L 85   **Local Production Systems and Regional Economic Development /**ed. by A.S. Novoselov and V.E. Seliverstov. – Novosibirsk, Sofia, Lodz, Ternopil, 2014. – 352 p.

This collection of papers contains the results of research carried out by the participants of the "International Project FOLPSEC № 295050 within the 7th EU Framework Program FP7-PEOPLE-2011 IRSES" "Functioning of the Local Production Systems in the Conditions of Economic Crisis (Comparative Analysis and Benchmarking for the EU and Beyond)".

The papers study the following problems: sustainable development of local production systems, business strategies of LPS, innovativeness of clusters, critical infrastructure protection, corporate social responsibility, environmental protection, local production system management, governance of local production systems in Bulgaria, Poland, Ukraine and Russia, policy guidelines with some measures of general application, aimed at problems observed in all LPS, and some specific measures differentiated according to a typology of local production systems.

RUSSIAN URBAN STRUCTURE: TENDENCIES AND DETERMINANTS[1]

Evgeniya Kolomak[2]

Aim of the paper is to estimate tendencies in the evolution of the urban system in Russia in the transition period and to discover factors influencing the development of Russian cities. There are several theoretical approaches to the explanations of spatial equilibria: 1) Zipf's law, based on the stochastic process of random walk; 2) agglomeration economics resulting from the increasing return and the monopolistic competition; 3) natural and historical fundamentals which determine a stability of settlements' location structure. In the paper we focus on an empirical analysis of the first two approaches: Zipf's law and agglomeration economics.

INTRODUCTION

One of the tendencies in the last century is growing role of cities, the urbanization is a phenomenon observed in almost all countries. There are two characteristic features of the process, firstly, urban population is increasing and the rate of growth is rather high and, secondly, big cities are growing faster. In 1900 urban citizens amounted to 13% of the total world population, in 1950 – 29%, in 1999 – 46% and in 2010 – over 50%. In the beginning of the XX century number of cities populated by more than one million people was 10, and in 2000 it reached 400.

Development of cities in Russia in the soviet period depended on the centralized planning, the key elements of the regulation were, firstly, restrictions on the growth of the big cities and, secondly, the stimulation of migration to and creation of production capacities in the small and middle cities and towns. Since the beginning of the reforms the market mechanism influences the spatial distribution of economic activity in the country. Aims of the paper are: 1) to evaluate trends in the evolution of the urban system in Russia in the transition period and 2) to identify factors affecting the development of cities.

APPROACHES TO THE EXPLANATION OF THE EVOLUTION OF URBAN SYSTEMS

The literature offers several theoretical approaches to the explanation of a spatial equilibrium: 1) Zipf's law, which is based on a random walk stochastic process, 2) agglomeration economics resulting from the increasing return to scale and monopolistic competition, and 3) the geographical and historical fundamentals predicting stability of settlement systems and its dependence on the historical events, climate and geographical characteristics.

Zipf's law is an empirical regularity describing the distribution of cities, which has been confirmed for many countries and shows high stability. The law predicts that the probability of the size of a city to be more than S is proportional to 1/S. It was shown[3] that a stochastic process where cities grow randomly and demonstrate the same average growth rate and the same standard deviation converges to Zipf's distribution.

The arguments in favor of agglomeration economics are presented in the UN-HABITAT reports[1], where it is shown that the largest cities of the world have significantly higher labor productivity than the national average. Benefits of the large cities belongs to the both consumers and producers sides. There is a higher spatial concentration of population and labor force in a big city, and, as a consequence, the number of different consumer markets and related specialized industries increases. The propensity of consumers to the diversity means that a city, offering a variety of different products and resources, increases the utility function of the population. Accordingly, consumer's welfare increases proportionally to the size of a city. At the producers' side one of the sources of the benefits is cost savings due to the proximity to the partners, which is provided by the localization and increasing returns to scale. Interactions between firms include market and transaction communications. Allocation near suppliers of input reduces transport costs, what gives an opportunity to decrease prices of output and to expand the market. The suppliers also have incentives to set up firms in an agglomeration, where the demand is higher due to lower transaction cost. There are commodities and service that are provided within a metropolitan area only; in this case a cost-effective production is possible only if a significant demand is concentrated in a compact area. Co-location of suppliers and consumers reduces the overall cost, stimulate the effectiveness growth, and creates opportunities for extension of the existing and creating new markets. Active interactions between firms in the cities contribute to the creation of clusters and networks, mitigate the negative effects of the intra-industry competition and reduce the risks of cooperation. Networks allow for the more flexible usage of the common resources and provide an access to a range of specialized services. A big city creates opportunities for the more efficient exploitation of production and social infrastructure, for the increase of the number of users and makes it profitable and diversified decreasing individual costs. The result is a higher standard of life; cities have more developed transport, communication, health and education infrastructure, culture and leisure industry. Reducing the cost of infrastructure services due to the high population density makes them affordable, creates opportunities for human capital development. The concentration of economic, financial, administrative and human resources creates the conditions for an active exchange of business information and diffusion of innovations and new technologies what gives impetus to development dynamics. Large and the largest cities are places where higher education and academic research institutions are concentrated; they offer such institutions and platforms as business parks, business incubators and techno-parks. Big cities are characterized by more advanced and flexible labor market, the larger the city, the greater its ability to meet the demand from the business side.

Concentration and diversity of resources in large cities and metropolitan areas provide the possibility to utilize economy of scale, advantages of large market and of the variety of production factors. However under certain conditions the rapid growth of cities is associated with some negative consequences. Immobile resources (land and water) set limits for city growth. Big cities are suffering from environmental degradation and air pollution, population live far from nature and green spaces, the preservation of which becomes a difficult task.

One of the most acute problems of large cities is the transportation infrastructure. The reverse side of the concentration of economic activity and high population density in big cities is problems with housing and overcrowding, these reduce the quality of life and attractiveness of large cities. It is statistically confirmed that the increase of the general welfare of the population of large cities is accompanied by a sharp income disparities of the population and by growth of the absolute and the relative poverty.

Limitations of public policy are discussed in the studies devoted to the influence of fundamental economic, historical and geographical factors on the structure and evolution of

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[1] State of the World's Cities 2010/2011 – UN HABITAT. 2010. Urban World. Issue 4 – UN HABITAT. 2010.

urban systems. The authors come to the conclusion that the Russian urban system is sustainable even to the major disasters and shocks[1]. Problems of urbanization in Russia are systematically studied by demographers and economists geographers[2]. In this paper we focus on the empirical analysis of the predictions of the two theoretical approaches: the agglomeration economics and the random stochastic process.

EMPIRICAL ESTIMATES OF
THE EVOLUTION OF THE URBAN SYSTEM
IN RUSSIA

Information and descriptive statistics. We rely on the official data of Federal statistical service of Russian Federation and on the data base "Economy of Russian cities"; the latter is one of the resources of MultyStat system. The observations cover period 1985–2012. Number of the observed cities varies from 1030 to 1070.

The structure of Russian urban system estimated using the data of Federal statistical service of Russian Federation is presented in Appendix. The picture below (Picture 1) shows the dynamics of share of urban population living in the five biggest cities (Moscow, Sankt-Petersburg, Novosibirsk, Yekaterinburg, Nizhniy Novgorod) and in the four biggest cities without Moscow.

Share of the biggest cities is growing however this result is due to Moscow mainly. Share of the other biggest cities does not demonstrate essential growth. But share of big cities (population bigger than 500 thousand people) in the urban population is increasing (Appendix). We also observe growth of variance in size of cities (Picture 2).
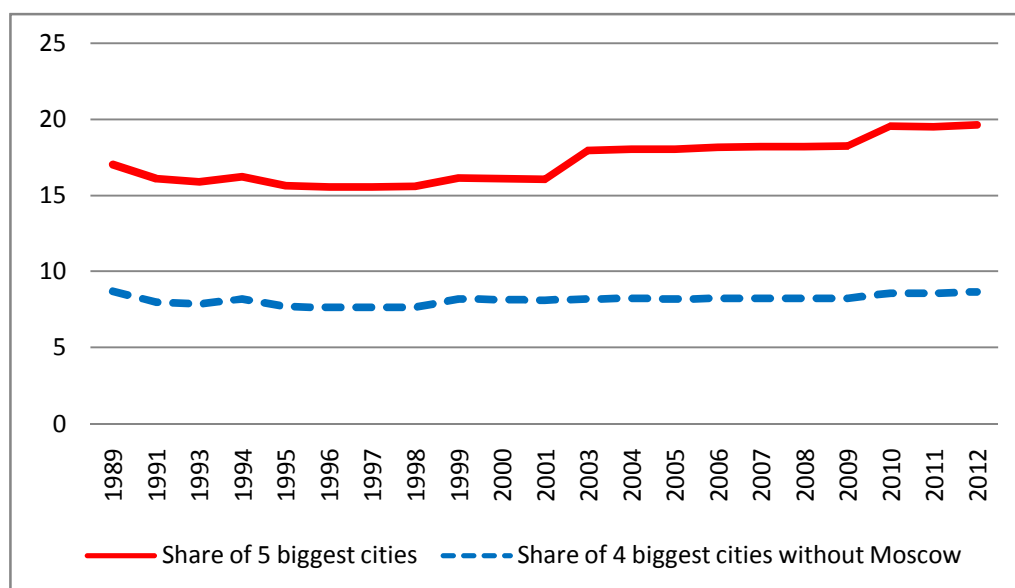
Picture 1. Share of the biggest cities in the urban population

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[1] Mikhailova T. Looking for multiple equilibria in Russian urban system. 2010, mimeo. Glazychev V.L. City without borders, M – The Territory of the future, 2011.
[2] Belkina T.D., Minchenko M.M., Nozdrina N.N., Protokalistova L.V., Shcherbakova E.M. Monitoring of the status and problems of development of cities of Russia in the years of reforms // Problems of forecasting, 2011, N 2. Zayonchkovskaya Zh.A., Nozdrina N.V. Migration experiences of the population of the regional centres of Russia (on the example of a survey in 10 cities) // Problems of forecasting, 2008, N 4. Zubarevich N.V. Russian cities as centres of growth// Russian expert review, 2006, N 2(16) Lappo G.M., Polyan P.M. The results of urbanization in Russia by the end of the XX century// Mir Rossii. – 1999, N 4. Leksin V.N. «Regional capitals» in Russian economic and social life// Voprosy ekonomiki, 2006, N 7. Leksin V.N. The city authorities: administrative centers of Russia// Mir Rossii, 2009, N 1. Nefedova T.G., Treyvish A.I. Theory of differential urbanization and hierarchy of cities in Russia at the turn of the XXI century // Problems of urbanization at the turn of the century, 2002.
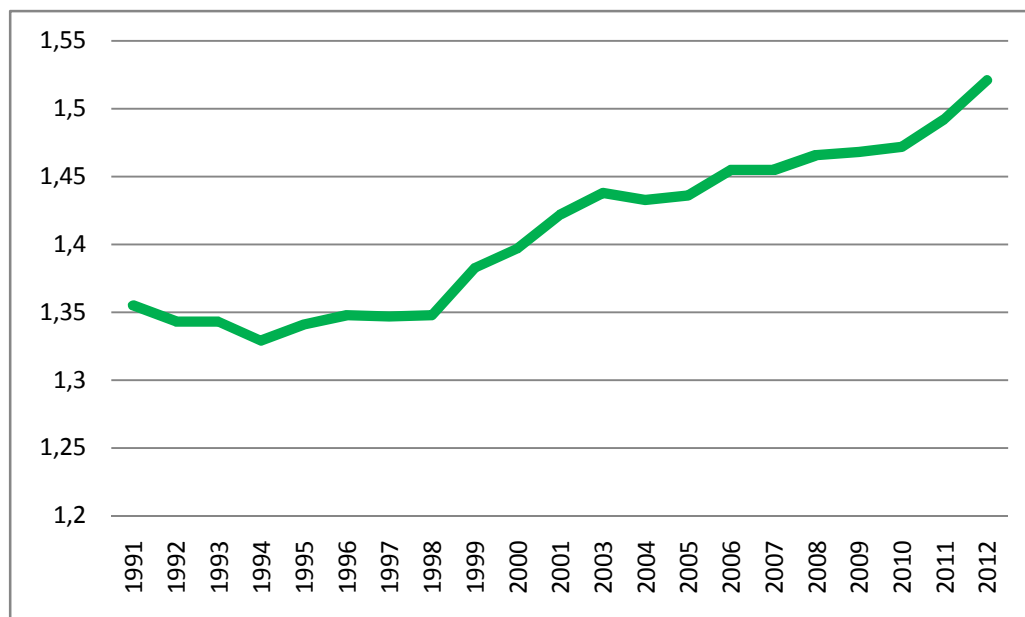
Picture 2. Variance of logarithm of Russian cities population

Growth of big and the biggest cities were accompanied by a fall of population in the middle-size cities. The share of population of small cities did not decrease (Table 1). A similar situation is described in paper of Tabuchi T., Thisse J.-F., and Zeng D.-Z.[1]; it takes place at the first stage of decrease of transaction cost and is a consequence of the increasing return to scale and monopolistic competition.

Table 1

Distribution of urban population in Russia, %

	1926	1939	1959	1970	1979	1989	2002	2010
Under 50 thousand	35,3	27,6	26,3	22,2	18,4	16,9	17,3	17,3
50–500 thousand	38,6	45,7	42,5	44,6	43,5	41,6	41,2	39,7
Over 500 thousand	–	26,7	31,1	33,2	38,1	41,5	41,5	43,0

Source: Scherbakova E.M. Global demographic barometer / Demoscop weekly. – 2010. – № 407–408. URL: http://demoscope.ru/weekly/2010/0407/barom01.php

We observe concentration processes in the Russian urban system particularly in Moscow and in the majority of big cities. It is interesting to compare the distribution of a city size in Russia with the world regularities and predictions of Zipf's law.

Does Zipf's law hold in Russia? If we compare the distribution rank-size for 1991 and 2012 (Picture 3 and Picture 4), we may conclude that there is no a significant change in shape. The left part of the distribution in 2012 is still below the line, what means that size of the big cities is less than the predictions of Zipf's law. In the majority of the developed countries the biggest cities are positive outliers. While middle Russian cities are bigger than the law predicts.

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[1] Tabuchi T., Thisse J.-F., and Zeng D.-Z. On the number and size of cities// Journal of Economic Geography, 2005, 5(4)).

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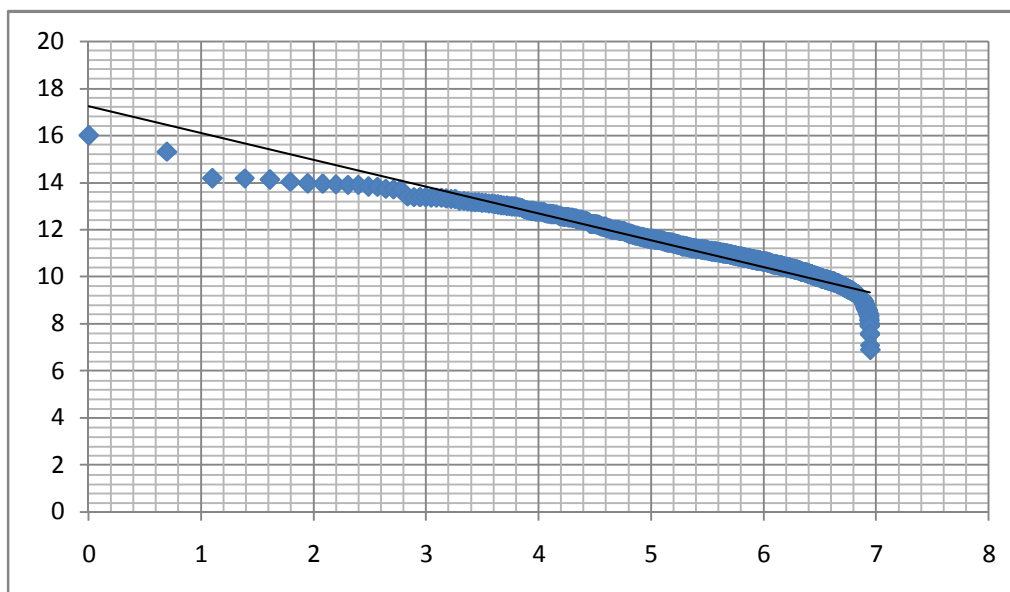
Picture 3. Zipf's distribution for Russian cities, 1991
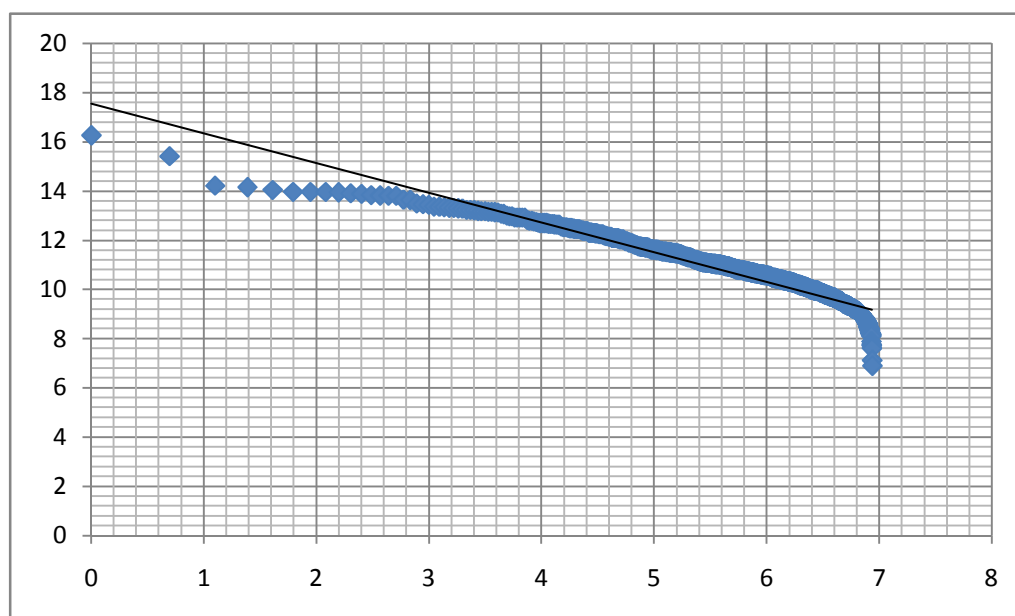
Picture 4. Zipf's distribution for Russian cities, 2012

The dynamics of Zipf's coefficient is also of interest, namely coefficient β in the following regression $\ln S_i = \alpha - \beta \ln R_i + \varepsilon_i$, where S_i – logarithm of city population, R_i – logarithm of city rank. Coefficient β shows the proportion of number of cities having population bigger than S, it equals correspondingly β/S. In the classical case coefficient β equals 1. The dynamics of the coefficient also differs from the predicted (Picture 5); the absolute value of the coefficient is increasing.

All these facts do not confirm the hypotheses that Russia does not support Zipf's law due to the centralized planning of the spatial distribution of economic activity. Transition to the market economy has to eliminate the distortions and has to improve the rank-size regularity. However despite the introduction of the market mechanism in Russian spatial evolution we observe the further decline from the classical value.
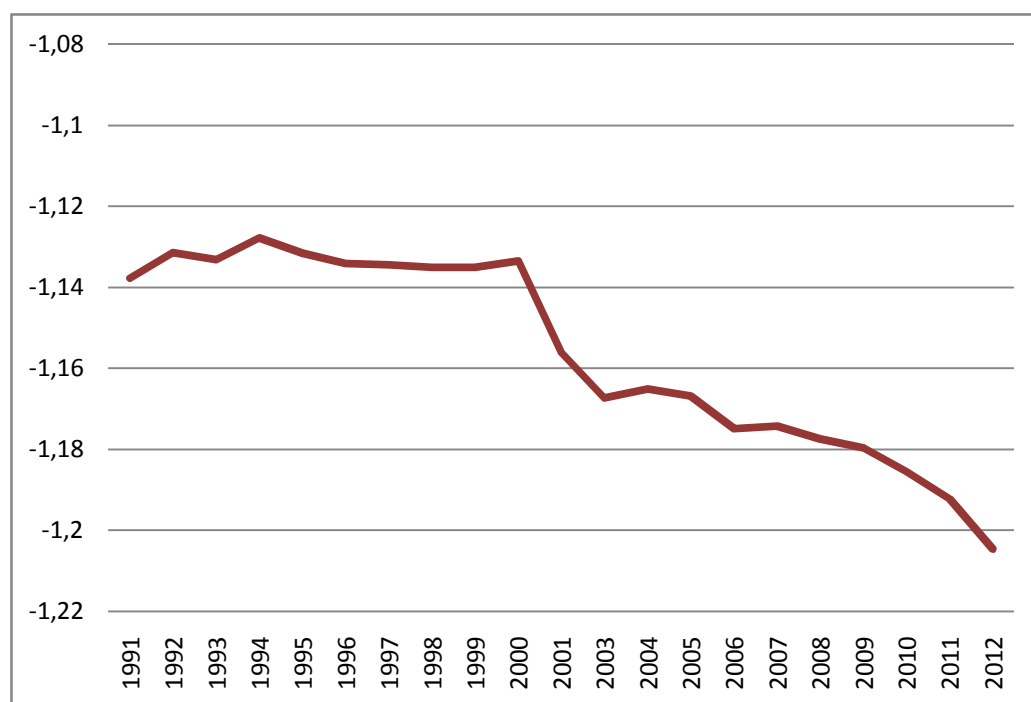
Picture 5. Zipf's coefficient

Table 2

Estimates of regressions for city size

Independent variable	2009	2010	2011
Distance to railway station	−0,149 (0,014)	−0,149 (0,014)	−0,153 (0,014)
Population density	0,222 (0,029)	0,230 (0,029)	0,233 (0,032)
Monthly wage	0,696 (0,059)	0,681 (0,060)	0,700 (0,061)
Herfindal index	−0,297 (0,056)	−0,295 (0,058)	−0,316 (0,058)
Housing per capita	−1,467 (0,145)	−1,460 (0,163)	−1,324 (0,198)
Number of doctors per capita	0,131 (0,085)	0,197 (0,093)	0,205 (0,091)
Secondary education	−0,152 (5,522)	−1,370 (6,076)	1,855 (6,794)
Higher education	68,464 (6,691)	71,998 (7,223)	93,851 (9,683)
Administrative center of region	0,408 (0,154)	0,448 (0,152)	0,248 (0,168)
Number of observations	963	937	954

Factors influencing development of Russian cities. To find out the significant factors behind the spatial distribution of the economic activity in Russia we run regressions where dependent variable is logarithm of city population. Set of the independent variables is determined based on the assumption that cities use internal and external economic resources and political one. The opportunities to attract the external resources depend on transport infrastructure and on the distance to the nearest railway station. The internal resources are characterized by population density, wage level, diversification of economic activity, availability of housing, provision of medical care and education. The political resources are fixed by the administrative status of a city.

The majority of the independent variables create the problem of endogeneity. To solve this problem we use method of instrumental variable, the instruments are lagged variables. We run regressions for 2009, 2010 and 2011, and instruments are values for 2005.

The results of the estimates for size of city are presented in Table 2. A portrait of a big city is as follows: an administrative center near a railway station having high population density, relatively high wage, its economy is diversified, the city has deficit of housing and relatively good provision of medical care and education.

The results of the estimates for growth rate of city size are in Table 3. The portrait of the growing city is following: it is big but it is not an administrative center, mostly with high population density, and providing good social infrastructure and housing. So predictions of the agglomeration economy are mostly confirmed.

Table 3

Estimates of regressions for growth rate of city population

Independent variable	2009/2005	2010/2005	2011/2005	2010/2009	2011/2009
Distance to railway station	0,002 (0,001)	0,002 (0,002)	0,001 (0,003)	−0,0004 (0,001)	−0,001 (0,002)
Size of city	0,011 (0,003)	0,007 (0,002)	0,018 (0,007)	0,007 (0,003)	0,009 (0,006)
Population density	0,007 (0,002)	0,019 (0,004)	0,009 (0,006)	0,012 (0,002)	0,002 (0,005)
Monthly wage	0,008 (0,006)	0,010 (0,009)	0,019 (0,012)	0,005 (0,005)	0,012 (0,010)
Herfindal index	0,013 (0,005)	0,016 (0,008)	0,016 (0,011)	0,0001 (0,005)	0,002 (0,009)
Housing per capita	−0,016 (0,015)	0,094 (0,025)	0,252 (0,039)	0,079 (0,014)	0,287 (0,033)
Number of doctors per capita	0,012 (0,008)	0,036 (0,013)	0,049 (0,017)	0,012 (0,007)	0,034 (0,014)
Secondary education	−0,215 (0,529)	−1,097 (0,864)	−0,917 (1,261)	−0,791 (0,481)	−0,333 (1,058)
Higher education	1,541 (0,716)	2,592 (1,138)	14,282 (1,981)	1,528 (0,633)	12,305 (1,662)
Administrative center of region	−0,041 (0,015)	−0,072 (0,022)	−0,229 (0,031)	−0,031 (0,012)	−0,190 (0,026)

CONCLUSIONS

Development of the Russian urban system in the transition period followed some world tendencies however did not confirm all the predictions proposed in literature. We observed the concentration of urban population in large cities. And forces behind this process are in accordance with the hypotheses of the agglomeration economics. They include size of the market, diversification of the economy, and the infrastructure. But the agglo-meration potential in the Russian economy was not enough. The rate of growth of metropolitan areas was not high. It was expected that the market forces would result in the active migration of population and in the economic activity in the big and the biggest cities. We did not observe very rapid concentration; the overall picture of distribution of Russian cities did not change significantly. Russian urban system is still far from the predictions of Zipf's law.

APPENDIX

Structure of Russian Urban System

	Number of cities and towns									Urban population, thousand								
	1989	2002	2003	2004	2005	2006	2007	2008	2009	1989	2002	2003	2004	2005	2006	2007	2008	2009
Cities and towns, total	3230	2940	2932	2890	2560	2454	2443	2455	2417	107959	106429	106321	105818	104719	104105	103778	103773	103690
Population, thousand																		
under 3	602	606	594	583	426	368	370	379	362	1084	1012	974	948	715	623	623	638	631
3–4,9	541	414	415	408	341	320	318	323	320	2145	1642	1625	1597	1355	1275	1268	1291	1283
5–9,9	795	683	686	674	607	588	581	579	564	5678	4880	4868	4790	4380	4220	4160	4162	4047
10–19,9	564	524	526	521	484	480	477	482	475	7873	7325	7330	7272	6796	6719	6676	6752	6629
20–49,9	398	383	383	377	375	374	376	371	376	12532	12277	12290	12123	12066	12064	12147	12034	12127
50–99,9	165	163	162	162	158	156	154	157	156	11286	11083	11024	11085	10831	10747	10672	10960	10889
100–499,9	131	134	133	132	135	134	132	129	129	28162	28391	28153	27986	28027	27987	27317	27008	27042
500–999,9	22	20	20	21	23	23	24	24	24	14040	12403	12398	13453	14968	14903	15360	15352	15388
Over 1000	12	13	13	12	11	11	11	11	11	25159	27416	27659	26564	25581	25567	25555	25576	25655
Cities, total	1037	1098	1097	1097	1099	1095	1095	1096	1099	94450	95916	95874	95700	96039	95808	95565	95522	95609
Population, thousand																		
under 3	7	11	11	11	12	11	11	11	11	12	23	23	22	25	22	21	21	20
3–4,9	17	21	20	22	22	24	24	24	25	73	88	82	91	93	102	101	100	104
5–9,9	82	101	102	103	101	100	103	105	107	629	772	773	786	777	768	789	800	816
10–19,9	243	277	276	277	280	280	280	283	282	3611	4094	4063	4086	4122	4101	4102	4150	4115
20–49,9	360	358	360	357	357	356	356	352	354	11595	11646	11699	11627	11615	11611	11648	11555	11580
50–99,9	163	163	162	162	158	156	154	157	156	11169	11083	11024	11085	10831	10747	10672	10960	10889
100–499,9	131	134	133	132	135	134	132	129	129	28162	28391	28153	27986	28027	27987	27317	27008	27042
500–999,9	22	20	20	21	23	23	24	24	24	14040	12403	12398	13453	14968	14903	15360	15352	15388
Over 1000	12	13	13	12	11	11	11	11	11	25159	27416	27659	26564	25581	25567	25555	25576	25655
Towns, total	2193	1842	1835	1793	1461	1359	1348	1359	1318	13509	10513	10447	10118	8680	8297	8213	8251	8081
Population, thousand																		
under 3	595	595	583	572	414	357	359	368	351	1072	989	951	926	690	601	602	617	611
3–4,9	524	393	395	386	319	296	294	299	295	2072	1554	1543	1506	1262	1173	1167	1191	1179
5–9,9	713	582	584	571	506	488	478	474	457	5049	4108	4095	4004	3603	3452	3371	3362	3231
10–19,9	321	247	250	244	204	200	197	199	193	4262	3231	3267	3186	2674	2618	2574	2602	2514
20–49,9	38	25	23	20	18	18	20	19	22	937	631	591	496	451	453	499	479	547
Over 50	2	–	–	–	–	–	–	–	–	117	–	–	–	–	–	–	–	–