLOMERATION	DISTANCE	+	-	-
		OVERLAP	+	-	-
	CONCENTRATION	GEOGRAPHICAL	-	+	+
		SECTORAL	-	+	+

Source: own work

To our understanding, **agglomeration** of economic activities in the region is with regard to its location density, it is measured by distance and overlap and it identifies the absolute uniqueness of the region in terms of the location of economic activity. Point (geographical) locations of firms in the geographic coordinate system are considered in relation to the area of the region and to location of other firms. It allows for assessment of the spatial structure of economic activity, spatial relationship between firms localised within its borders and to evaluate the impact of this relation on the formation of regional specialisation. The agglomeration is based on the measurement of distance and overlap of the economic activity in the region. The distance indicates the level of spatial dispersion or density (polarisation) of the activities in the area of the region. The overlap measures the degree of spatial accumulation of firms and is based on the joint and overlapping spatial ranges of firms.

In our approach the **concentration** of economic activity is understood as a process of sectoral domination (polarisation) of economic activities or production/value chains within the regional structure of the economy. As shown in tab. 3, it is measured as a share of economic activity in region's economy and it results in social, cultural, organisational,

technological or relational benefits that are specific to given economic activity. Concentration understood as above has no direct links with location of business units. Space is used here only indirectly, by focusing on the reference aggregates of spatial units (as total employment in a given region). Concentration determines the relative uniqueness of the regional economy by relating to its sectoral structure, and one can observe here internal and external relativity. Internal relativity compares volume of given sector in given region with total capacity: with total volume of this sector in all studied regions ($emp_{ij}/\sum emp(indA)$ - geographical concentration) or with total volume of all sectors in this studied region ($emp_{ij}/\sum emp(terrA)$ - sectoral concentration). This volume most often is determined using the number of firms, number of employees, gross value added or export value. Internal relativity limits the analysis to one sector only (geographical concentration) or one region only (sectoral concentration). External relativity compares the whole sectoral and regional structures. It refers the share of given sector to shares in reference system. External sectoral concentration is based on analysis of sectoral structure of the region in comparison to reference sectoral structure given with supra-regional (over all regions) volumes ($[emp_{ij}/\sum emp(terrA)]/[\sum emp(indA)/\sum\sum emp]$). External geographical concentration is based on comparison of the share of a given sector in a given region to its share over all regions ($[emp_{ij}/\sum emp(indA)]/[\sum emp(terrA)/\sum\sum emp]$) (see Figure 3).

**Figure 3: Geographical and sectoral concentration**
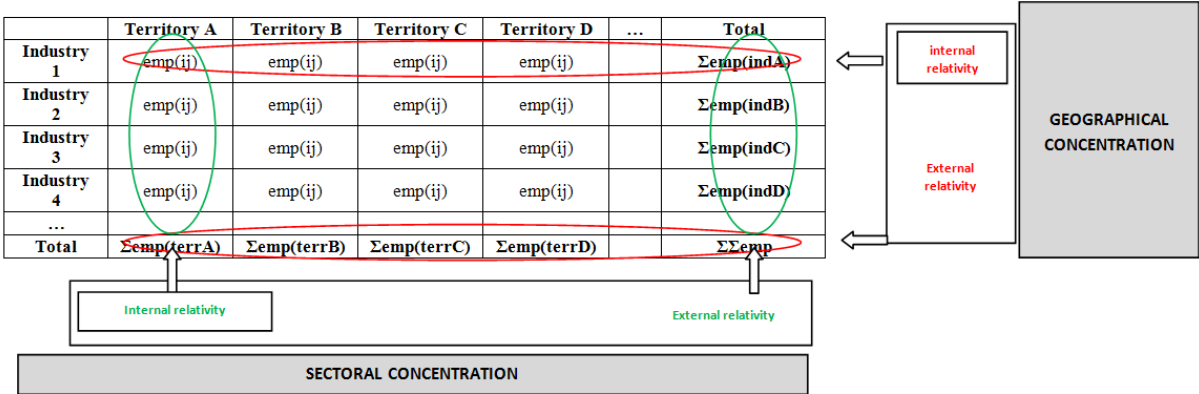
Source: own work

To our understanding, investigating the **regional specialisation** with the given as above assumptions and definitions of agglomeration and concentration, requires using complex and integrated approach. Regional specialisation is thus the uniqueness of the region that is determined by specific economies resulting from agglomeration and/or concentration. In the proposed approach we want to underline this two-dimensional approach and to move away from the narrow use of the specialisation term, which in the literature usually means the sectoral (internal) concentration. Large freedom and unconcern in interpretation of specialisation presented many authors, who identify it with any kind of specialisation, including regional specialisation, introduces in our opinion, unnecessary definitional confusion. The proposed method of defining and investigating regional specialisation focuses on the importance of spatial (geographical) and sectoral dimensions, which should be considered always together, because of their complementary nature in shaping the uniqueness of the region related to its specialisation. Moreover, this approach shows that regional specialisation studies should be based on identification of agglomeration and concentration of economic activity in the region. As we assume, agglomeration identified by individual georeferenced spatial location of economic activity significantly improves the measurement in comparison with the currently predominant approach based on spatially (regionally)

aggregated values. It generates the ability to conduct in-depth, contextual territorial studies in which a factor of proximity can be used.[9]

It should be noted, however, that the recommendation to consider jointly the agglomeration and concentration when determining the regional specialisation, does not require the presence of these two processes simultaneously at a predetermined level. Regional specialisation may indeed occur in the particular case even in the absence or low level of agglomeration and concentration of economic activity within its borders. Thus, the agglomeration and regional concentration of economic activity are seen as the dimensions used in the identification process of regional specialisation rather than strictly its components. At least four situations can be pinpointed here (see Fig.4).

Figure 4: Agglomeration and concentration – the axes of regional specialisation
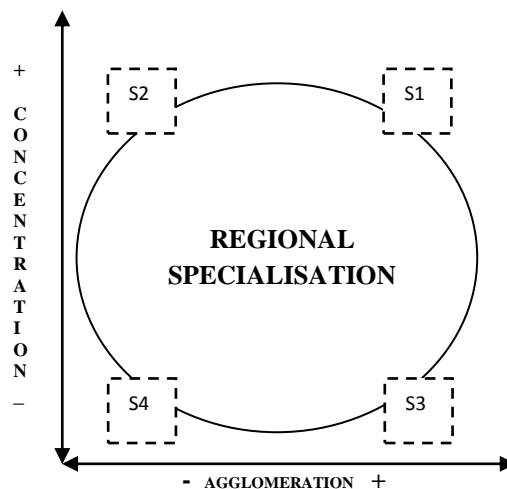
Source: own work

The first situation, denoted with S1 in Fig.4 is characterized with high level of both sectoral concentration and spatial agglomeration. The joint impact of a high level of concentration and agglomeration can generate benefits such as an increased innovation in the region, raising the level of competitiveness of the economy and a territorial development. Silicon Valley is a clear example here. In this case, the key factor which determines the specialisation is the proximity, which drives the benefits such as intellectual and technology spillovers (Saxenian, 1996). Also, Japanese industrial zones: Keihin around Tokyo and Yokohama as well Hanshin around Osaka and Kobe, used to be the areas with a high level of both agglomeration and concentration. Over time, the importance of economies of agglomeration decreased, also due to the emergence of negative externalities such as congestion. It was followed by the geographical dispersion of industrial activity, and increasing investments in other peripheral regions of Japan (Mano & Otsuka, 2000).

The second situation (S2), is one in which there is no specific intensity of the agglomeration, and only the above average sectoral concentration is clearly visible. Such an understanding of regional specialisation follows the uniqueness of the place / region and not the specifics of agglomeration. The occurrence of uniqueness and concentration of sectors, industries or production chains generates special benefits in the region. An example of this type of situation may be regions of specialisation related mainly to the raw materials (e.g.

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[9] It justifies the need to formulate this type of indices of agglomeration of economic activity, which could be used in the identification of regional specialisation. It seems that it is not of sufficient interest in previous studies (Marcon & Puech, 2003, 2009, 2014; Duranton & Overman, 2005, 2008 ; Arbia et al., 2010; Mori & Smith, 2014).

Copper Basin in south-western Poland), manufacturing of simple, unprocessed products as well as agriculture or farming. The wine regions in France are also a well-known example here. This situation is well described by Aiginer and Rossi-Hanberg (2006), indicating that the decline in transportation costs leads to an increase in the level of concentration (which they call a specialisation) and a decrease in the level of agglomeration (which they call a regional concentration).

The third situation (S3), is the one where the concentration is relatively low, while the level of agglomeration can be described as particularly high. This situation is explained by Jacobs, claiming that the high level of diversification is key to regional specialisation, as it gives the above-average benefits associated with urban amenities and spillover effects. An example of such specialisation may be regions with highly diversified structure of economic activity and business located in metropolitan areas and large cities with well-developed labour and business-support markets. Another typical example is given by Overman et al. (2009) who analysed the productivity of individual industries forced by agglomeration economies only. Industries that benefited the most were the aviation and automotive industries, while the relatively smallest benefits were observed in agriculture and fishing (Gibbons, Overman, & Tucci 2009).

Finally, the fourth situation (S4) is that when it is difficult to point to a particularly high level of both concentration and agglomeration. In this case, the place of the unique characteristics and a few activities (low concentration) can also produce benefits for the region augmenting it as a result of regional specialisation. An example of this can be regions that carry out their activities based on outstanding individuals in the field of cultural sector, for instance or single reputable institutions / specialized infrastructure is located there despite the lack of agglomeration-similar features. Cooke (2015) cites the perspective of institutions, organisations and business culture, identifying the region as the driver of innovative changes, while Boschma and Lambooy (1999) use the term "chance events" to emphasize the new technological trajectories that arise in new companies / industries, independently from the previous location choice of high technology industries. They write: "*Chance events and increasing returns, rather than selection, are important factors to explain the spatial formation of new high-technology industries.*" (p. 425). This latter situation, although the most difficult in the identification and interpretation, may be important to seek the cores of regional specialisation formation.

3. Mechanisms of regional specialisation and its measurement

Theoretical concepts of economy and regional science from part 1 of this paper are the key to explain the phenomenon of specialisation and to provide the basis to identify the mechanisms responsible for the regional specialisation. What makes up these mechanisms, can be considered on the ground of different concepts, as they offer the explanation of "driving forces" of regional specialisation related to the factors, economies of agglomeration or concentration. As stated previously, the type of regional specialisation is identified on the two axes – agglomeration and concentration. Depending on the specific theoretical concepts, the various factors are considered as those that trigger certain types of benefits associated with the location and performance of business. This is undoubtedly a dynamic process. It means that new factors of growth can occur not only because of joint interaction of agglomeration or concentration economies, but also the triggering factors (*drivers*) may be marginalised, transformed or even strengthened by the processes launched due to agglomeration and/or concentration.

The four-field model (S1-S4) from part 2 of this paper (see Fig.2) gives two axes (agglomeration and concentration) that define the foundations relevant for identifying relationships that shape regional specialisation. While the axes can point to the internal spatial

and sectoral structure of regional specialisation, its specificity and, above all, the value for companies located in the region (but also for the region itself) is prejudged by the mechanisms of regional specialisation. We believe the mechanisms are shaped by the combination of factors and benefits gained by companies located in the region and the region itself[10].

Therefore, the phenomenon of regional specialisation is used to describe and explain the regularity of economic processes from at least two perspectives. Firstly, from a business perspective, it is assumed that regional specialisation determines the market specificity of functioning and development of firms, by the fact that the selected firms gain specific benefits (business location perspective and its linkages to other locations)[11]. Secondly, from a regional perspective, it is considered that regional specialisation determines the territorial development processes of the region; most commonly it is the economic region (regional perspective and networks of spatial units).

For both business and regional perspectives one can use at least two research approaches: the positive (process approach) and normative (final approach) (Chojnicki, 1999). In a positive approach, which is to determine the current state, we focus on describing the course of the process itself and attempt to explain its preconditions. The normative approach deals with the question: how to specify the goals for the desired process and its implementation. In the perspective of companies it focuses on conditions for business strategies; in regional perspective it refers to the validity of allocating public funds by means of development policies. In other words, the mechanism of regional specialisation can be interpreted in terms of its importance for the observed specific changes that make up the process (e.g. the productivity of companies, labour market sustainability, territorial innovation) or setting up/achievement of the objectives of this process by specific entities[12] (e.g. smart and sustainable growth, smart specialisation) (see Table 4).

Table 4: Typology of research approaches to regional specialisation

Target of analysis / Research approach	Firm and its location	Region as a set of inter-linked locations
Positive (process; descriptive and explanatory)	Regional specialisation as a source of benefits to the firm	Regional specialisation as regional development factor
Normative (final)	Regional specialisation as the determinant for business strategic activities	Regional specialisation as a criterion / result for allocation of public funds

Source: Own concept

The following analysis focuses just on the positive (process) approach that is descriptive and explanatory. Therefore, the recognition of mechanisms that create the benefits for companies in their locations and for whole sectors of economic activity (sectors, production chains, added value chains) are central to this study and further may become fundamental to support the normative approach. Consequently, it is assumed that agglomeration and/or concentration economies, as a source of benefits to the company in their locations and regions, identified within the particular streams of economics and regional science, can be the basis for the identification of the mechanisms of regional specialisation.

The presented below research perspective is business (firms) oriented. On the contrary, regional perspective (changes in the regions, territories) should be considered consequently to

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[10] Actually, it does not exclude the spill-over effect, innovation diffusion or other effects for which the impact is global.

[11] This applies both to companies that are already located, companies considering location, but also may include companies located in neighbouring regions, e.g. trans-border regions – an interesting work in this area has been introduced by Moreno et al. (2005) or Boschma (2011)

[12] This is fairly well described by McCann & Ortega-Argilés (2015) and Foray (2009, 2015).

the business perspective with a strong emphasis on externalities. This leads to the conclusion that the mechanisms of regional specialisation depend on the specific factors, which impact the benefits gained by firms from economies of agglomeration and scale, and all are enhanced by different types of proximity. Thus, joint interpretation of the economies of agglomeration, and of sectoral and geographical concentration that lead to economies of scale, with regard to different types of proximity, are the basis to describe the mechanisms of regional specialisation. Table 5 identifies few mechanisms of regional specialisation. This is to underline that one cannot identify a single universal category of regional specialisation within the positive approach. Actually, each of the mechanisms is a consequence of theoretical findings using individual achievements of theoretical concepts (as shown in rows) and the set of key factors influencing the benefits obtained by the companies (as shown in columns). These mechanisms are present in at least three streams of interpretation that should be analysed diachronically[13]:

1) regional specialisation: the effects identified by means of competitiveness,
2) regional specialisation: the effects identified by means of competitiveness and innovation,
3) regional specialisation: the effects identified by means of competitiveness, innovation and territory.

In this classification, it should be noted that in the case of classical and neoclassical economics, the mechanisms resulting from the comparative advantages obtained as a result of specialised division of labour, does not fit in any of the trends above. Simply speaking, it does not allow for the interpretation of regional specialisation, as it deals with a-spatial productive specialisation only. The proposed approach reflects the evolution of regional specialisation within the concepts derived from economic and regional science streams. In the first stream of regional specialisation, operating with competitiveness, the core factor is the accumulation of economies of scale (and to a lesser extent, the economies of agglomeration) to improve the competitive position of companies. In the second stream, operating with competitiveness and innovation, economies of agglomeration and of scale determine the growth of innovative capacity. Although innovation is the hallmark of the second stream of interpretation, the competitiveness invariably accompanies the processes of development. In the third stream of interpretation, which is based on territory, we incorporate also the perspective of competitiveness and innovation. Nevertheless, territory is here the key factor, as the "territorialisation of companies" or simply speaking seeing firms rooted strongly in territories (see. e.g. Camagni, 2002) becomes more important. This holds true especially when related to complex spaces (physical, economic, social, institutional, etc.) that are believed to be the source of the agglomeration economies to companies on the territory. Below we present the details of the described mechanisms.

In the first of the proposed analytical streams, i.e. in the stream of regional specialisation associated with the competitiveness, the mechanism is based on trade expansion as a result of the aggregation of economies of scale of various companies. Regional specialisation is determined by such factors as the distinctive competencies, unique infrastructure and technologies and extensive, specialised network of suppliers (Porter, 1990). The resulting benefits of concentration allow for the trade expansion by increasing the spatial extent of the market and sales volume. In other words, economies of scale are the result of the concentration of economic activity. Nevertheless, they may be due to the chain of production created by the network of suppliers and manufacturers using, e.g. a common infrastructure, enhanced by the benefits of agglomeration. Of course, in this case, spatial proximity, especially for certain activities, may be significant because of the lower costs of suppliers (proximity of suppliers' network). Basic benefits of regional specialisation in this mechanism

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[13] Similar approach can be found in Martin (2005) and Capello (2014)

are the unit cost reduction by increasing the production scale and sharing of costs between suppliers. This happens together with trade expansion and the same mechanism enhances concentration by sector, which very often is the last stage of mergers and acquisitions leading to the concentration of capital and centring the decision-making in one company. This type of regional specialisation corresponds to a S2 (Fig. 4) situation, described with the above-average sectoral concentration and possibly low level of agglomeration. Over time, agglomeration grows what follows the intense process of urbanisation. In consequence, stronger factors of specialisation develop, by strengthening the existing ones or new ones appearing. As the competitive position is under pressure of global competition, the structure of regional specialisation may transform. An example of such change in "the foundation" of regional specialisation, are the coal mining regions, where the restructuring of the sector evoked the structural changes and increased the spatial agglomeration.

In the second of the proposed streams, i.e. the regional specialisation associated with competitiveness and innovation, three synthetically defined mechanisms have been distinguished. The first mechanism is a mechanism of costs reduction incurred by the company due to knowledge spillovers. As essential for this mechanism one should recognise the economies of agglomeration (in particular, the localisation economies). These economies arise from knowledge and technology flows on a global scale (Krugman, 1991). The nature of geographical proximity is "relative" since globalisation and technological progress give it a new character. Cost reduction caused by knowledge spillover is positively determined by the agglomeration of economic activity. The second mechanism involves the exploration and exploitation of innovative solutions in diverse activities and economic sectors. Innovation is highly linked to knowledge (and its transfers) located in cities (Jacobs, 1969). Thus, the agglomeration economies (in particular, the urbanisation economies), result from the significant diversification of economic activities often undertaken by companies. This fact is considered to be significantly affecting the penetration of technological innovations and new knowledge. The scope of new knowledge and innovations is significantly determined by the agglomeration of economic activity. The third mechanism is based on acquisition and accumulation of knowledge through the relational proximity. The increased supply highly-skilled specialists and an access to professional networks are key determinants of the firms' development. The agglomeration economies resulting from access to knowledge are considered to be more achievable in places that are characterised by its high accumulation, but also ease in its flows. Thus, the importance of proximity goes beyond its initial meaning and it is expanded to relational proximity that strengthens cooperation (Malmberg & Maskell, 1997, 2007). The uniqueness and location advantages of these sites are confirmed by the agglomeration of economic activity. The main driver of this trend that shapes regional specialisation is a permanent search and exploitation of new opportunities and improvement of organisational solutions. In contrast to the first trend, the direction of specialisation is less predictable and less stable. However, specialisation of this origin generates high profits of companies which are the creator and a leader of change. This type of specialisation corresponds to a situation described as regional specialisation with above-average level of agglomeration and relatively lower level of concentration (S3). The key factors of regional specialisation in this case are: science, technology, relational closeness that through agglomeration of companies and institutions generate localisation and urbanisation economies and allow for the increased innovation and competitiveness of the region. In this particular type of specialisation, the agglomeration is of key importance, as it promotes the creation of innovative solutions and expertise in modern industries. Concentration may here lead to a slowdown in innovation processes.

Table 5. Regional specialisation mechanisms: the business and regional perspective

Economics and regional science: selected theoretical concepts / Triggers of economies of scale, scope and agglomeration	division of labour / factor endowments	spatial proximity and factor endowments: labour and capital	spatial proximity, relational proximity and knowledge spillovers	spatial proximity and urban amenities	socio-cultural, relational, institutional and cognitive proximities and territory
Classical theory	*Comparative advantage growth mechanism based on labour specialisation*				
Neo-classical theory	*Comparative advantage growth mechanism based on factor endowments*		1. Regional specialisation: the effects identified by means of competitiveness		
New trade economy		*Aggregated economies of scale trade expansion mechanism based on professional distinctive competences, unique infrastructure, technologies and networks of suppliers*			3. Regional specialisation: the effects identified by means of competitiveness, innovation and territory
New Economic Geography		2. Regional specialisation: the effects identified by means of competitiveness and innovation	*Cost reduction mechanism based on knowledge, and technology globally-wide internationalisation*		
Jacobs's theory of urban growth			*Innovative solution pursuit mechanism based on diversified activity in urbanised areas*	*Business anchorage and productivity growth mechanism based on urban amenities*	
Knowledge-based economy			*Knowledge acquisition and accumulation mechanism*		*Co-opetition mechanism*
Institutional economics / Evolutionary Economic Geography					*Trust-based risks' reduction mechanism* *The mechanism of agents' interaction and adaptive process*

Source: own concept

The third of the identified streams explains the roots of regional specialisation with the concept of territory and is characterised by three mechanisms. The first mechanism is based on the use of the benefits that the municipal facilities generate towards productivity growth in companies. In this case, agglomeration economies (urbanisation economies) are determined by the high quality of residence places and are associated with a wide range of infrastructure (urban amenities) and events for leisure (Brueckner, Thisse & Zenou, 1999). Localisation economies, due to the relationship with mobility of people and the urban costs, are determined by the lower costs of living and working in the city (Tabuchi & Thisse, 2006, p.1295). Therefore, companies are looking for such benefits, where the cost of living and labour are relatively low, and urban facilities are possibly highly attractive. These factors lead to the selection of the company's specific location and agglomeration of economic activity that keeps businesses and professionals[14] in a specific location (called: *territorialisation*). The administrative and urban systems are evolving toward functional areas or coherent territories. Geographical proximity reinforces the importance of costs primarily resulting from the use of the infrastructure, however, other dimensions of interpretation of proximity are apparent here, including relational proximity and socio-cultural proximity. The second mechanism is identified as a result of sustained cooperation within the territory and its importance to meet external competitiveness (co-opetition). New knowledge that firms acquire or develop is a factor achievable thanks to the cooperation of administration, business and environments that create scientific knowledge (see territorial capital and territorial governance by Camagni (2000, 2008), and the concept of the triple-helix/quadruple helix by Etzkowitz (2008)). The benefits of agglomeration reinforce the importance of the knowledge. Relational proximity (density of relations) and spatial proximity determine the creation of synergies between innovation and innovation environments (*milieus*) within the territory, and the competition is primarily in an external dimension. In turn, organisational proximity (Rallet, 1993; Rallet & Torre, 1995) enables the development of economic activity of companies. This is translated to facilitating the movement of knowledge as a result of the similarity of organisational systems in companies and thus to ease the contacts between them and their employees. The third mechanism is based on the opportunities to learn, possible to firms thanks to knowledge available in a given system (Asheim & Isaken, 1997; Lundvall, 1992) and the proximity of the institutional entities forming the system (Cooke & Morgan, 1994). Companies gain the economies of agglomeration in such locations where systems are deep-rooted in socio-institutional common standards, codes, rules of behaviour. The agglomeration of economic activity uses a process of knowledge flow and learning, perceived by firms forming the economy of the territory (Storper, 1997). The crucial categories for business are: the cost reduction due to a strong business environment, in particular through trust and reduction of transaction costs (Crevoiser, 2004), territorial utility and the territorialisation of firms (Pallares-Barbera et al., 2004). In this stream, regional specialisation depends on the set of specific factors offered by the territory, i.e. benefits assigned to the territory, and not an administrative unit. Qualitative factors, and in particular cultural factors, play crucial role in building the benefits as well as the relationships in-between several stakeholders. The following assumptions apply here as the territory is not defined here as administrative space. Companies are localized within the territorial production systems that tend to their institutional completeness, what in turn may drive the concentration (not always and not within the region). Therefore, the agglomeration is a dimension that describes the structure of regional specialisation that forces "thinking by means of territorialisation" of companies. It corresponds to the logic of industrial concentration or sectoral concentration. Concentration is by definition applied automatically in the overview of this phenomenon as one assumes it

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[14] In a broader sense, this is often referred to as creative class (Florida, 2002)

often reaches the maximum possible values. The agglomeration in such a mechanism is crucial, and this situation has been described as in model S1.

Regional specialisation defined by territory can be also described with the S4 situation from Fig.4. Low levels of agglomeration and / or concentration that are noticed in the mainstream evolutionary economic geography (Boschma & Labmooy, 1999; Cooke, 2015) should not eliminate the possibility of the occurrence of regional specialisation. This is because some regions may have a kind of specialisation which does not fit the model and statistics due to the common relativism of studies of regional specialisation (Kemeny & Storper, 2015). The uniqueness of the place (people, infrastructure, events, new technology companies, cultural heritage) may enforce the specialisation, even when its territory is not matching the administrative borders.

Mechanisms of regional specialisation described in Table 5, may be the basis to explain the driving forces leading to the agglomeration and concentration of business activity in economic structures of the region. This means that the mechanisms of regional specialisation presented hereby are derived from economies shaped by specific factors (explained in various fields of economic frameworks). These factors are reinforced by the proximity obtained by firms. The benefits obtained by the number of firms define consecutive localisations, and territorial patterns allowing for benefits taken by the territories. As a result, we believe that the identified mechanisms of regional specialisation must primarily be based on explaining the driving forces of performance and development of localisations and economic activities, i.e. real economic processes, which are primary to the aggregated over space values. The measurement of regional specialisation based on the above-mentioned mechanisms derived from agglomeration and concentration is equivalent essentially to determining the extent and relative specificity of these two phenomena. While identification (as well as the measurement) of concentration of companies/sectors in the region is based on well-known set of indicators, the phenomenon of agglomeration of companies and its effects in the region are much harder to measure. It seems that this fact is a consequence of both the interpretation difficulties and restrictions on access to the data. Interpretational difficulties are associated with fitting the categories that are explained, the need to combine them and merge categories such as: social, economic, cultural and environmental and finally the complexity of the relationships. The difficulties in accessing the data are basically due to the fact that we need to use them in measuring the agglomeration of micro-data, which should be based on sets of spatially geo-coded information. Their absence or the high cost of obtaining them lead to a noticeable asymmetry in the literature on measurement of regional specialised mechanisms which, in most cases is based on a measurement of concentrations using cluster-based methods, and occasionally take into account the measurement of agglomeration based on distance-based methods (Table 7).

The proposed typology of measures of agglomeration, concentration and regional specialisation uses the two-dimensional analysis. In the first dimension (rows) we give the five streams of interpretation. In the second dimension (columns) the identified results and their interpretation were assigned to the two classes of measurement, i.e. cluster-based methods, and distance-based methods. As it can be seen, the groups identified confirm a significant underestimation of the impact of spatial heterogeneity of economic activity in the measurement of regional specialisation. The analyses with the distance-based methods are relatively rarely used in the description and analysis of the agglomeration of economic activity and its influence on regional specialisation. Studies of regional specialisation, taking into account the economic consequences of the phenomenon of agglomeration are thus rare, and are usually replaced with descriptive qualitative analysis (see Karlsen, 2005).

Table 7: The basic measures of regional specialisation

Research area / Measurement types		Cluster-based indicator	Distance-based indicator
Agglomeration			Duranton & Overman, (2005); Duranton & Overman, (2008); Do & Campante, (2009); Jensen, Michel (2011); Marcon & Puech (2010); Behrens & Bougna (2015); [*Ripley's K function*] Mori & Smith (2014) [*global extent (GE) and local density (LD)*] Lang, Macon & Puech (2014) [*relative density m function*]
Concentration		Hoover (1936); [*Hoover index*] Arbia (2001a), Arbia (2001b); Arbia & Piras (2009) [*Spatial Concentration Measure*] Bickenbach, Bode & Krieger-Boden (2013); [*Herfindahl index, absolute and relative Theil index*] Bruelhart & Traeger (2005); Cutrini (2009) [*entropy index*] Franceschi, Mussoni & Pelloni (2009); [*Regional Industrial Mass and Regional Industrial Concentration*] Giullian & LeGallo (2007) [*Gini with ESDA*] Guimaraes, Figueiredo & Woodward (2011) [*inflation factor as correction of other measures*] Tian (2013); Kowalewski J. (2011)	
Regional specialisation: the effects identified by means of competitiveness	Comparative advantage growth mechanism based on factor endowments	Carlei & Nuccio (2014) [*Relative Industrial Relevance*] Barbaccia Davi, Lopez-Baro,(2009); Maurel & Sedillot (1999); [*Ellison & Glaeser index, Herfindahl index, Isard index*] Paluzie, Pons & Tirado (2001); Ezcurra, Pascual, & Rapun (2006); Betran (2011); DeSiano & D'Uva (2014); Tabuchi & Thisse (2006); Paci & Usai (1999); Meliciani & Savona (2015)	
	Aggregated economies of scale trade expansion mechanism based on professional distinctive competences, unique infrastructure, technologies and networks of suppliers		
Regional specialisation: the effects identified by means of competitiveness and innovation	Innovative solution pursuit mechanism based on diversified activity in urbanised areas	Duranton, Puga (2001); Sohn (2014) [*spatial distribution*] Meliciani & Savona (2015); Audretsch & Feldman (1999); Andersson, Quigley & Wilhelmsson (2005); Amiti (2001); Ezcurra, Pascual, & Rapun (2006); Fritsch & Slavtchev (2001)	Arbia, Espa, Giuliani & Mazzitelli (2010) [*Ripley's K function*]
	Knowledge acquisition and accumulation mechanism		
Regional specialisation: the effects identified by means of competitiveness, innovation and territory	Business anchorage and productivity growth mechanism based on urban amenities	Desmet & Fafchamps (2006)	
	Co-opetition mechanism		
	Trust-based risks' reduction mechanism		

Source: own concept

The multidimensionality of the development process is and will be an area of discussion and interpretations in the social sciences. Growing importance of business locations in the geographic space in the presented streams of interpretative approaches to the mechanisms of regional specialisation confirms the need to focus attention on the measurement of agglomeration. Hence, it can be assumed that the description and explanation of the phenomenon of specialisation should be better targeted to address the aspect of heterogeneity and measurement underestimation of specialisation for which the administrative borders do not matter. A territorial approach to regional specialisation (*de facto* territorial specialisation) can open up a whole new field of analysis of the phenomenon of economic specialisation that occurs in diverse economic space territories. The offerings of literature to use new metrics for measuring connecting agglomeration and concentration of economic activity in the identification of regional specialisation, which include SPAG (Kopczewska et.

al, 2015), should open to a broader discussion and the need to verify the current understanding of regional specialisation.

Conclusions

The results of the analysis allows us to make decisions with regard to the three basic areas of research necessary for understanding and explaining the mechanisms of regional specialisation on the basis of the social sciences. They concern i) the narrowing of the concept of regional specialisation and clarifying terminology associated with it, ii) determining the factors which decide on the benefits used in the mechanisms of formation of regional specialisation and iii) deriving the recommendations relating to the ways of its measurement.

The paper clearly points out that regional specialisation must be defined by means of an integrated and complex approach. This identifies the uniqueness of a given territory (region) assessed in the complementary dimensions of agglomeration and concentration of economic activity. The uniqueness is determined by specific benefits for businesses seeking sustainable advantages. The level of this uniqueness is considered to be the essence and basis for regional specialisation. The systematisation of concepts leads to 'rewriting' the relationship terminology resulting from the use of complementary dimensions of *specialisation*, which we believe is *agglomeration* based on measurement of distance and overlap and *concentration*, based on the measurement of its geographical and sectoral aspects. Uniqueness is the other issue. The combination of benefits of agglomeration, concentration, or the uniqueness of economic activity are the drivers boosting the regional specialisation. These have been organized in a matrix of four model situations to allow the interpretation of mechanisms for regional specialisation.

In the attempt to identify the determinants of benefits used in the mechanisms of formation of regional specialisation, *a positive approach* has been adopted. The two-dimensional model with agglomeration and concentration on the axes seems to be the suitable framework for interpretation towards regional specialisation. The perspective of business is a primary one, above the regional one, which should be considered in this process as a consequence. The specificity of the mechanism of regional specialisation is determined by diverse factors underlying the company benefits gained by economies of agglomeration and scale, which are reinforced by different types of proximity. Joint interpretation of the economies of agglomeration, and of sectoral and geographical concentration, which lead to economies of scale, under the assumption of certain types of proximities, is the basis to describe the mechanisms of regional specialisation. The most important mechanisms should be regarded as those where regional specialisation is seen within the effects identified by means of i) competitiveness, ii) competitiveness and innovation, iii) territory. Conducted analysis leads to the conclusion that the interpretation of the mechanisms of regional specialisation must always take place using the conceptual apparatus identical to the concept adopted as a theoretical basis for its explanation. It is postulated that more attention to the scientific and pragmatic background should be given in the sphere of selection and application of concepts. This fact seems to be highly important in the light of the popularity and, observed in the literature, "relative" freedom of defining and explaining regional specialisation in its relationship with phenomena such as: territorial cohesion, territorial utility or smart specialisation.

The measurement of regional specialisation is to determine the extent and relative specificity of agglomeration and concentration of economic activity. In current practice, in most cases it is based on measurement with use of cluster-based methods that gives information on concentration. Only occasionally researchers use distance-based methods which can measure the agglomeration of economic activities. However, as indicated in an article, there is a strong need to include in measurement of specialisation the effects of

agglomeration. In the current research on the phenomenon of regional specialisation it seems to be fundamentally undervalued. At the same time, the continued and growing importance of the territorial approach in explaining development processes has been given particular focus. The analysis of the agglomeration of economic activity in territory with the use of micro-data parameters described geo-locationally, instead of commonly used aggregates of administrative units (NUTS), can therefore contribute to the qualitative improvement of the accuracy in explaining the foundations of change of territorial development and normative conclusions for policy development. That is why new measures of regional specialisation should be found, taking into account both the dimensions of agglomeration and concentration of companies and that will not be vulnerable to problems known from the literature such as the Modified Areal Unit Problem and will not be characterised by constraints resulting from the application of Ripley's K function. Such a proposal could be a new index of spatial agglomeration called SPAG (Kopczewska et al., 2015).

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