

The Process of Agglomeration in Big Cities: the Case of the Yekaterinburg

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Keywords: Agglomeration; Cities; Industry; Yekaterinburg.

Abstract. In this research we identify and analyze key economic drivers of agglomeration processes in the old industrial areas. As a model, we used the economic mechanism of agglomeration of Cobb-Douglas production function. The object of our research is agglomeration of Yekaterinburg and its nearest city-satellites. All together present Big Yekaterinburg. The purpose of our research is to show whether there is agglomeration in an industrial monocentric city. We included only cities which are situated within the 60 kilometers vicinity around Yekaterinburg. Analyzing agglomeration factors by Cobb-Douglas production function, such as labor per capita, population, relative change in the number of employees per capita, average wage, residential area and revenue of enterprises, we conclude that there agglomeration effects do not exist in industrial monocities in spite of big population. We propose polycentric organization of Yekaterinburg for greater agglomeration effects. The results of this study can be used in further research, both theoretical and applied and also in solution of practical issues of regional and urban policies.

Introduction

The development of economic geography influenced highly on urbanization and agglomeration theories. In fact, theoretical explanations of basic economic issues - the factor mobility and trade - in the papers of Ohlin [1] and Mundell [2] inspired Krugman [3] to analyze factor mobility in a world of differentiated products and monopolistic competition. According to Mundell [2], factor mobility and trade may act as substitutes for one another. Migration of labor and capital are influenced by the factor-price differences which exists due impediments to trade, such as tariffs or transportation costs. Incentives for migration are associated with the extent of the market. Many other theories, starting from [4], recognized that agglomeration of economic activity is driven by economies of scale, while assuming that the scale economies are external to the individual firm but internal to the industry or the city and hence consistent with perfect competition.

The benefits of agglomeration ultimately reflect gains that occur when proximity reduces transport costs [6]. Marshall explained that three different types of transport costs (the costs of moving goods, people, and ideas) can be reduced by industrial agglomeration. The last one explanation is connected with “technological spillovers” between firms in a well defined area due to transfers of knowledge useful in production. Firms will locate near other firms in the same industry because there is a benefit to locating near plants that share some characteristic [5].

Yekaterinburg agglomeration is an essentially new phenomenon for Russia from the point of view of agglomeration processes management [7]. Already existing agglomerations (Moscow, St.-Petersburg, Nizhnij Novgorod) were created on the basis of a rigid monocentric model: the vertical power structure of the central city extended to cities-satellites, i.e. the administrative unit remained the same. In Yekaterinburg the concept of ‘polycentric agglomeration’ that is widespread in Europe (Lisbon, Paris, London, and the Ruhr Area in Germany) is legally established. It implies formation of the multilevel completely new structure that involves synergetic effect concerning its components. Realization of the well-grounded and consistent steps on the city’s way to agglomeration demands precise understanding of social and economic, administrative, and social and cultural tendencies for both the whole and its elements.

Key features of industrial monocities transformations taking into account regional specificity have been identified in the article on the basis of international experience and theoretical preconditions that form different types of the urbanized territories. The authors recognize that monocentric city areas have concentric hierarchy of settlement and functional density while polycentric regions are often based on diversified distribution of social and economic indexes within their space, finding out physically and functionally rather differentiated picture of centrality.

Territorial development grows out of difficult interdependence, basically economic, social and ecological tendencies. The municipalities participating in the project *Ekaterinburg Agglomeration*, do not merge in a uniform administrative unit but form the union equal in rights. Cities keep independence, but solve strategic issues together. Nevertheless, it is underlined that agglomeration processes are not reduced only to problems of territory management.

Experience of Yekaterinburg can be successfully used in other regions of Russia and other countries with transition economies. However, it is possible to allocate a number of the potential problems already at a design stage complicating realization of science based ideas. First, in the Russian legislation there is no concept of a city-agglomeration (existing agglomerations in the legal plan are simply cities). Therefore, it is necessary to build regulation of relations between agglomeration elements, and also relations between agglomeration and external subjects practically from zero. Secondly, absence of a dominant does not cancel necessity for coordination center.

The main purpose of our work is identification of the key economic drivers of agglomeration processes in the old industrial areas. The authors have modelled the economic mechanism of agglomeration by means of Cobb-Douglas production function; the results of this study can be used in further research, both theoretical and applied, and also in solution of practical issues of regional and urban policies. The object of our research is Yekaterinburg agglomeration which is being formed now by combining Yekaterinburg and its nearest city-satellites. Sometimes it is called Big Yekaterinburg. It will include only those cities, which are situated within the 60 kilometers vicinity around Yekaterinburg. This is the distance of everyday transport access for people who live in these cities.

Research Method and Materials

The focus of the present research is the concept of territory development of agglomeration of Big Yekaterinburg. We used the related indicators: labor per capita, volume of retail trade per capita, built residential area per capita etc. to make a comparative analysis of the cities and calculate an integrated rating for them. It was shown that Yekaterinburg is a leader in two from 8 socio-economic indicators: population and retail trade volume. It is the second in average wage rating and annual revenue of enterprises per capita.

Regardless of what supports the process of agglomeration (factor mobility, technological and knowledge spillovers, economic concentration, locational proximity, natural advantages), effects of agglomeration can best express by the neoclassical production function:

$$Q_{ij} = A_{ij}F(K_{ij}, L_{ij})$$

Where Q is the volume of output, K is the capital stock, and L is employment, for the i th firm in industry I located in city or region j . The production function F is assumed to exhibit constant returns to scale. In our paper we used the Cobb-Douglas production function. The Cobb-Douglas production function is the particular production function that takes the form:

$$Y = a_0 K^{a_1} L^{a_2}$$

Where Y stands for output (total production), K for capital (investments in fixed assets), L for labor (person-hours worked in a year) and a_0 is a productivity parameter (a higher value of a_0 means producing more with the same inputs). The exponents a_1 and a_2 are the output elasticity's of capital and labor, respectively. They are found from empirical data.

On the basis of official statistic data on municipal development we have studied the time. According to the calculation results we divided all cities into 3 groups. The first one contains two cities: Yekaterinburg and Zarechnyi which have shown the increasing returns to scale. The

determination coefficient is greater than 0.94 and the F-test of significance of regression coefficients is good enough.

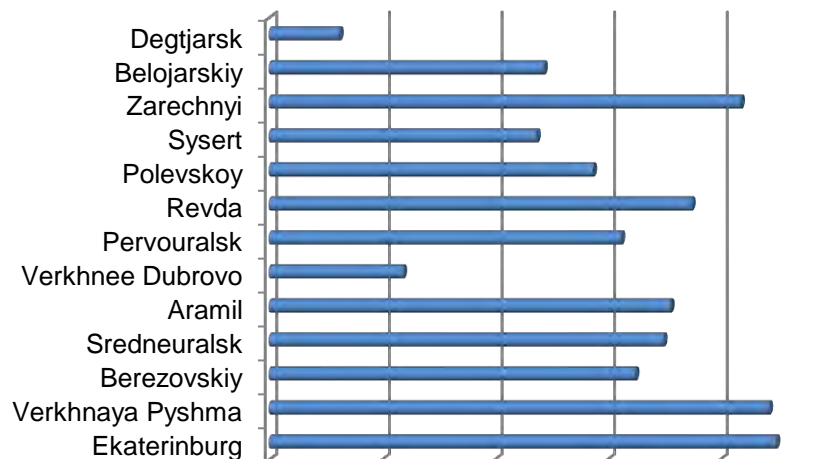


Figure 1. Final ranking. Source: calculated by authors.

For Yekaterinburg we got the elasticity with respect to labor equal to about 0.73 and elasticity with respect to capital equal to 0.7. Thus the sum of these elasticity coefficients is 1.43. For Zarechnyi the sum of elasticity coefficients is a little bit lower and equal to 1.18. Next two cities Aramil and Berezovskyi belong to the group of cities with the constant returns to scale (Figure 1). These two cities-satellites of Yekaterinburg don't have highly developed industrial enterprises, but they show good trend in development. The cities have a strategy of increasing of the investment attractiveness and becoming a small business development area. A special case is Verkhnaya Pyshma. It is a well developed city with one of the biggest Metallurgical plants in Russia with good infrastructure and social-economic conditions. But the C-D model does not reveal good returns to scale (the sum of coefficients is about 0.57). The decreasing returns to the scale was revealed for Pervouralsk and Sredneuralsk. In spite of the second place in the integrated rating on population and the industrial enterprise (Pervouralskiy pipe plant) Pervouralsk does not show any agglomeration effect. As for Sredneuralsk it is the second by investments per capita and the third by the revenue of enterprises per capita but the agglomeration processes are weak enough.

Conclusion

Agglomeration effects can be observed at different levels of aggregation. Large cities provide greater opportunity for economies of scale, availability of quality human capital, cluster effects, innovation processes and knowledge spillover, but under certain conditions smaller cities can also achieve some of the effects of agglomeration and can play an important role in territory development. In our research, monocentric cities do not show agglomeration affects. In the case of Big Yekaterinburg in the whole does not show agglomeration effects in spite of big population. It is the questions for our further study, but now we can state that the agglomeration Big Yekaterinburg should be polycentric.

Acknowledgement

This study is supported by Russian Foundation for Basic Research (RFBR) for the project with the number 17-22-07001.

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