The Concept of Socio-Spatial Development as the Basis of Economic Security of Megalopolises

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Abstract. This paper investigates major lines of research in socioeconomic and spatial analysis of major urban centers. After thorough investigation of previous research in the fields of spatial economics, proximity analysis and using the phenomenological field concepts, authors propose to consider sociospatial development as foundation of urban economic security. In order to measure the state of urban security, authors suggest distinguishing between three phenomenological axes: axis of socioeconomic development, axis of quality of urban environment, axis of crime rates, and to use methodology of proximity analysis. Using the data on St. Petersburg authors demonstrate degrees of proximity along distinguished axes. Comparative analysis is performed via STATISTICA packages for cluster analysis, grouping major urban centers using agglomerative cluster method. Indicators relating to phenomenological axes are chosen as a result of previous studies analysis in the areas of quality of urban environment, urbanization rates and conflicts in major urban centers, as well as through expert evaluation of relative importance of indicators for livability provision.

1. Introduction

Contemporary sociospatial development of major urban centers is characterized as combining both polycentric and monocentric features, “socioeconomic polarization and local communities integration” [1] as demonstrated by a number of authors [2, 3]. Therefore, current research on urban economic security assumes that social and spatial processes in cities are a part of a complex system, comprised of multiple elements with complicated cause-and-effect relations and multilayer hierarchies [4].

Since 1970s both economics and social sciences have relied heavily on concepts developed through extensive research in the field of spatial economics. Lasuen and Pottier [5-6] develop various aspects of urban poles growth theory, their structure, internal and external connections, etc. Boudeville [7] suggests a framework to understand development and hierarchical structure of the city. Perroux [8] also concludes that cities are intrinsically connected to growth and progress. Together these studies provide sufficient evidence to define major urban centers and agglomerations as focal points of urban growth and economic development.
Multiple studies in spatial economics use the concept of “proximity”, described at its best in studies by Sierra [9] and Gilly [10]. By invoking this concept, scholars attempt to integrate instruments of spatial and socioeconomic analysis into a single research strategy, combining spatial and social data at the same time. The need to address this dualism in spatial research strategies is highlighted by Animitza et.al, who claim that “contemporary stage of socioeconomic development could be most vividly described as a process of embedding regional economies into local social and spatial relations, thus, resulting in even more differentiation between regions” [11]. Research by Vadim Ukrainsky suggests that both spatial and sectoral analysis have been established as main tools of economic research in the late XX century [12].

By drawing from a vast array of fields and research traditions, such as global cities theory (Sassen [13], Hall [14]), francophone studies on growth poles and proximity [15], cluster theory (Porter [16], Marshall [17]), social space and social structure research [18-20], notable studies in spatial economics (Torre [21], Minakir and Demyanenko [22]), in this paper we argue for a sociospatial approach in analysis of such complex objects as urban centers. Similarly, Bouba-Olga and Grosetti [23] identify spatial and socio-economic dimensions in their analysis of effects agent proximity on R&D application.

A considerable amount of studies have examined the notion of urban security. Belov suggests that security “should be considered not only as a certain state of productive forces and productive relations, but as a capacity of societal systems to thrive when facing conflicts, ambiguity and risks” [24, p. 564]. Aliynova [25] points out that providing adequate quality of life for residents of specific urban territory is a crucial part of accomplishing economic security within this area. Spatial dynamics of cities represent yet another dimension of urban economic security. Significant volatility in social fabric of urban space and its spatial differentiation pose a considerable challenge to any researcher who tries to investigate a degree of spatial and social proximity in the internal divisions of major urban centers. However, a thorough analysis of proximity between various urban districts allows researcher to form clusters of similar territories, which, in turn, could be used to justify public policies aimed at managing the most critical discrepancies in urban development through eliminating segregation and adjusting rates of socioeconomic polarization, adding up to overall state of security.

2. Purpose of research

In this paper authors develop sociospatial approach to analysis of cities and consider contemporary urban centers to be focal points centripetal trends that allow them to accumulate significant demographic, economic, cultural resources and produce innovations.

Sociospatial approach to cities, used in this research, draws forth such concepts as comprehensive urban development, sustainability and security of urban space as most crucial sites of interdependence between spatial and social processes within the city. Having critically examined considerable body of literature and multiple previous studies outlining the features of sociospatial approach, authors build their research on the following assumptions:

- The definition of proximity for specific locations of megapolis contains spatial and socioeconomic characteristics.
- The degree of proximity is established not just as a metric of geographic location, but through complex indicators of livability and security in specific locations.
- Degree of proximity is to be distinguished according to highlighted in previous studies phenomenological axes.
- Criteria and measurements of degree of proximity are to be distinguished as well as through economic and statistical analysis and expert evaluation.

The idea of phenomenological axis is put forward by Ivanov and Lozhko [20], and, combined with methodological approach designed by Bouba-Olga and Grosetti [23], it allows authors to differentiate between three phenomenological axes, “socio-economic development”, “quality of urban environment” and “crime rates” respectively, in order to analyze the degree of proximity between specific locations. Therefore, the overall aim of this paper is to evaluate sociospatial differences in the
state of economic security of administrative districts of St.-Petersburg by applying the concept of phenomenological axes, gathering corresponding data and, as a result, establishing the general types and degrees of proximity between these territories.

3. Data and methods
This study relies on works of Russian and international scholars in the field of global cities research, spatial and regional economy, economic security [5, 7, 10, 13-17]. Sociospatial approach to economic security of global cities relies on the works of Russian scholars, including Belov [24], Alynova [25], Kuznetsov [18], Tylitcheva [19], Ivanov and Lozhko [20] and international scholars – Batti [26], Bouba-Olga and Grosetti [23] and several others. Authors use statistical database of the Federal State Statistics Service with indicators of Saint-Petersburg social and economic development [24]. Comparative analysis is conducted via STATISTICA software packages that allow cluster analysis of major urban centers via agglomerative clustering method based on described phenomenological fields. Indicators related to phenomenological fields are chosen according to previous research on social environment quality, urbanization rates and conflict potential in major urban centers as demonstrated in studies [13, 19], as well as expert evaluation of indicators of secure and livable environments [27]. Authors conduct their analysis using logical, comparative, historical methods, expert evaluation.

4. Results and discussion
Authors have grounded this research on the assumption that specific urban territories demonstrate significant socio-economic and spatial differences when compared according to the state of critical indicators of urban development. Using types of proximity, identified by Bouba-Olga and Grosetti [23], and the concept of “phenomenological axes”, suggested by Ivanov and Lozhko [20] as main methodological tools when analyzing gathered data, authors distinguish between three types of proximity between administrative districts of St.-Petersburg:

1. Proximity along the axis of quality of urban environment. This type of proximity is embedded in public policies that regulate investment, construction and spatial development of St.-Petersburg, and are aimed at providing legislative groundwork and criteria for assessment of vital resident needs satisfaction when constructing basic public amenities. According to results expert evaluation conducted by authors, pre-school institutions, medical clinics and schools should be understood as basic public amenities that provide satisfaction of vital needs of local residents. This axis allows us to see specific urban localities as a micro sites of state functions’ implementation, the success of which heavily depends on general normative framework describing criteria and standards of resident need satisfaction.

2. Proximity along the axis of socioeconomic development. This type of proximity is embedded in various economic and demographic processes within the borders of administrative districts, and is significantly determined by public policies on demographic changes, unemployment and incentives for local economic activity.

3. Proximity along the axis of crime rates. This type of proximity is embedded in institutional frameworks that alleviate spatial segregation and extreme socioeconomic polarization, provide economic security and resilience towards internal and external dangers. The axis of urban security is closely connected to axis of socioeconomic development, since the increases in unemployment seem to correlate with rising crime rates, as well as with the axis of quality of built environment, since street design and specific planning techniques allow decreasing the probability of both traffic fatalities and certain types of crimes.

The measurements are chosen on the basis of current research on quality of life analysis [19], expert evaluation of livable environment and its accessibility to residents [27], and essential principles of “Smart city” models [28, 29].

Spatial proximity provides an opportunity to talk about similar indicators that estimate formed level of quality of life and the current level of favorable living conditions for the main factors that meet the
Measurement of spatial proximity of St. Petersburg’s districts has been measured according to the indicators:

- number of educational organizations, places;
- number of preschool educational organizations, places;
- number of medical clinics, units.

Socio-economic proximity provides an opportunity to assess the proximity of territories by the dynamics of economic space compression, reflected in the main demographic indicators, the dynamics of the proximity of socio-economic activity, including the level of employment, and also indicators of crime rates – the number of offenses and road accidents.

Socioeconomic similarity of St. Petersburg’s districts has been measured according to the indicators:

- population, pers.;
- number of births per 1000 people, pers.;
- number of retirees, pers.;
- average number of employees in organizations, thou. pers.;
- accrued average monthly nominal wages, RUB;
- number of recorded crimes, units;
- number of road accidents, units.

The main stages of research:

1. Clustering of the megalopolis territories by the level of proximity along the socioeconomic axes for the period 2005-2017.
2. Clustering of the megalopolis territories by the level of spatial proximity along the axes of quality of urban environment. It includes the indicators of meeting residents’ needs in socially significant objects (schools, preschool educational organizations, medical clinics) for the period 2005-2017.
3. The clustering of megalopolis territories by the level of proximity along the axis of crime rates. It includes following indicators: the number of offences and road accidents for the period 2005-2016.
4. The combined cluster analysis of territories proximity by the particular phenomenological fields.

The results of the cluster analysis in terms of phenomenological axes, based on the use of STATISTICA software packages, on the example of St. Petersburg are shown in table 1.

**Table 1. The differentiation of St. Petersburg’s districts according to the phenomenological axes*.**

| Cluster | Phenomenological axes | Phenomenological axes | Phenomenological axes |
|---------|-----------------------|-----------------------|-----------------------|
| I       | Petrogradskiy         | Tsentral'nny          | Nevskiy, Kalininskiy, Vyborgskiy |
| II      | Kronshhtadtskiy       | Vborgskiy             | Kurortny              |
|         | Primorskiy, Frunzenskiy, Krasnogvardeyskiy, Krasnosel'skiy, Moskovskiy, Tsentral'nny, Cronshhtadtskiy |
| III     | Nevskiy, Petrodvortsovsky, Kolpinskiy, Kurortny, Kalininskiy, Pushkinskiy, Kirovskiy, Vyborgskiy | Moskovskiy             | Kronshhtadtskiy        |
| IV      | Vasileostrovskiy      | Krasnosel'skiy        | Petrodvortsovsky, Petrogradskiy, Pushkinskiy, Kolpinskiy, Krasnosel'skiy |
|         |                      |                      |                      |
| V       | Tsentral'nny, Moskovskiy, Admiralteyskiy | Kronshhtadtskiy, Kolpinskiy, Pushkinskiy, Frunzenskiy, Krasnogvardeyskiy, Kirovskiy | Primorskiy, Nevskiy, Kalininskiy, Admiralteyskiy |
| VI      | -                     | Primorskiy, Nevskiy, Kalininskiy, Admiralteyskiy | Admiralteyskiy       |
| VII     | -                     | Petrogradskiy, Vasileostrovskiy, Admiralteyskiy | -                     |

* Compiled by [26]
On the base of combined cluster analysis of phenomenological axes that are “socioeconomic”, “quality of urban environment”, “criminality”, the St. Petersburg’s districts have been grouped into six Clusters: Cluster 1 – Petrogradskiy; Cluster 2 – Kronshtadtskiy; Cluster 3 – Kurortny; Cluster 4 – Primorskiy; Cluster 5 – Frunzenskiy, Nevskiy, Krasnosel'skiy, Krasnogvardeyskiy, Petrodvortsovy, Kolpinskiy, Pushkinskiy, Kirovskiy, Kalininskiy, Vyborgskiy; Cluster 6 – Vasileostrovskiy, Tsentral'ny, Moskovskiy, Admiralteyskiy.

5. Conclusion
The results provide means for concluding that St. Petersburg’s districts are significantly different in proximity along the axes. There are three types of similarity: high, low and minimum / average (normative or average level set in each megapolis).

According to proximity along the socio-economic axes there have been distinguished following groups of territories:
1. Territories with a high level of socioeconomic development, large number places of employment and high wages (Vasileostrovskiy, Tsentral'ny, Moskovskiy, Admiralteyskiy).
2. Territories with an average level of socioeconomic development (Primorskiy, Frunzenskiy, Nevskiy, Krasnosel'skiy, Krasnogvardeyskiy, Petrodvortsovy, Kolpinskiy, Kurortny, Pushkinskiy, Kirovskiy, Kalininskiy, Vyborgskiy).
3. Territories with a low level of socioeconomic development (Petrogradskiy, Kronshtadtskiy).

According to proximity along the axis of quality of urban environment there have been distinguished following groups of territories:
1. Territories with a high quality of urban environment (Tsentral'ny, Vyborgskiy, Moskovskiy).
2. Territories with a low quality of urban environment (Admiralteyskiy, Vasileostrovskiy, Petrogradskiy).
3. Territories with minimal admissible quality of urban environment (Primorskiy, Nevskiy, Kalininskiy, Frunzenskiy, Krasnosel'skiy, Krasnogvardeyskiy, Petrodvortsovy, Kolpinskiy, Kurortny, Pushkinskiy, Kirovskiy, Kirovskiy, Kronshtadtskiy).

According to proximity along the axes of crime rates there have been distinguished following groups of territories:
1. Territories with a low level of crime rates (Nevskiy, Kalininskiy, Vyborgskiy, Kirovskiy, Kronshtadtskiy).
2. Territories with a high level of crime rates (Krasnosel'skiy, Krasnogvardeyskiy, Primorskiy, Moskovskiy, Tsentral'ny, Frunzenskiy, Kirovskiy, Admiralteyskiy).
3. Territories with an average level of crime rates (Petrodvortsovy, Petrogradskiy, Pushkinskiy, Kolpinskiy, Vasileostrovskiy).

The analysis provides an opportunity to distinguish the locations of St. Petersburg, to diagnose the problems of economic security in each of the districts of megapolis.

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