

SPATIAL EFFECTS AND EXTERNALITIES OF THE RIVALS' NETWORKS IN HUNGARY

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ABSTRACT

Empirical results of the concept of territorial capital suggest that the Hungarian regional economic development is defined by the cooperative networks of small- and medium-sized enterprises (SMEs). Therefore, overall purpose of this paper is to scrutinize theoretically and empirically on one hand the structural characteristics of the Hungarian cooperative networks of SMEs, on the other hand is to analyze effects of the networks of same firms on regional economic development. Altogether three Hungarian cooperative networks of SMEs were found and analyzed longitudinally embracing 127 entrepreneurs thus 127 interviews and 127 questionnaires were conducted as well. Since the cooperative networks of enterprises have territorial extension, the advanced methods of network science and spatial econometrics were combined. The key findings show that focal firm plays outstanding role in redistributing market information, organizing mutual transportation and guarantees robustness of the cooperative networks. Finally, the cooperative networks of SMEs determine significantly the new jobs creation and pay raise, in general, the accumulation of territorial capital at regional scale as well.

Keywords: Nodal regional economic growth, Spatial network analysis, Cooperative networks, Power-law degree distribution

JEL Classification: D62, F12, L24, P13

1. INTRODUCTION

The Hungarian regional economic development and growth are determined by the inter-firm relationship (Jóna, 2015a; Jóna, 2015b), thus the paper theoretically and empirically concentrates on scrutinizing the Hungarian cooperative networks of SMEs and the effects of the networks of rival firms on the regional economic growth. The cooperation has occurred as a new category in the terminology system of social sciences that refers to the special dynamic interplay between same firms in which the competitors collaborate and compete with each other simultaneously (Bradenburger & Nalebuff, 1996; Gnyawali & Park, 2011; Pathak-Wu & Johnston, 2014, Raza-Ullah, Bengtsson & Kock, 2014; Lindström & Polsa, 2015; Gnyawali, Madhavan, He & Bengtsson, 2016). By applying cooperation, the market automatism does not disappear from economic structure, of course. The competition remains in hegemony in the economic setting but in some place of business life the enterprises in network of SMEs collaborate to achieve effectively their purposes. The paper concentrates only on effects of cooperative networks on regional economic development but does not consider the network evolution.

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Moreover, well-known fact that every cooperative network has territorial extension so a territory which is covered by a network is has to be named as a *nodal region* (Nystuen & Dacey, 1961; Thilenius, Havila, Dahlin & Öberg, 2016). Since economic networks, economic relationships and the territorial concentration of economic activities create nodal region, it must be scrutinized by combining toolkits of network science and spatial econometrics. Taken together, the paper thus describes impacts of the cooperative networks on the economic development of nodal regions (hereinafter: regions). Spatial extensions of the cooperative networks are illustrated by maps in the paper.

The overall purpose of this paper is on one hand to scrutinize theoretically and empirically operational automatism of three Hungarian bottom-up cooperative networks. Whereas every cooperative network possesses geographical extension, these are dissected by applying advanced (both basic and novel) toolkits of spatial network analysis to understand architectures and territorial impacts of cooperative networks. On the other the paper elaborates a network measurement model with which spatial effects of cooperative networks can be operationalized longitudinally as well.

2. THEORETICAL UNDERPINNINGS AND EMPIRICAL OVERVIEWS

Empirical results of the concept of territorial capital suggest (Jóna, 2015a; Jóna, 2015b) that the Hungarian regional economic growth and development have been determined by networking of the small- and medium-sized enterprises (SMEs)³. More precisely, the inter-firm relationship has outstanding role in the regional economic growth therefore the methods of network science must be applied to analyze trajectory of regional economic development (Stimson, Stough & Nijkamp, 2011; Stimson, 2014).

At first time Hakansson and Snehota (1995) concentrated on examining the evolving of the business networks theoretically and empirically, the basic information and characteristics of the entrepreneurial networks were mustered by them. They stress that the business network is not 'an island but a multiple system' encompassing human being with emotion, regional past, traditions, special socialization, etc (Hakansson, 2015). It is clear, the entrepreneurial decisions, performances and the networking can be determined by on one hand exogenous and endogenous assets and on the other hand regional proximities as well (Boschma, 2005; Torre, 2008; Torre, 2011; Bernela & Levy, 2015); these usually have to be taken into account by the regional economic analysis.

It has to be emphasized that the networks of companies have spatial components and dimensions, in the early 1960s so many scholars described and concentrated on it (Haggett & Chorley, 1969). Notwithstanding, this perspective had lasted only a few years and the academic investigations subsequently focused on innovation potential of networks. Nowadays, increasing number of papers has again dealt with territorial effects and patterns of the network of SMEs; the network approach in researches has been shifting fast in this field.

Furthermore, the networking of firms has been configured in every type of regions, numerous empirical studies corroborate that social and economical bonds have been formed among local small enterprises in peripheral, semi-peripheral and core regions as well (Dubois, 2015). Eventually, it seems nowadays the SMEs' networking can be revealed irrespective of territorial development level.

Moreover, as the network structure is analyzed intensively in the next chapters, the scale-free architecture of network has to be understood adequately. Obviously, the random graph theory cannot describe the network scheme in the nature but the Barabási-Albert model

³ According to the Hungarian law system, the SMEs can be defined as firms that have no more 250 employees or its balance sheet total is no more the 43 million Euro/year. The paper accepts this definition.

can grab it (Albert & Barabási, 2002). Fundamentally, the scale-free network structure can be defined as power-law degree distribution. The degree distribution illustrates how often nodes occur with varying edges in a certain network. Simply put, usually one or only some nodes have a large number of connections in the network, in so doing, most of the agents have only a few links thus hubs (high degree nodes is called hub) are formed that guarantee the robustness and integration of the network. The power-law degree distribution system is usually evolved by preferential attachment automatism referring to the more connected players, the more likely it is to receive new and new ties (Albert, Jeong & Barabási, 2000). Consequence of the scale-free network topology is that the robustness of network becomes high. More precisely, in the network of SMEs there is a focal firm that is known by everyone in the network, playing prominent role in the allocation of information, organizing, coordinating and integrating the actors of network. Ultimately, the dominant firm (the hub) is defined as the Achilles Heel of network of SMEs (Albert *et al.*, 2000; Albert & Barabási, 2002) since it is the main actor in the network.

The scale-free network structure has advantages and drawbacks as well. Barabási (2015) accentuates advantages of scale-free network architecture finding out that the power-law degree distribution can protect network against random attacks. In general, if an actor is gone out of the network by a random attack, the network can operate on because the network loses a node with a few connections. It is because, most likely, a member with a few connections would be attacked thus the network lost low value. Moreover, the paper emphasizes that scale-free property shows that the focal firm that integrates and manages the network.

Finally, the functions of focal firm belong to intensive academic dispute. On one hand numerous scholars (Hakansson-Snehota, 1995; Hakansson, 2015) argues that central firm can create dictatorship within the network, on the other hand Barabási (2015) notes that scale-free topology provides robustness of graph thus it can protect itself against different attacks.

Nowadays, the entrepreneurial alliances have meaningful role in the bargaining, by collaborating with each other so that SMEs could take the best bargaining power against certain service providers (such as electricity, gas and central heating companies). For example, if local SMEs cooperate with each other to reach cheaper services, certain services provider may treat them as a vast venture thus the lower prices will be provided for the players of networks. The Hungarian law system absolutely permits the entrepreneurs to cooperate with each other in such way and to decrease their expenditure. Actually, the corporation of competitors brings confidence relations, new possibilities and positive externalities for enterprises by at interregional level as well (Karlsson, Johansson & Staught, 2005).

The networking of SMEs facilitates the cooperation in some fields such as cost transaction and mutual transportation, risk reducing, collective learning (Hakansson, 2015), knowledge spillover (Carrington & Scott, 2005), product development (Jackson & Watts, 2002), technical shifts, information changes, R&D collaboration and adaptation of innovation (Karlsson *et al.*, 2005). Moreover, within the inter-firm network so many formal and informal communication channels can be formed so that the entrepreneurs could share market information and knowledge spillover effect could be evolved as well. Marshall's early profound work argues that the regional inter-firm relationship might promote to the internal economies of scale and the accumulation of endogenous assets as well (Marshall, 1930).

In this respect, the proximity has meaningful function in the networking of SMEs. The proximity has so many types in the modern regional studies; Boschma (2005) distinguishes social, cognitive, organizational, institutional and geographical proximities. Those networks of SMEs manage to work successfully in practice which struggle that the above mentioned proximities prevail between firms. The related literature, in particular the French School of

Proximity (Torre, 2008; Torre, 2011; Bernela & Levy, 2015), accentuates that in these days the role of technological proximity has been emerging so the combinations of proximities define evolution and function of the networks of entrepreneurs. When these proximities evolve at inter-firms level, bottom-up networks can be established contributing to the accumulation of territorial capital and to the equilibrium of regional economic development. For example, Czernek and Czakon (2016) underscore in their case study that some Polish cooperative networks of SMEs (for instance in the tourism sector) can operate well if among firms exist emotional and physical proximities; this condition causes trust-building between firms defining regional economic growth. In such socioeconomic circumstances the networks of SMEs could be easily formed as well. Moreover, other scholars highlight that the physical and cognitive proximity determine the knowledge sharing, investments and complementary capabilities, furthermore 'when cultural sensitivity is low, psychic distance takes on greater importance in attenuating relationship value, whereas when cultural sensitivity is high psychic distance has no discernible effect' (Skarmeas, Zeriti & Baltas, 2015). To sum, the proximities can impact significantly on the qualities of inter-relations in the networks of firms.

Significant close connection is recognized between the networks of SMEs and regional economic growth; it can be proved by not only conceptually but also by empirically as well. Tangible examples of the economic networking are the Silicon Valley and Hollywood (Cohen & Fields, 1999); 80 percent of the Italian agricultural sector based on small family business (Ciravegna, Lopez & Kundu, 2014; Gurrieri, 2014; Campopiano, Massis & Cassia, 2016) and almost whole Danish economic structure has been based on the networks of SMEs (Chetty, Partanen, Rasmussen & Servais, 2014). Finally, the network of SMEs and its spillover effects are found in all economic systems around the world so it works in practice as well.

A large number of theoretical and empirical investigations confirm that the SMEs' networking has meaningful role in the regional economic development but only the networking is not enough. The network of SMEs has to be embedded in the social and economic structure in order that the synergy effect could escalate and thus a region can step on a stable and harmonic development trajectory (Meschi & Wassmer, 2013). Embeddedness of a network means that the entrepreneurs of network and their acts are accepted fully by the local residents and communities thus the networks are integrated in the multiple regional settings (Granovetter, 1985); the networks of SMEs become the organic component of the local traditions, characteristics and milieu. Malecki (2012) suggests that the local embeddedness can be defined by social capital that refers to 'the overlap between the social and economic spheres of human life.' (Malecki, 2012: 1025). Eventually, the topic of local embeddedness seems relevant, however, operationalization of its elements are still vague.

On one hand, the structure of economic networks is needed to be analyzed by graph theory (Jackson-Watts, 2002), on the other hand, network dynamic formation can be scrutinized by the game theory – particularly (non)corporative game theory (Rosen & Hubert, 2015) – and dynamic models of collective behavior theory (Peter & John, 2005; Vega-Redondo, 2007; Goyal, 2007; Jackson, 2008; Bramoullé & Kranton, 2016). The core characteristics of complex network method have been improved and summarized by König's so many profound and fundamental papers (König & Battison, 2009).

As above mentioned, the driving force of the Hungarian regional economic growth is the networking of SMEs. However, establishment of SME was forbidden in the socialist area, meaning that enterprises did not exist formally and there were no networks of companies, of course (Kornai, 2008). Furthermore, as the social relationship and face-to-face partnership were controlled and managed intensively in total communist dictatorship, the mutual trust and personal support, confidence relations and respect were eliminated from the local

society and thus the bridegroom entrepreneurs (Hankiss, 2014). After the regime change (in 1990) the Hungarian local residents could establish firms but they did not have links and enough relational capital; SMEs were allowed to be formed but the SMEs networking was restricted on account of early wrong political and social experiences (Berend, 1996). This multiple situation determined significantly both the fluctuation of entrepreneurship and the networking of SMEs. After the regime change, numerous enterprises were established in Hungary but these had to functionalize almost total alone because entrepreneurs did not believe in each other, the inter-firm nexus has not been configured easily. Ultimately, the social network of entrepreneurs has been specified by the communist heritages. The communism had been over but the socialist socio-cultural and personal effects have remained in the Hungarian patterns of connections.

Notwithstanding, I managed to find three bottom-up, supply-oriented cooperative networks of SMEs (hereinafter cooperative networks of SMEs) that have been functionalizing as real networks; it proves as well that the Hungarian SMEs' networking has already begun.

In the next sections the paper demonstrates on one hand how dataset of the networks was collected and analyzed; on the other hand the paper focuses on investigating structural features of the cooperative networks of SMEs such as topology, robustness, functions, centralities and small-world-effects of the networks. Afterwards, the chapter of result characterizes and compares above mentioned three Hungarian cooperative networks of SME and describes how SMEs' networking impact on regional economic growth.

3. METHODS AND MODEL OF NETWORK

The primary network dataset was assembled as follows. Employing my informal friendship including so many enterprises I found four collaborating same firms. Firstly I fixed up and conducted interviews separately with them and after that I asked entrepreneurs for telling me who else belong to this informal network. By following snowball method, three bottom-up, cooperative networks of SMEs were revealed. Nevertheless, quantitative (questionnaires) and qualitative (sociological semi-structured interviews) methods were applied simultaneously in order to the characteristics of the cooperative networks can be understood in-depth (Paula, 2015; Smith & McKeever, 2015; Sanou, Le Roy & Gnyawali, 2015); the paper prefers micro-geographic approach. Basically, the primary database includes 127 interviews and 127 questionnaires. In general, the questionnaire consists of basic information of firms such as postal code, street, house number of firm location, number of employees, annual income, etc., while the interviews map out the nature of links between same companies. The interviews lasted 110 minutes on average, the longest one is 4 and a half hours, the shortest one is 55 minutes. The database was collected between April and September 2015.

Nevertheless, the paper accepts statement that almost every network of SME has spatial extension thus toolkits of network science and spatial econometrics are combined. The first network is located from Tihany to Budapest (network of Budapest and Tihany: NTHBP), the second one exists in Nyíregyháza (network of Nyíregyháza: NNYH), and the third network is situated in Budapest (network of Budapest: NBP). NTHBP embraces 72 firms, NNYH consists of 14 firms, and NBP includes 41 firms, all together ($72+14+41=127$) 127 enterprises belong to the research model. In a nutshell, $NTHBP=\{1,2,3...72\}$, $NNYH=\{1,2,3,...14\}$, and $NBP=\{1,2,3,...41\}$. Moreover, these have to be defined as disjoint sets, so $NTHBP \cap NNYH \cap NBP$, meaning that the networks could be analyzed separately and compared to each other in the next sections.

All of three unintentional cooperative networks of SMEs are regarded as unweighted and undirected graphs⁴ referring to the interaction is mutual among firms, nodes are in symmetric relationship. In this model: $G_{NTHBP,NNYH,NBP}=(V,E)$, where G is graph, V are vertices and E is edge. In this case V means firms and E means link among firms. More precisely, the vertices mean premises of firms and the edge refers to cooperative interactions between firms. Basically, on one hand the paper scrutinizes relation structure of inter-firms and quality of bonds, on the other hand quantifies how inter-firms nexus affects regional economic development.

The structural properties of the cooperative networks of SMEs can be gauged by degree centrality, betweenness centrality, closeness centrality, the Duranton-Overman index, geodesic distance, average degree, small world, graph density, scale-free network topology and the large of network (Wasserman & Faust, 1994; Vega, 2007; König & Battison, 2009; Barabási, 2015; Jackson, 2016). In this vein, the paper accepts that the network structure determines significantly the network functions. In this chapter their calculations are demonstrated.

The actor centrality and player position in the network can be operationalized by three paths, such as degree centrality, betweenness centrality and closeness centrality. The degree centrality with Freeman centralization (C_D) stresses that the network activity depends on in-degree (how many players choose him/her) (Wassermann & Faust, 1994), it has to be calculated: $C_D = \frac{\sum_{i=1}^g [C_D(n^*) - C_D(n_i)]}{[(n-1)(n-2)]}$, where C_D is the group centrality, $C_D(n^*)$ is the highest degree in a certain network and g expresses the number of players of network. C_D 's value can be 0 and 1, where theoretical value 1 demonstrates that the focal firm belongs to every enterprise but others do not know each other (Scott, 2000). Moreover, the closeness centrality C_C highlights that a firm has central position in the graph if a company can be accessed easily thus it can gather and distribute directly adequate and important market information. The closeness centrality has a well-known formula: $C_C(n_i) = [\sum_{i=1}^g g(n_i, n_j)]^{-1}$ where g is a distance and i and j show the distance between actors. In addition, the betweenness centrality C_B expresses that those player has power in the graph and can control network evolution as well who is located among numerous other actors. Its equation can be described as this way $C_B(n_j) = \frac{\sum g_{ij}(n_j)}{g_{ij}}$ where $i \neq j$, $l \neq j$ and $g_{ij}(n_j)$ expresses the number of the shortest edges between i and j (Balakrishnan & Ranganathan 2012).

The paper emphasizes that eigenvector is not being calculated because a few number of agents take part in these cooperative networks.

Furthermore, in the spatial econometrics well-known Duranton-Overman index [$\hat{K}(d)$ -index] is employed to analyze the territorial concentration of SMEs. Its formula can be described as $\hat{K}(d) = \frac{1}{Eh} \sum_{i=0}^n \sum_{j, e(i,j) \in E} f\left(\frac{g-g_{i,j}}{h}\right)$, where f is a Kernel function, h stands for the optimal bandwidth, i and j show the geographical distance between firms (Scholl-Garas-Schweitzer, 2015: 8).

The small world of network refers to the distance between hubs so it can be obtained if we divide local clustering coefficient by average path. In case of undirected graph the local clustering coefficient (C_i) refers to 'the extent to which one's friends are also friends of each other' (Watts & Strogatz, 1998) so $C_i = \frac{\text{number of pairs of neighbors connected by edges}}{\text{number of pairs of neighbors}}$. Finally, the global value of C_i is obtained: $CL_t = \frac{1}{N} \sum_{i=0}^n C_i$. Nevertheless, in the case of undirected graph the average path AP can be counted this way: $AP_{i,j} = AP_{j,i}$ so the well-known formula

⁴ The notions of graph and network emerge synonyms in this paper.

can be obtained: $AP = \frac{\sum_{i=1}^n \sum_{j=1}^n g_{ijt}}{N(N-1)}$. It contributes to calculate the small world (SW) by employing above mentioned equitation: $SW = \frac{CL_t}{AP_t}$ (Watts, 2016).

Moreover, the graph density (D) compares the number of edges to the maximal number of edges, so: $D = \frac{E}{N(N-1)}$. Besides, the average degree of undirected graph: $\langle k \rangle = \frac{1}{N} \sum_{i=1}^N \frac{2L}{N}$ and the large (L) of network can be obtained: $L_{max} = \frac{N(N-1)}{2}$.

Finally, the scale-free network architecture can be measured by the well-know mathematical formula (Csermely, London, Wu & Uzzi, 2013; Barabási, 2015): $P = kT^{-\alpha}$, P presents probability, k is a constant, T is a certain variable, and $-\alpha$ is exponent of power function. In the nature, the value of α is between 2 and 3 consistently. The paper accepts and applies this premise.

After the presentation of quantitative methods, now the qualitative toolkits are illustrated. The face-to-face sociological, semi-structured interviews were conducted as well. By applying the qualitative design, on one hand, the personal narratives and the socioeconomic circumstances can be taken into account (Yin, 2011). On the other hand, the interviews serviced to map out informal relationships and positions of agents in network; the informal bonds of network can be investigated scientifically with qualitative method (Gilleskie & Zhang, 2009; Badev, 2013; Qu & Lee, 2015; Ciliberto, Murry & Tamer, 2015) and it is applied systematically.

The qualitative dataset is elaborated by both the structured content analysis and qualitative input-output analysis. The dimensions of interviews are structured as follows:

- introduction,
- network evolution,
- collaborating with competitors,
- horizontal network structure,
- business model,
- the network effect on the income and establishing of new jobs.

The next chapters provide insight into the empirical results, more precisely, the topology of three Hungarian cooperative networks of SMEs and the impacts of the networks on the regional economic growth.

4. EMPIRICAL FINDINGS

4.1 The cooperative network of SMEs between Tihany and Budapest

Tihany has always been a typical ecclesiastical and historical middle-sized town in Hungary; it is located in a peninsula of the north-Balaton Lake approximately 140 km far from Budapest (capital of Hungary). The local society of Tihany can be called special too, consisting of few priestly elite and a large number of citizens who had been living under the Hungarian average living standards (Horváth, 2015). Of course, in center of Tihany can be found some popular and rich tourist destinations but the old and bigger element of the settlement is underdeveloped; huge territorial and social disproportion appeared in Tihany. Nevertheless, this sad socio-economic circumstance has been reshaped basically by a very successful entrepreneur of Budapest who was born in Tihany. He decided on establishing a new local market in Tihany where the poor local inhabitants could sell their old and handmade products, odds and ends, vegetables and fruits from home gardens etc. Put another way, because of the new local market overwhelming of unemployed local people

started working at new market and became entrepreneur and taxpayer citizens, moreover, they have been able to sign on further unemployed people of Tihany. Spread of the local entrepreneurship and the new marketplace have led to eliminate the poverty and regional inequalities. As a whole, the regional economic development could start in Tihany because of the cooperation.

It has to be emphasized that the local market was formed in 2008 but the solvent demand misses therefore owner of new market managed to invite his VIP friends from Budapest so that elite of capital could purchase local residents' productions and as a result the local market has expanded; relational capital of the owner has been converted into economic capital. As a consequence, some successful enterprises of Budapest have been interested in selling products at new market of Tihany so nowadays approximately 20% of the NTHBP come from Budapest.

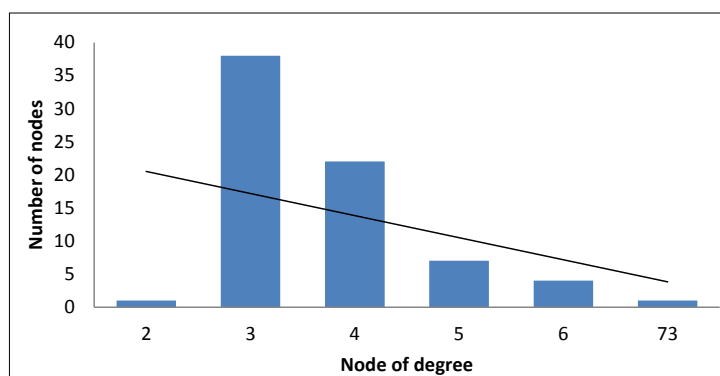
Interestingly, the NTHBP is similar to the www.amazon.com, that is based on cooperation business strategy, both offer places for actors of supply side so that customers and sellers could meet and do business with each other (Ritala, Golman & Wegmann, 2014). The core difference between both is that the NTHBP provides physical market for firms while the www.amazon.com offers only Internet territory.

Indeed, the NTHBP has to be defined as an unintentional cooperative network of SMEs because its counterparts collaborate with each other to mutual transportation of goods so as to reach higher profit. Since the mutual transportation, a typical form of cooperation, prevails in the all three Hungarian cooperative networks, the mechanisms of mutual transportation of goods have to be scrutinized thoroughly at this point.

Initially, SMEs of the cooperative network understand that the price of transportation (expenditure) can be reduced by mutual transportation. So, when products start running out, an entrepreneur (usually focal firm of the network) books orders and musters the needed list of goods. Just as many trucks are used for transporting goods that is enough for delivering the ordered volume of products, as a result, savings can be realized collectively. For example, in the NTHBP usually 57 trucks deliver goods for 72 firms thus the cost of transportation and amortization of 57 trucks have to be paid by 72 enterprises. By sharing and reducing transportation cost, firms can save financial resources to establish new workplaces or to increase income of their employees.

Arguably, the focal firm has crucial function in the cooperation in Hungary. The role of dominant firm (sometimes it is called as broker by Madhavan, Gnyawali & He, 2004; Choi & Wu, 2009; Pathak *et al.*, 2014) can be identified adequately by scrutinizing architecture of the NTHBP. As Figure 1 shows, the NTHBP has scale-free property referring to that only one agent (namely the focal firm) in the network has a large number of cooperative connections, conversely, numerous nodes have only a few cooperative links.

Figure 1. Topology of the NTHBP



Source: Own Elaboration

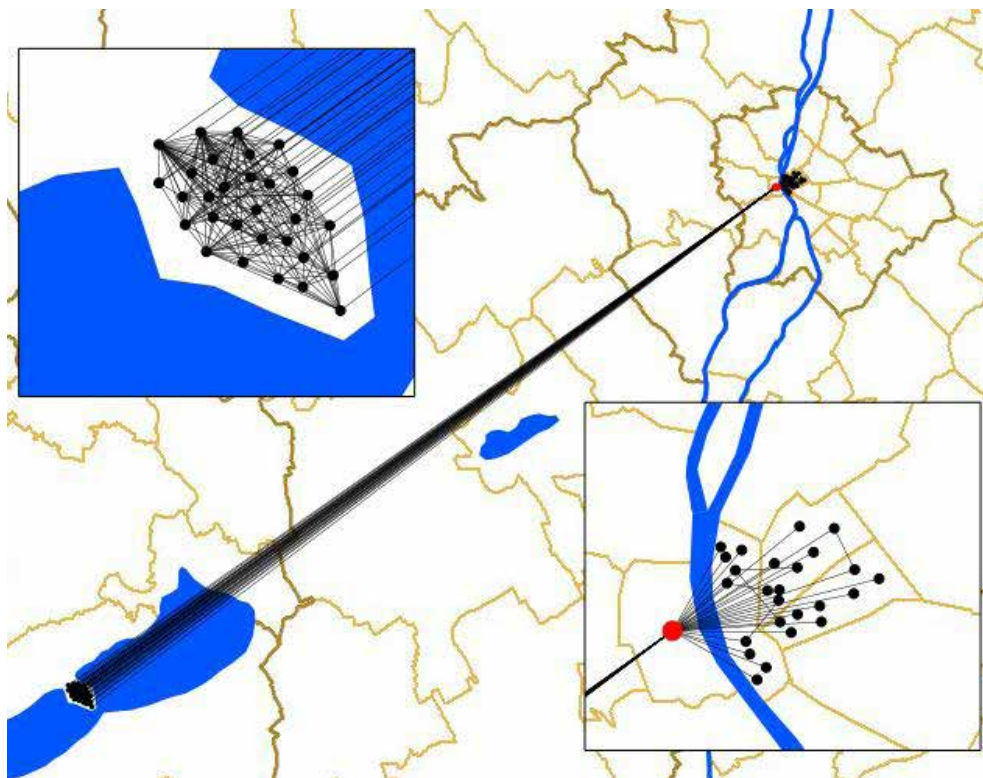
Simply put, the dominant firm, owner of new marketplace, is known and trusted fully by everybody in the NTHBP but the entrepreneurs do not trust in each other. As already indicated, it is because on one hand these entrepreneurs have been socialized in distrustful milieu of communism, on the other the rivals' relationships are not friendly. Therefore, the focal firm mediates among firms in the network and can build bridge among competitors; the hub is the Achilles Heel in the cooperative network. It can be lighted by a part of an interview.

'I hate C. J. (name of an entrepreneur was mentioned) because she deceived me a lot earlier. We hate each other. But I know A. P. (name of focal firm of the NTHBP was mentioned) who also knows C. J. I know that mutual transportation always brings me huge profit but I cannot negotiate with her so A. P. manages transportation between us. A. P. is a really good man, I trust him. He asks me and C. J. what we need next weekend and these are transported for us. But I never negotiate with C. J. but the mutual transportation works because A. P. helps and mediates between us!' (121st interview)

Basically, the focal firm guarantees integration and robustness of the network (Pachura, 2010). Formally, the central firm organizes mutual transports so that price reduction and profit maximization can be reached by all entrepreneurs in the NTHBP.

The NTHBP is defined territorially because it consists of 72 enterprises (57 from Tihany and 15 from Budapest) but only some firms of Budapest have cooperative nexus with enterprises of Tihany. More specifically, the NTHBP might be divided into two subgraphs territorially. The first subgraph can be found in Budapest, another one is revealed in Tihany and the two subnetworks are integrated by the focal firm (red point in Figure 2) thus the NTHBP become a connected network.

Figure 2. Spatial extension of the NTHBP



Source: Own Elaboration

In other words, numerous inter-relation ties can be emerged within both subgraphs but only a few bonds exist between subgraphs but everyone knows focal firm. Framework of the cooperative networks is illustrated by the Table 1.

Table 1. Some spatial parameters of three cooperative networks

	N	L	$\langle k \rangle$	C_{DF}	C_B	C_C	$\hat{K} (d)$ -index	D	AP_t	CL_t	SW_t	P
NTHBP	72	1742	48,38	0,73	1,93	0,82	0,19	0,69	1,36	2	0,4264	1,6314T ⁻² ,135
NNYH	14	91	13	1	4	1	0,41	1	1	1	1	-
NBP	41	431	21,02	0,64	1,11	0,71	0,23	0,53	1,44	2	0,2361	1,4871T ⁻² ,018

Source: Own Elaboration

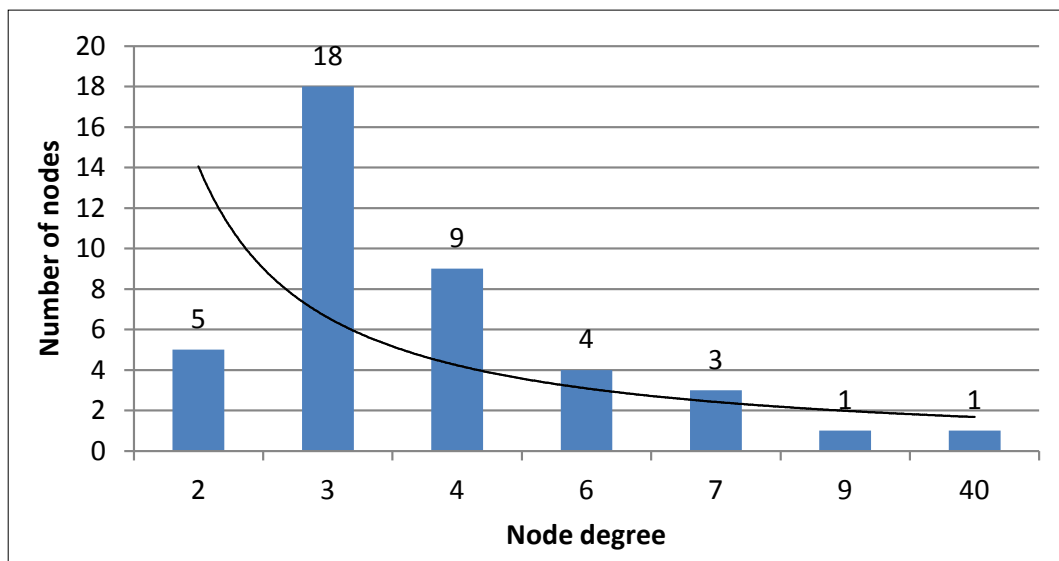
To date, the NTHBP possesses domestic and international reputation showing a large number of the elites, VIPs and celebrities have already visited to purchase and meet friends at local market. The solvent demand and urban milieu can be improved intensively and the NTHBP promotes to the value creation, values capture and value appropriation at regional level.

4.2 The cooperative network of SMEs in Budapest

The actors of the NBP sell wine establishing in 2008 and encompass 41 same firms. The unintentional cooperation of NBP was constituted for mutual transportation so NBP similar to the NTHBP. A central firm of the NBP manages mutual transport thus wine has not been needed to transport separately so the partners of the NBP could save price of fuel to invest in creating new workplaces (Thornton, Henneberg & Naudé, 2015). Basically, partners of the NBP compete fiercely on quality, price and value but collaborate in the sphere of mutual transportation simultaneously so it has to be called a dynamic cooperative network of SMEs.

By dissecting architecture of the NBP, scale-free network topology can be found again. Dominant firm in the NBP is the Achilles Heel so robustness of the NBP is so high. The R², coefficient of determination, demonstrates how regression line fits the primarily database so it is able to describe the real conditions in the NBP statistically (see Figure 3).

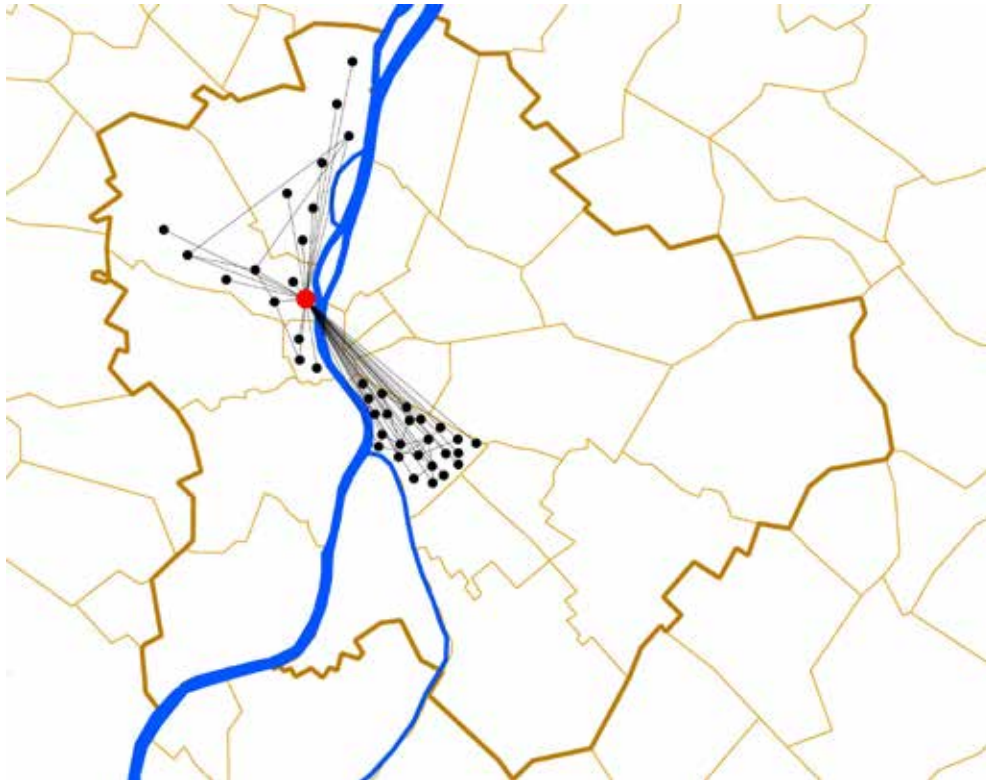
Figure 3. Topology of the NBP



Source: Own Elaboration

The NBP is determined territorially meaning that actors of the network locate in the 5th, 6th and 9th (the most developed) districts. Besides, the focal firm (red point in Figure 4) is situated in the 2nd district, the richest place of Budapest. In this respect, the Hungarian élite prominent function in the regional economic development nowadays. This map (Figure 4.) suggests that focal firm organizes cooperation in the NBP; all entrepreneurs of this network operate as ‘an island’ in practice (Hakansson & Slehota, 1995) due to mistrustful of inter-firms. Irrespective of salient tension, the NBP can functionalize because the central firm brings so strong cohesion power and high robustness in the network.

Figure 4. Spatial extension of the NBP



Source: Own Elaboration

Finally, the Marshall-Arrow-Romer specialization externalities (so-called the localization economies of scale) has been revealed on territory of the NBP because of cooperation and that has led regional economic growth.

4.3 The cooperative network of SMEs in Nyíregyháza

The entrepreneurs of NNYH sell perfumes, establishing with 14 members in 1993, so far the number of entrepreneurs has not been changed and the NNYH has been operating without any formal contracts. The NNYH can be named as very special cooperative network of SMEs due to entrepreneurs of the NNYH are Christians following strongly the dogmas of Church thus it should be called as a closed network of companies. This closeness has to be explained by the religion since Christian entrepreneurs of the NNYH do not cooperate with non-Christians. The results of structured content analysis and qualitative input-output analysis of interviews suggest clearly that non-religious entrepreneurs attempted to engage in cooperation but the Christian entrepreneurs did not trust them.

‘A lot of local entrepreneurs have been trying to enter our informal alliance but we refused it because we do not believe in them. We have special Christian value-system, they do not have like this. We are afraid that they would abuse harmfully our network so we protect our Christian system and thus network.’ (39th interview)

Evolution of the NNYH is so interesting. Initially, an entrepreneur’s truck broke down and could not purchase products but a same firm in Nyíregyháza brought goods to him irrespective of competing with each other on the market. The competitors have afterwards begun to distribute market information relating to which wholesale provide discount. He did it because they were Christian; in the first period the cooperation was configured and inspired by Christian theorem and not by economic interdependence in the NNYH. Nowadays all entrepreneurs in the NNYH engage in cooperation because they have understood that rivals’ cooperation can bring mutual benefits. To be precise, two cooperative activities can be distinguished in the NNYH such as mutual transportation and allocation of market information.

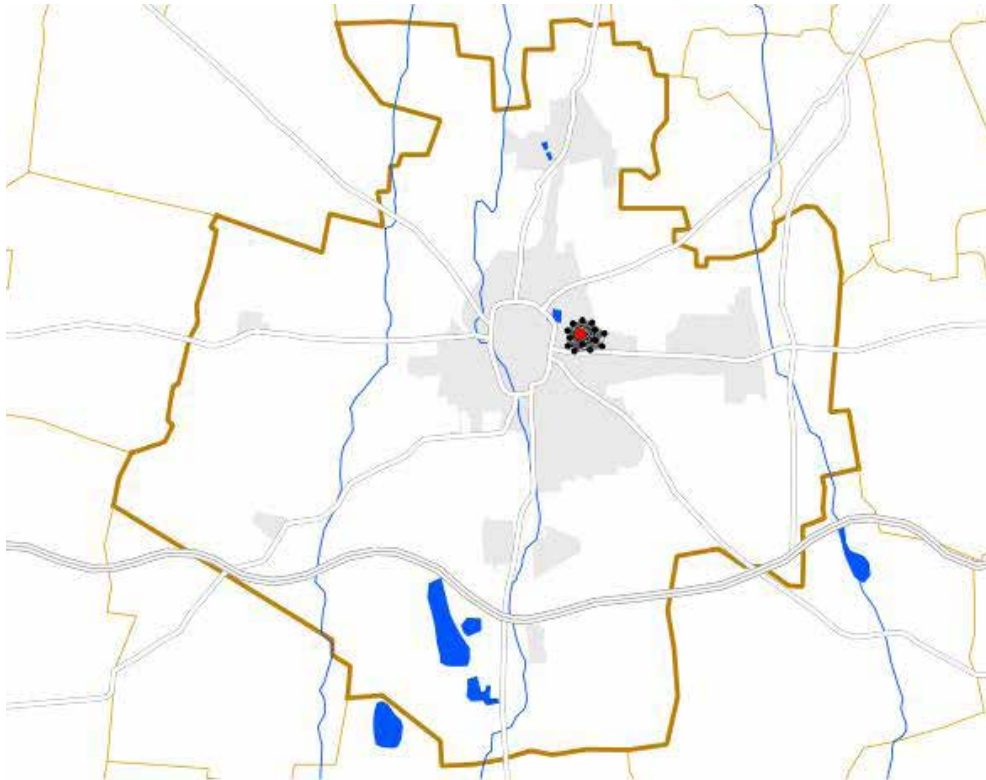
For the first time, the NNYH had scale-free property referring to a focal firm had been organizing mutual transportation and allocating market information among same firms. However, after a short time, all rivals started cooperating with each other intensively in some fields of business life thus they did not need more dominant firm. The central firm disappeared because all entrepreneurs of the NNYH trusted in each other and could make cooperative interactions. Trust-building of the NNYH has been accelerated by mutual faith therefore the role of central firm was marginalized gradually and the NNYH became a complete graph. In the complete network every actor is connected to every other actor; every entrepreneur has cooperative interaction with every entrepreneur in the NNYH. In general, the NNYH might have become complete graph so quickly because its entrepreneurs have been Christians preferring reciprocal trust and respect as well.

Indeed, the NNYH has been effective but a static and closed network with only 14 nodes in which everyone knows each other; the NNYH has not scale-free scheme. The complete graph referring to determines functionalizes of network (Knieps, 2015), on one hand the robustness of NNYH is relatively low, and on the other hand it works democratically as horizontal bonds emerged among them.

‘This is a little alliance in Nyíregyháza, we know. Everybody knows each other, but K. D. (the monograph of focal enterprise in NNYH) had been managing every issue for some years but later we, all member of the network, have taken part organizing mutual transportation. He was the central point in our alliance but now we have been able to organize transportation. By doing that, we can save a lot of money because eight or nine trucks are enough for moving new goods, perfumes, you know... Basically, we do not need contracts; we trust in each other regardless of competing with each other too. We collaborate with each other in field of transportation and sometimes distribute market information where we can buy perfumes cheaper and that’s all but we compete with each other in a lot of fields.’ (7th interview)

In addition, the NNYH is located on Örkösföld situated in the most developed district of Nyíregyháza (see Figure 5) meaning that the driving force of regional economic development comes from the richest areas.

Figure 5. Spatial extension of NNYH



Source: Own Elaboration

In a nutshell, vertical competition and horizontal cooperation can be revealed and merged among entrepreneurs of the NNYH and it has brought financial success to them. The cooperation of rivals significantly contributes to appear the localization economies of scale (Marshall-Arrow-Romer specialization externalities) on territories of the NNYH (Panne, 2004).

4.4 The networks' effects and regional economic development

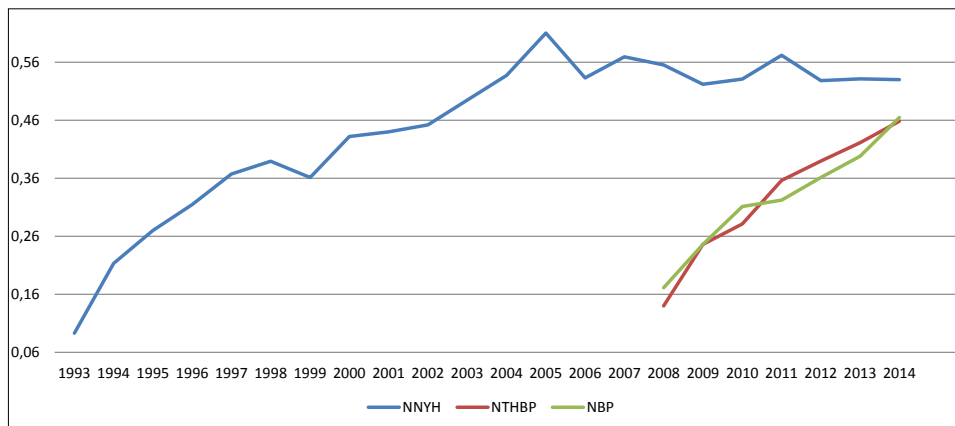
Now paper focuses on quantifying longitudinally how the cooperative networks of SMEs define trajectory of regional economic growth. To date, there is no standard spatial econometrics method how the effects of the cooperative networks of SMEs can be gauged on regional economic development (Boucher & Fortin, 2016). In this vein, the paper now attempts to quantify network effects. In improved network model, the impact of the cooperative networks of SMEs on the regional economic development is defined by (1) pay raising and (2) new jobs creating (Pachura, 2010). Actually, the applied network model answers the question how and to what extent the cooperation strategy defines the change of income and employment rate on a certain network territory.

Basically, the gauging is divided into two components such as quantitative and qualitative ones (Thomason, Simendinger & Kiernan, 2013). On one hand the quantitative research focuses on employment and income data of the networks, on the other hand the qualitative dataset depicts how the regional milieu and atmosphere have been shifted in studies phase.

The sharp question is how the gross costs of pay rise (PR) and the gross costs of creation new workplace (NW) can be financed by saving (S) that comes from cooperative activities. On one hand, the cooperative activities of firms can be expressed by saving (S), and on the other hand $PR + NW = GCRD$ where $GCRD$ is the gross cost of regional development. On condition that $S \geq GCRD$, then saving can finance absolutely the gross cost of regional

development. Of course, if $S < GCRD$, then S is not enough to cover GCD . Moreover, $GCRD = \frac{S}{NW+PR}$ where $GCRD [0,1]$ shows what proportion the gross costs of pay rise and creation new workplace can be covered by saving. The global value of $GCRD$ within a time period: $\sum_{i=1}^n GCRD$. The Figure 6. reports the longitudinal changing of $GCRD$, obviously, the NNYH is the most successful in savings.

Figure 6. What proportion can the gross costs of pay rise and creation new workplace be financed by savings? (%)



Source: Own Elaboration

The Figure 6. demonstrates that in 2014 the 52.98% of pay rise and new job creation (in applied network model these variables operationalize the regional economic development) could be financed by the savings in the NNYH. Moreover, in same time the 45.83% of the regional economic development were covered by cooperative accomplishment in the NTHBP. Lastly, the 46.47% of regional economic development could be financed by the cooperative business strategy in the NBP. It is clear that cooperation in the practice has provides economic possibilities so that firms could expand market or create new marketplace, raise income and employee rate.

The quantitative data collection provides insight into the employment rate of three cooperative network separately. According to the data, the NTHBP has creates 136 new workplaces in which 26 were established in Budapest; NNYH could form 97, while 54 new jobs were constituted by the NBP. In a nutshell, the cooperative actions of firms significantly contribute to the job creation.

Interestingly, the influence of financial economic crisis of 2008-2009 was not strong on accomplishment of the cooperative networks. The capacities of NTHBP and NBP were picking up sharply while the performance of NNYH was falling slightly under the period of economic crisis. Put another way, the cooperative network effects were stable on the regional economic development irrespective of the global financial crisis.

In parallel, the qualitative results show that the regional milieu and atmosphere were reshaped in Tihany. The local attitude has been changed and urban habit was emerging meaning that local residents have started following modern life style but retaining their traditions and past simultaneously. In a nutshell, qualitative research findings demonstrate that the new local marketplace has been able to modify the conservative image in Tihany by forming a special mixed form of the modern and historical conventions with local folklore. As a whole, the cooperative networks have a qualitative spillover-effect namely these contribute to the strengthening of the local social integration.

‘Since when I started working at new local market, Tihany has received a new face because a lot of celebrities come to visit and buy something. They bring new fashion, new ideas and mood and moral. It is true, the new style has not been supported by everyone in the town but it does not matter. The point is that they have been able to buy things and thus they give money for the town bringing new circumstance and mindset.’ (63rd interview)

5. CONCLUSION

The Hungarian rivals of networks have already increasingly started understanding and exploiting both collaborative and competitive advantages thus contributing to the regional economic development directly. It means that relatively developed business culture has been appeared and prevailed among the Hungarian small enterprises. In the practice, entrepreneurs of cooperative network share risks, cost and market information so as to maximize their profit rate that finally covers the cost of nodal regional economic growth. The empirical findings depict on one hand the localization economies of scale emerged on territories of the NBP and NNYH, and on the other hand the urbanization economies of scale revealed on territory of the NTHBP.

Obviously, year by year financial savings could in every cooperative network be accumulated by cooperative activities so as to be able to finance both creation of new workplaces and pay rising. In particular, the cooperative networks of same local entrepreneurs have established peculiar economic ecosystem and pleasant atmosphere through exploiting both local endogenous and exogenous assets as well.

Basically, competitors in cooperative network collaborate with each other because financial resources could be accumulated intensively. In general, their relational capital has been converted into economic capital contributing to significantly the increasing the level of local welfare. Notwithstanding, these three cooperative networks emerge as bottom-up network meaning functionalizing without any formal arrangements or official forces apparently. Furthermore, it refers to regional politicians, stakeholders and other official members of regional economic development might not interfere in formally networking process; these cooperative network operate alone as an ‘island’.

Finally, the accomplishment of bottom-up cooperative networks might provide a new message to both the Hungarian regional policy and territorial planning as well. The local SME sector can increasingly control and manage to the regional economic growth thus activities of cooperative network ought to be taken into within a framework of the formal Hungarian regional economic development policy account in the future.

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