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The Russian Urban System in Transition: The View of New Economic Geography

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The Russian Urban System in Transition: The View of New Economic Geography

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1. Introduction

Since the collapse of communism in Russia and the Soviet Union, a large-scale change in the Russian system of cities is undergoing. On one hand, emigration of large parts of the population from the peripheral regions of the North and the Far East and Eastern Siberia takes place; on the other hand, the political and economic centers of the country, that are located in the European part of the country, are faced with a high level of immigration. Another sign of the change process is the disappearance of many urban settlements² from the statistics due to reorganizations, transformations in rural settlements and return to nature. However, shifts in the distribution of the urban population are mainly a consequence of migration processes that take place continuously over long periods with varying intensity. A strong immigration can affect the natural growth of the local population, as well as the growth of a city may require an adaptation of institutional conditions, e.g. its relations to the surrounding communities (up to incorporation), at greater intervals. Therefore, a theory that purports to explain changes in the urban system must include the explanation of migration between the cities as a central element.

In the "new economic geography" (NEG) models with mobile human capital, movements of this factor play a central role. The term "NEG" refers to a class of spatial general equilibrium models that help explain the formation of agglomerations while ignoring physical externalities.³ Factor movements, which make territorial balance in the event of a distortion again, follow a simple replicator dynamics: if some people migrate from cities with lower real wages to cities with higher real wages, these movements are reinforced by themselves if real wage differentials increase due to migration. If, in consequence of further migration, the real wage differentials do not disappear, migration continues until all individuals are at the place that allows them to maximize their benefits. Migration for other reasons, as well as migration from rural areas to cities, and vice versa in this models do not occur.

Despite the enormous size of the Russian territory, the NEG is rarely been used to explain spatial economic phenomena in Russia. Exceptions are the papers by Maurseth (2003) and Cheviakhova/ Rytchkov (2004) who analyse the development of spatial disparities in Russia after the collapse of the Soviet Union. Fujita et al. (2005) explicitly express the view of the NEG to the anomaly of the rank-size distribution of the large Russian cities (i.e. the lack of

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² In this paper, the term „urban settlement“ refers only to "poselki gorodskogo tipa (pgt)", but not to cities that are part of a municipal district (munitsipal'ny raion). Unless it is explicitly restricted to cities in a narrower sense, the term „city“ in this paper encompasses always all cities as well as urban settlements (pgt).

³ First approaches can be found in Fujita (1988), Krugman (1991, as core-periphery model has become known basic model of NEG), and Venables (1995). Introductions to the NEG found in Fujita et al. (1999), Brakman et al. (2001), Baldwin et al. (2003), Schöler (2005) Chapter 5, and Schmutzler (1999). For criticism with regard to the concept of NEG from the perspective of economic geography see e.g. Martin (1999) and Güßefeldt (2005).

gradation of city sizes in areas such as cities with about one million inhabitants): Firstly, one cannot easily compare the French and U.S. metropolitan areas with Russian cities in their administrative boundaries, secondly, the size of the distances within the country should be considered, leading to a trade-off between agglomeration economies and transportation costs between the conurbations. Especially in Asian Russia, the small number of cities has proven to be a disadvantage. Göler (2005) holds the NEG not suitable for an application to the problems of peripheral regions of Russia, as it is originally applied to an innovation and knowledge-based economy. Ofer/ Ickes (2006), however, support the NEG as a reference model for showing the differences between the actual path of economic development of Russian regions and a fictive experience without communist regime. Mikhailova (2012) calculated in such a setting an over-population of Siberia and the Far East, from 9.6 to 14.5 million people, or 28-42% of the inhabitants of these regions in 1990. Coulibaly et al. (2012) examine the evolution of the large Russian cities in a global context that is in the tradition of the World Development Report 2009 of the World Bank.⁴

The aim of this paper is to investigate the changes in the Russian urban system (where urban settlements are included) from the perspective of the New Economic Geography. This comes in the wake of the sharp rise in real transport costs as a result of price liberalization in 1991.⁵ Particularly, the NEG focuses on cost of transportation of goods. The costs of passenger transport (which also have experienced a sharp increase and thus exert an inhibitory effect on the migration behavior) amount to zero in the model and are not included in the empirical part of the paper. The contribution relates in particular to the simulation model in Kauffmann (2010b) of a system consisting of $(2m + 1)$ cities ($m = 1, 2, \dots$) which are ordered equidistantly on a straight line. This exhibits some similarity with the band structure of parts of the Russian urban system. It is shown that the changes observed in the size distribution of Russian cities under the assumption of increasing transport costs agree with the predictions of the model, and that migration between regions account for these changes, at least partially. An empirical test of the model in terms of the estimate of the market potential of cities cannot be done due to the lack of data. The empirical part of the article focuses on the analysis of data of population statistics for all cities in Russia (including urban settlements, see footnote 2) and population statistics of federal subjects (FS). Such analysis has been done first time in this form and completeness.⁶

The paper is organized as follows: Section 2 briefly and verbally describes the model and

⁴ In World Bank (2009) findings of the now popular NEG are applied to countries with different economic development. Storper (2011) argues that the NEG needs an update that „breaks some of the self-imposed theoretical and methodological shackles“ – in particular, an equilibrium approach that is incompatible with the non-equilibrium effects of innovation. Peck/ Sheppard (2010) refer to further comments to the World Development Report 2009. World Bank (2011) that is based on World Bank (2009), focuses strongly on the modernization of the Russian transport sector, whose obsolescence restricts the mobility of goods and of people - contrary to a basic assumption of the NEG.

⁵ Technical progress in the transport sector will certainly cause even in Russia a long-term decline in transport costs. So far, the data cannot yet see a complete compensation of the price jump at the beginning of the 1990s. The price trend in specific segments of the transport sector (e.g. the supply of retail in the suburbs of large cities) has not been examined in this paper.

⁶ This paper is based on Kauffmann (2010a, b), where many of the details, in particular the theoretical modeling, described in detail. Kauffmann (2010a) contains also an overview of the relevant literature, including on the Soviet and Russian urban system, as well as on the migration flows between the regions of Russia (pp. 4–27).

the resulting hypotheses derived for the development of the Russian urban system under the influence of increased costs of freight transportation. Section 3 presents the demographic data that are processed in sections 4 and 5. Section 4 descriptively analyses real price development of freight transportation in Russia, as well as population growth of Russian cities related to their size in 1993 and to their distance to each respective regional center. In Section 5, the hypotheses will be tested statistically (OLS, *t*-tests). Firstly, the population growth of cities is regressed on initial size and geographical location (distance from the regional capital, and coordinates) and (as control variables) unidirectional migration flows, which are not considered in the model. Secondly, the effects of bidirectional migration volumes and other components of population growth on the changes of concentration measures of the urban population (Herfindahl index, shares of the two largest cities in each FS in the city population as well in the entire population of the respective FS) are examined in the regression model. Both analyses show that the relationships that match the model predictions can be observed statistically significant. Section 6 concludes.

2. Theoretical background and hypotheses

The basic models of the NEG combine monopolistic competition, economies of scale in production and so-called iceberg or linear transport costs in a $2 \times 2 \times 2$ factors/ sectors/ regions model. The two as "manufacturing" (also called "*L*-sector") and "Agriculture" ("*A*-sector") designated sectors employ qualified, and unqualified mobile and immobile workers, respectively. While the *A* good that is produced under constant returns to scale is traded in a competitive market (excluding transport costs), the *L*-Good whose market is dominated by monopolistic competition is produced under economies of scale. It is assumed that the *L*-Good exhibits a variety of qualities (short „varieties“), which are more or less close substitutes. The preference of consumers for variety Krugman (1991) has modeled using a Dixit-Stiglitz utility function, in which the inner is a CES utility function for the varieties of the heterogeneous *L*-good. The outer bracket of *L*- and *A*-goods here is a utility function of the Cobb-Douglas type. The alternative core-periphery model of Ottaviano et al. (2002, hereafter OTT) displays monopolistic competition and love for variety with the help of a quadratic utility function, followed by linear demand functions for each variety of the heterogeneous good. In contrast to Krugman (1991), the OTT model may be solved analytically and can be supplemented by the inclusion of urban costs which are an important issue for the modeling of urban areas. Tabuchi et al. (2005, hereafter TTZ) enhance the OTT basic model with urban costs to *n* regions, which clearly shows that the period of the growth of large cities in the era of industrialization and the subsequent suburbanization can be traced back on a secular transport costs decline, which is itself based on exogenous technological progress in the transport sector.

However, the modeling of space in the TTZ model is very restrictive: In a star-shaped arrangement, all cities are located on a circle and are connected via paths, which touch each to the center point where no city is located. Therefore, the symmetry is in view of the distances between cities maintained: The only asymmetry in that model follows from the assumption that urban costs differ for cities of different size. The model results are determined by the interplay of the effects of urban and of transport costs. In view of the band structure of the Russian urban system, Kauffmann (2010a, b) transfers a large part of the assumptions of the TTZ

model on an urban system with linear space structure. In the n -region case, this is done at the expense of analytical solvability of the model. To separate the effect of the different distances between cities, for all cities identical positive urban costs are fixed. Because of the real jump in transport costs after the price liberalization in Russia in 1991 it is assumed that the costs of freight transportation are increasing. With parameters of the utility function and the relation of employment in the L- and A-sector proposed in TTZ, starting with equal distributed L-workers when transportation costs are zero, the model of Kauffmann (2010b) displays the *exodus from the smaller, peripheral cities to the large central cities of the system if transportation costs increase*.

A similar result would be obtained by assuming a CES utility function in the event of a reduction of transport costs. Ago et al. (2006) show the analysis in the context of a three-region model with linear space arrangement, which is, however, designed without urban costs. The model parameters underlying the simulations in Kauffmann (2010b) correspond to the case of a small L-sector in Ago et al. (2006). Accordingly *proposition 3 (2)* in Ago et al. in the event of increasing costs of transport different cases are possible, one of which is limited growth of the central city. In case of transport costs fall below the initial level, the central city would slightly start to shrink, but then – as in the model with CES utility function – a migration process takes place that ends only if all L-workers are concentrated in the central city.⁷ So the model framework by Ago et al. (2006) contains a transport cost-interval within which the models with quadratic and with CES utility function amount to similar statements. The increase of the concentration in the central city as a result of increasing transport costs, however, is incompatible with a CES utility function.⁸

The models on which World Bank (2009, 2011) and Coulibaly et al. (2012) are based apply a CES utility function in the monopolistic competition framework of Dixit/Stiglitz. Hence, compared to this paper, there are met completely different assumptions, both in terms of the assumption regarding the behaviour of transportation costs (falling vs. increasing) as well as to the respective utility function underlying the model, while the fact to be explained – the increase in concentration in the Russian system of cities – is one and the same! An interpretation of the results and conclusions that may be derived (and recommendations as well) must therefore be done very carefully.

The results that are contradictory to the Krugman CP-model can be attributed to two effects:⁹ Firstly, the increase in transport costs raises the price for the L-good in the more remote regions, which corresponds to a cut in real wages in these regions. Secondly – and this is crucial – increasing transport costs reduce the intensity of competition, especially in the urban centers and their surrounding regions, resulting in the relocation of companies from the periphery to the center, where the supply of goods as well as real wages increase.

⁷ See Ago et al. (2006) p. 831 and Fig 2ii p. 832. It is likely that the inclusion of urban costs would limit the growth of the city center in the event of a decline in transport costs. A deeper analysis of these effects has still not been done.

⁸ The controllability of the results of the NEG models by restrictive assumptions proves particularly a problem when an explicit reference to this possibility is omitted. The solution would be to apply a general utility function in the model. Zhelobodko et al. (2012) may be regarded as a step in this direction, where monopolistic competition and love for variety are modeled using a general additive utility function. The results are compatible with other utility functions (including quadratic, translog, but not CES).

⁹ See Ago et al. (2006) S. 833 ff.

From the model framework developed in Kauffmann (2010a, b) the following hypotheses can be derived:

1. Under the assumption that the costs of freight transportation since the early 1990s have increased in real terms, the major centers of the country grow more (or shrink less) than the smaller towns in the peripheral regions in the North and East of Russia (the link between growth and size of cities as well as between growth and geographic location of cities).
2. The different growth patterns of cities and towns are reflected in a greater concentration of urban population in the centers of the country. These changes are caused by migration (the link between change of concentration and the volume of migration flows between cities).

3. Data

The number of inhabitants of the cities and urban settlements (pgt) are published by Goskomstat Rossii or Rosstat annually since 1991.¹⁰ Since also the corresponding figures for 1989 (last census in the area of the Soviet Union) are available,¹¹ it would be logical to compare the data of the two census years 1989 and 2002 (or January 1, 2003, resp.). However, the publication of 1989 (and in many cases up to 1996) lacks the so-called "closed formations" or "secret cities". These are cities and urban settlements (pgt), whose data were secret in the Soviet era, and even in the early years after its end have been kept secret. Because the sum of population in cities and rural units should be consistent to the population figures published for the country (and for the regions, at least in most cases) the inhabitants of these places were appended to other cities. This practice was changed only with the abolition of confidentiality of the cities in question (in most cases between 1994 and 1996). Therefore, 1993 (de jure) data were selected as the base year for the present investigation to get a date in the middle of the last census year (1989) and the year of first publication of the number of inhabitants of (almost) all cities. Here, for the "secret cities" for 1993 those figures have been inserted that were published for the first time some years later. But the number of inhabitants of those cities, which contained additionally the inhabitants of the "secret cities" in 1993, had to be replaced with corrected values. These have been published by GOSKOMSTAT exclusively for 1989, in the 2002–2004 editions of the Statistical Yearbook of Russia.¹² To gain a greater time interval to the initial year, the 1.1.2004 was chosen as the end point of the study period. This decision was also influenced from the fact that in the course of 2004, approximately one in six urban settlements (pgt) disappeared from the statistics.¹³ Thus, comparability of distributions in 1993 and 2005 would have been problematic.

The data for population of the FS (total, urban and rural population) that are applied mainly in section 5 are from the Demographic Yearbook of Russia in 2006. The data on the natural

¹⁰ Chislennost' naseleniya Rossiiskoi Federatsii po gorodam i poselkam gorodskogo tipa v ... godu (further: "Chislennost' naseleniya ..."). The published data for 1991 and 1992 are only de facto, 1993–2001 de facto and de jure, from 2003 only de jure data, for each year at January 1.

¹¹ Gorodskie poseleniya RSFSR po dannym vsesoyusnoi perepisi naseleniya 1989 goda, Moskva: Republikanskii informatsionno-izdatel'skii tsentr. The volume also contains the data collected during the 1979 census.

¹² See Tolts (2001, 2004, 2008). In later editions of the Statistical Yearbook at this location are published again the fake values! An overview of the "secret cities" and the support of its inhabitants in the statistics can be found in Kauffmann (2010a), pp. 190–193.

¹³ See Lappo (2005a, b). The origin and development of this for the Soviet Union and Russia specific type of settlement see Meckelein (1964). See also footnote 2 above.

growth of the population in the FS (total, urban and rural population) are from various editions of the Demographic Yearbook between 1993 and 2007. The number of people who dropped out (or entered into) urban population in consequence of administrative-territorial changes (ATCh) was extracted from the various 'Chislennost' naseleniya ...' and have been aggregated to the level of the FS. Furthermore, annually migration matrices could be used for the years 1993–2003 (city-city, rural-rural, urban-rural, rural-urban and total) at the level of the FS, which were created by Goskomstat Rossii. Data on external migration from and to FS for the whole area of urban and rural space (i.e. not separated) were found in different editions of the Demographic Yearbook and of "Chislennost 'i migratsiya naseleniya Rossiiskoi Federatsii v ... godu (Statisticheskii byulleten ')." "

At the level of FS, also data for the cities of Moscow and St. Petersburg are reported to be as independent subjects of the federation under the direct authority of the central government. To introduce migration flows between the capitals and their respective region (i.e. the Moskovskaya and the Leningradskaya Oblast') as well as between regions Moscow/ Moskovskaya Oblast and St. Petersburg/ Leningradskaya Oblast' adequately – i.e. in the same way as for the other FS and their capitals – properly in the econometric model, the main cities are for the purpose of statistics assigned to their surrounding regions. In the so-formed regions of Moscow and St. Petersburg/ Leningrad, the amounts of the migration flows between Moscow Oblast and the city of Moscow to FS (that are reported in the official statistics separately) are internal migration flows (and between St. Petersburg and Leningrad Oblast' as well). The migration flows between the oblast 'and the City of Moscow (or of St. Petersburg/ Leningrad oblast', resp.) and other FS are merged for each additional FS. The same applies to the natural growth, the external migration and the ATCh, which are determined in each case together for the capital and its surroundings.

The data of the cities in the republics of Chechnya and Ingushetia have proven as extreme outliers. Because the underlying acts of war don't have anything in common with the investigated processes, these cities are excluded from the econometric analysis.

4. Descriptive statistics

4.1 Index of transportation costs in Russia

After the price liberalization in 1991, the prices of freight transportation have more than proportionally increased relative to the prices of other goods that are produced in Russia. To display this, a price index of transportation costs in Russia has been built from nominal prices of freight transportation by all means of transport, deflated by the GDP deflator (see fig. 1). The annual growth of prices for goods transportation services (average cost per tonne-kilometre) was taken from the editions of the Statistical Yearbook 2000 (to 1999), 2008 (2000–2006) and 2012 (2007–2011). The GDP deflator can be downloaded from the website of the Higher School of Economics (www.hse.ru).

Along with the price development of freight transportation services, the real price trends in producer prices of electric energy is shown. The close correlation of the two series shows that the increase in transport prices follows the price trend for energy. The figure shows that the jump in price resulting of the liberalization has a lasting effect. The strong increase of prices of transportation is not surprising if one considers that the transport sector in the Soviet Union

was heavily subsidized, to maintain the planned economy with its strong geographic diversifi-

Fig. 1: Development of costs of freight transportation and producer prices of electricity in Russia, related to the GDP deflator 1991–2011 (in percent)

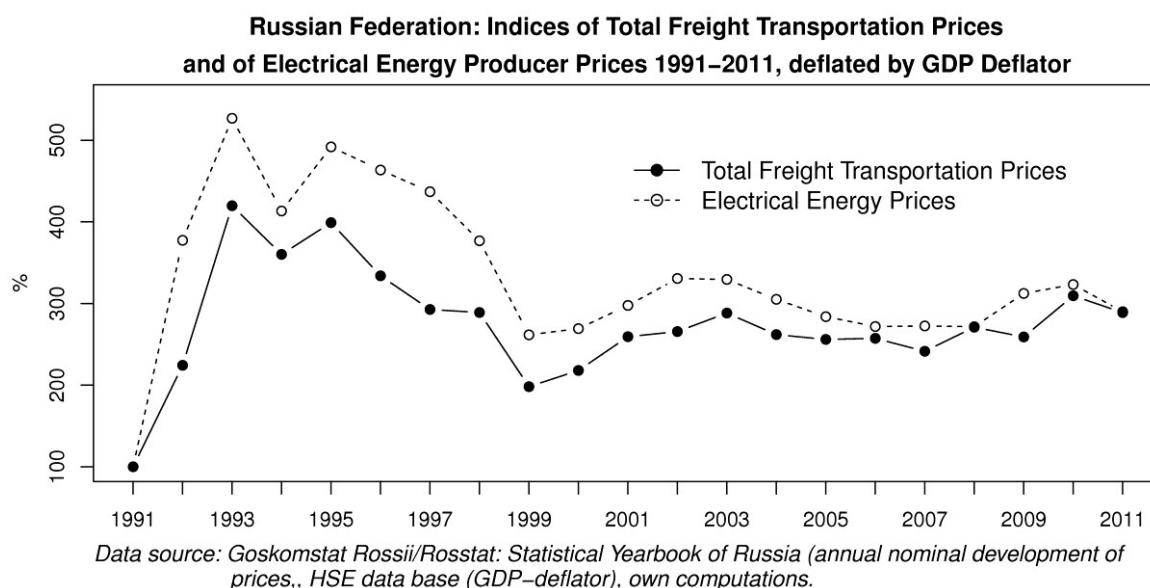
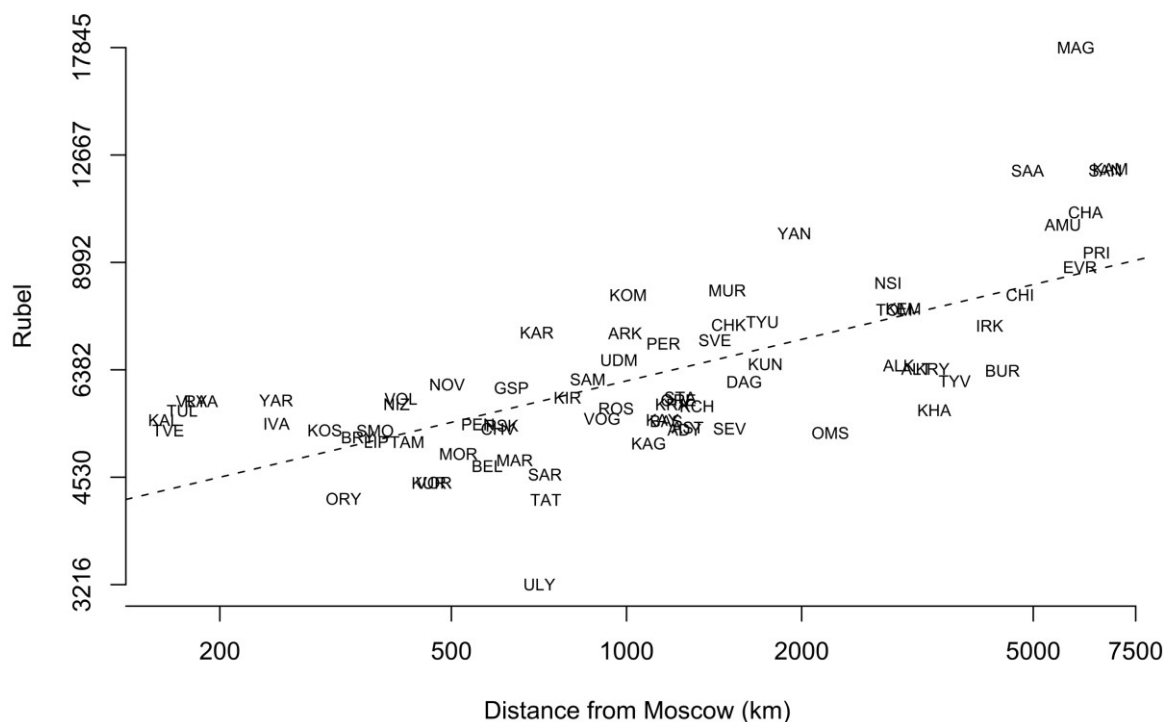


Fig. 2: Price of a basket of 25 staples in 74 federal subjects of Russia in November 1993 (in Rubles) and distance of each regional capital to Moscow^a

74 Subjects of Russian Federation: The Cost of the Basket of 25 Staples (Rubles), November 1993



a) For the meaning of the abbreviations of FS see the appendix.

Source: Kauffmann (2010a) p. 129.

cation (resulting in "mono-cities" which were often located at the wrong places). 1993–1999,

transport costs have fallen in real terms, but not near to or below the departing level. After 1999 the index displays signs of a slight upward trend. Therefore, one can assume for Russia increased aggregate costs of freight transportation. However, this does not mean that in different market segments of freight (as well as passenger) transportation there has not been a reduction in costs. But, this can hardly be quantified. How should we evaluate the gain in freedom that has brought the liberalization of transport (and even the possibility of individual traffic for broader parts of the society)?

The impact of transport costs on the regional retail prices is shown in fig. 2.¹⁴ The log-log confrontation of the straight distance between the respective regional capital and Moscow (on the abscissa) and the price of a basket of 25 goods (on the ordinate) reveals a significant positive trend. Thus, higher distances of remote areas lead to higher costs of transportation and, hence, to higher regional prices of goods. Therefore, the distance to Moscow or the geographical location of the city as well as their distance from the respective capital of the FS can be used as proxies for transport costs.

4.2 Growth of cities in size classes

The numbers summarized in table 1 give a first impression of the changes in the distribution of the urban population of Russia.

Table 1: Overview of the numbers of cities and urban settlements (pgt), as well as means and concentration of their population

	cities and pgt		cities		pgt	
	1993	2004	1993	2004	1993	2004
Number of units	3169	2880	1084	1097	2085	1783
therein „secret cities“	41	0	19	0	22	0
Number of inhabitants (mill.)	108,8	105,8	96,2	95,7	12,6	10,1
Mode of inhabitant	5464	6326	23892	19976	5086	5572
Median of inhabitants	7900	8000	30600	28000	4900	4700
Arithmetic mean of inhabitants	34333	36745	88776	87238	6028	5679
Size of the city where the median inhabitant lives	233300	266200	321800	329100	8400	8000
Herfindahl coefficient	0.0106	0.0143	0.0135	0.0175	0.00076	0.00091
Gini coefficient	0.786	0.797	0.696	0.713	0.396	0.410

Source: Kauffmann (2010a) p. 133 and 147, own calculations based on “Chislennost’ naseleniya ... (1993 ... 2004) and on Stat. Yearb. 2004.

The number of urban settlements (poselki gorodskogo tipa, pgt) dropped significantly, while the number of cities (without pgt) increased slightly. Comparing the figures for 1993 and 2004, one has to consider that all changes are net changes. For example, the number of urban settlements that have disappeared from statistics is larger than 302 because some new ones have been founded during the period. The same applies to the change in population, which is

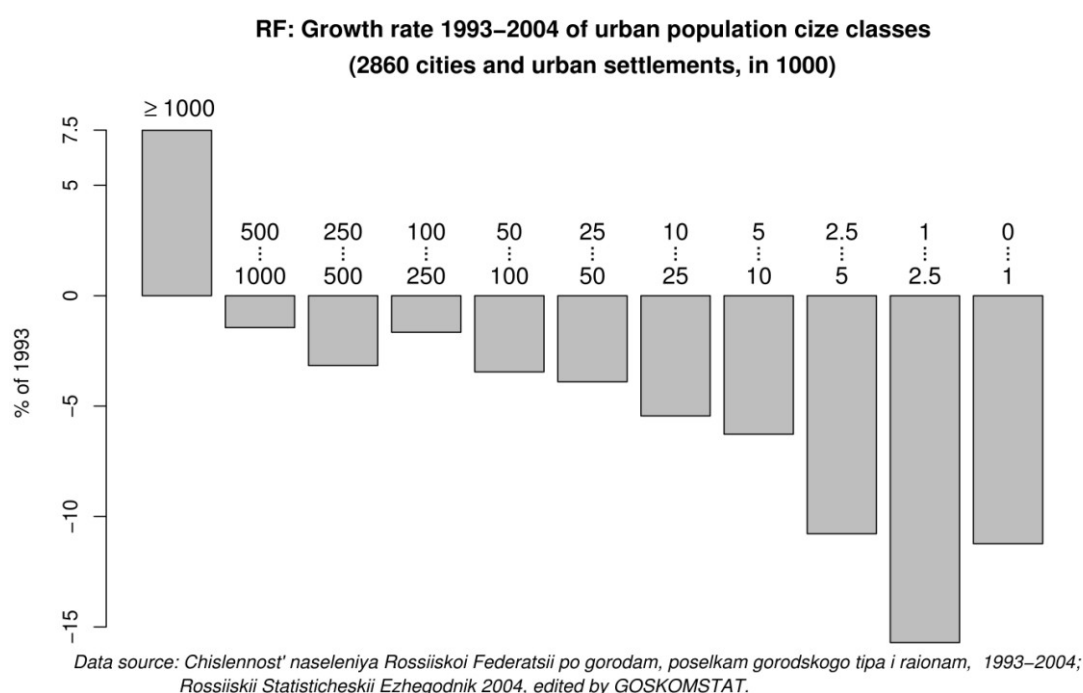
¹⁴ Regional prices for a basket of 25 staples were originally computed by Goskomstat (but not published). One can find them on the web page of Prof. Konstantin Gluschenko (http://econom.nsu.ru/staff/chair_et/gluschenko/Research/Data/basket-25.xls).

composed of several components: immigration and emigration (where the domestic source and destination regions may be the urban or the rural area, as well additionally external migration has happened), natural growth and ATCh (which are mostly conversion of urban settlements to rural ones or incorporations of urban settlements to larger cities).

The differences in the changes of modes of sizes of cities¹⁵ and urban settlements (pgt) indicate differences in interaction of these components in the two groups: The increased mode in the group of urban settlements is due to the disappearance of many small units out of that group (ATCh), while the decline in mode of population of cities (without pgt) may be explained rather with the predominance of emigration and shrinkage in a majority of the smaller units. The median as well as the arithmetic mean have fallen in both groups, suggesting that the urban settlements (pgt) are also affected by emigration and natural shrinkage. However, median and arithmetic mean of the entire distribution (cities and urban settlements) have increased. For the mean, this may be caused by processes that concern the tails of the distribution (dropping of the smallest units, growth of the largest cities), the median growth should be due to the disappearance of many small urban settlements, despite the shrinkage of other small units.

Also the differences in the change of size of those cities in which lived at the time the respective "median inhabitant" indicate the larger number of ATCh affecting urban settlements. The concentration of the urban population has increased overall and in both groups, with different reasons that are responsible in the two groups, in each of them with different weights.

Figure 3: Mean growth rates 1993–2004 of population of Russian cities and urban settlements (pgt) in size classes, in percent of 1993 population



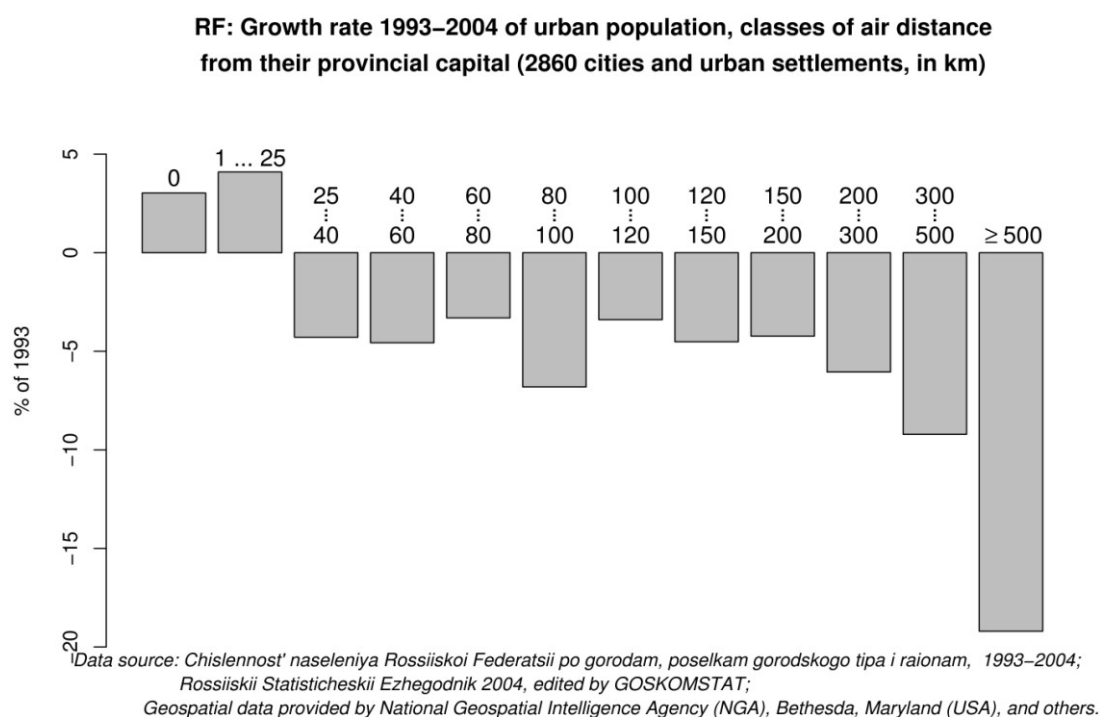
Source: Own computations based on "Chislennost' naseleniya ..." (1993 ... 2004) and Stat. Yearb. 2004.

¹⁵ The modes were computed by means of kernel density estimators. See also Kauffmann (2010a) p. 134.

The trend towards divergence in the size distribution of Russian cities is evident when one looks at the average growth of the units grouped in size classes (Fig. 3). It should be noted that a part of the units (in particular of smaller urban settlements) 2004 no longer appears in the statistics.¹⁶ The coefficients of variation of the growth differ over size classes and are very high. Figure 3 must therefore be interpreted with caution, the supposed positive correlation between urban growth and size must be subjected to a statistical test.

The relationship between population growth of the city or urban settlement and its location in the respective FS, approximated by the straight-line distance to the respective capital corresponds to the hypothesis formulated from the model assumptions (fig. 4): While the regional capitals and their suburbs on average grow shrink the more remote places on average stronger with increasing distance. This relationship must be proved statistically significant (for the reasons mentioned above), as well. The formulation of appropriate regression models follows in the next section.

Fig. 4: Mean growth rates 1993–2004 of population of Russian cities and urban settlements (pgt) in classes of distance between local units and their respective regional capital, in percent of 1993 pop.



Source: Own computations based on “Chislennost' naseleniya ...” (1993 ... 2004) and Stat. Yearb. 2004.

5. Regression analysis

The alleged relationships between the growth of Russian cities and their size in 1993 as well as their geographical location have to be tested in a linear regression model. The geographical location is mapped on the one hand by the geographical coordinates (hypothesis: negative correlation between east longitude and urban growth as well as between north latitude and growth); in addition, the population growth of cities and settlements is regressed to

¹⁶ For class frequencies and other particulars of fig. 3 and 4 see Kauffmann (2010a) p. 148 ff.

their distance to the respective regional capital of each unit.¹⁷ As control variables, features were included that are excluded in the theoretical model: urban-rural migration, external migration, and natural growth. The control variables are only available at the territorial level of FS. The regression model is

$$\begin{aligned} \dot{\pi}_{c \in c_i} = & \beta_0 + \beta_1 \ln \pi_c^{1993} + \beta_2 \ln \delta_{ci} + \beta_3 \text{Lo}_c + \beta_4 \text{La}_c + \beta_5 \mu_{i,\text{intra}}^{v2c} + \beta_6 \mu_{i,\text{intra}}^{c2v} \\ & + \beta_7 \mu_{i,\text{betw}}^{v2c} + \beta_8 \mu_{i,\text{betw}}^{c2v} + \beta_9 \mu_{i,\text{ext}}^i + \beta_{10} \mu_{i,\text{ext}}^o + \beta_{11} \nu_i + \varepsilon_i \end{aligned} \quad (1)$$

The symbols used in regression models (1) and (2) are explained in table 2.

Table2: Explanation of Symbols used in regression models (1) and (2)

π_c	Population of city c in FS i at 1st january 1993
$\dot{\pi}_{c \in c_i}$	Growth rate of population of city c in FS i 1993–2004
δ_{ci}	Distance between city c in FS i and the capital of FS i
Lo_c, La_c	Longitude and latitude of city c
$\mu_{i,\text{intra}}^{v2c}$	Intraregional rural-urban migration in FS i
$\mu_{i,\text{intra}}^{c2v}$	Intraregional urban-rural migration in FS i
$\mu_{i,\text{betw}}^{v2c}$	Interregional rural-urban migration in FS i
$\mu_{i,\text{betw}}^{c2v}$	Interregional urban-rural migration in FS i
$\mu_{i,\text{ext}}^i, \mu_{i,\text{ext}}^o$	External immigration and emigration to/from FS i
ν_i	Natural growth of population in FS i
ΔH_i	Change of Herfindahl coefficient of concentration of population in FS i
$\Delta C_i^{2c}, \Delta C_i^{2a}$	Change of the share of the two largest cities in urban population (and in total population, resp.) of FS i
$\mu_{i,\text{intra}}^{c2c}$	Migration volume between cities within FS i
$M_{i,\text{betw}}^{cc}$	Migration volume between cities of FS i and cities of other FS
$M_{i,\text{intra}}^{cv}$	Migration volume between cities and rural settlements of FS i
$M_{i,\text{betw}}^{cv}$	Migration volume between cities of FS i and rural settlements of other FS as well as between rural settlements of FS i and cities of other FS
$M_{i,\text{ext}}$	Migration volume between FS i and foreign locations
A_i	Net number of inhabitants whose territorial status has changed from urban to rural and vice versa due to ATCh in FS i

¹⁷ Originally, the distances to the national capital of Moscow and the capital of the respective FS were included as explanatory variables in the model. During the investigation it has appeared that the geographic coordinates of the cities fit distance well and may additionally contribute to the explanation power of the model.

Table 3 displays the results of the OLS estimation of eq. (1). Following regressions 1 and 2, for the explanatory variables the null hypothesis is rejected at a significance level of 95%. For the control variables, a clear hypothesis can be formulated only in the case of natural growth that should make a positive contribution to urban growth ($\beta_{11} > 0$). The corresponding null hypothesis has to be rejected because $\hat{\beta}_{11} > 0$ at the 5% significance level. Regarding the migration flows between rural and urban sphere, urban-rural as well as rural-urban flows may predominate, and immigration from rural to urban settlements (or to cities, as well) may take place together with strong emigration from the same cities to other cities or to foreign locations. Hence, for the signs of $\hat{\beta}_5 \dots \hat{\beta}_{10}$, there is no clear hypothesis.

Table 3: Results of regression (1) for Russian cities and urban settlements (dependent variable: growth of urban population 1993–2004)

		Regression 1		Regression 2		Regression 3	
1	$\hat{\beta}_0$	0,64	(11,04)*	0,58	(12,85)*	0,077	(3,44)*
π_c	$\hat{\beta}_1$	0,013	(4,42)*	0,019	(6,33)*		
δ_{ci}	$\hat{\beta}_2$	-0,026	(-7,76)*	-0,019	(-5,55)*		
Lo_c	$\hat{\beta}_3$	-0,0020	(-10,68)*	-0,0020	(-16,98)*		
La_c	$\hat{\beta}_4$	-0,0068	(-7,36)*	-0,0090	(-11,59)*		
$\mu_{i,intra}^{v2c}$	$\hat{\beta}_5$	-3,0e-04	(-0,80)			-0,0012	(-3,25)*
$\mu_{i,intra}^{c2v}$	$\hat{\beta}_6$	-1,3e-04	(-0,24)			8,5e-04	(1,63)
$\mu_{i,betw}^{v2c}$	$\hat{\beta}_7$	0,0043	(7,76)*			0,0032	(5,55)*
$\mu_{i,betw}^{c2v}$	$\hat{\beta}_8$	-0,0053	(-10,85)*			-0,0070	(-14,10)*
$\mu_{i,ext}^i$	$\hat{\beta}_9$	-2,6e-05	(-1,34)			0,0012	(7,17)*
$\mu_{i,ext}^o$	$\hat{\beta}_{10}$	9,2e-04	(3,36)*			-5,5e-04	(-2,12)*
ν_i	$\hat{\beta}_{11}$	0,0017	(11,64)*			0,0018	(11,74)*
R^2		0,269		0,196		0,205	
n		2849		2849		2849	

t-values in parentheses. * significant for 5% significance level. Source: Kauffmann (2010a).

For population exchange between villages and cities in different regions, the regression coefficients display significant positive correlation between immigration to cities and growth ($\hat{\beta}_7 > 0$), while emigration from cities and growth are negatively correlated ($\hat{\beta}_8 < 0$). In the case of external migration (for which data only for the aggregated urban and rural areas are available), the opposite is the case (at the significance level of 5%). However, this may be influenced by multicollinearity: since population growth is regressed on the control variables alone, the signs of the regression coefficients of external immigration and emigration are changing. This instability is also evident in the case of emigration to rural areas of the same

region ($\hat{\beta}_6$), while $\hat{\beta}_5$ (immigration from rural areas in the same region) in regression 3 correlates with the growth of the urban population significantly negative (i.e., rural-urban migration within regions is predominantly in those regions where cities are shrinking stronger than in the mean).

Overall, the predictions of the model with regard to stronger growth (or weaker shrinkage) of the large cities as well as of the cities nearby the regional centers seems to be confirmed. Particularly, this is true for the centers themselves.

Regression 1 also was tested for the cities and urban settlements (pgt) of the seven¹⁸ federal districts (FD) separately (Table 4).¹⁹ Here, regional peculiarities come to light. The hypothesis of stronger growth (or weaker shrinkage) of the big cities confirms in the FD "Volga", "Ural", "Siberia" and "Far East" (rejection of the null hypothesis at the significance level of 5%). For the FD "Centre", the null hypothesis would be rejected at the significance level 10%; in the FD "South" $\hat{\beta}_1$ is obviously insignificant. In FD "Northwest" $\hat{\beta}_1$ has for a significance level of 10% a negative sign (at the 5% level is not significant). The much weaker relationship between growth and size in the FD "center" is probably due to the special status of the capital, Moscow, and many political location decisions in their surroundings. In the case of the FD "Northwest", the significant negative $\hat{\beta}_1$ value is a consequence of the very sharp decline in the population of the city of Murmansk, Vorkuta and Severodvinsk expressed. The first two cities were military bases and locations of the military-industrial complex and lost in importance, while in Vorkuta the reduction in coal production is responsible for the emigration of large parts of its population. In FD "South", some peculiarities of the Muslim peoples of the North Caucasus, where agrarian settlement structures are prevailing, may be responsible for the insignificance of $\hat{\beta}_1$, as well as the war events in and around Chechnya that touch also neighboring areas.

The coefficient estimators of the variable "distance to the regional capital" $\hat{\beta}_2$ have in all regressions for the FD the expected negative sign. In FD "Northwest", $\hat{\beta}_2$ is not significant at the 5% level (p-value: 5.2%), in the FD "Volga" that contains large conurbations it is completely insignificant. The estimators for the coefficients of the east longitude $\hat{\beta}_3$ are insignificant for those FD, where one should to expect this outcome (FD "South" and "Centre"). On the other hand, for the FD "Northwest", "Volga", "Siberia" and "Far East" $\hat{\beta}_3$ exhibits a negative sign, as expected as well. The positive value of $\hat{\beta}_3$ in the FD "Ural" is likely a consequence of the fact that the oblast Tyumen, where the West Siberian gas production is concentrated, belongs to this FD. The coefficient estimators of the northern latitudes $\hat{\beta}_4$ for all FD have a negative sign, but are not significant in the FD "South", "Volga", "Ural" and "Far East". In FD "Ural", this may be due to the northern location of the Western Siberian gas cities; for the FD "South" and "Volga" is expected that $\hat{\beta}_4$ should be insignificant. In the far north of the FD "Far East", some urban settlements (pgt) have been abandoned in the period from 1993 to 2004, which may be reflected in the insignificance of $\hat{\beta}_4$.

¹⁸ Federal Districts (Federalnye Okrug) have been constituted in 2000, mainly as an administrative level between the central government and the federal subjects. FD „South“ was divided into the present-day FDs „South Russia“ and „North Caucasus“ at 19th January 2010.

¹⁹ Table 4 displays only results of regression 1 of eq. (1). For those coefficient estimators which are significant at 5%-level, regressions 2 and 3 have always the same signs as in regression 1.

Table 4: Estimation results for regression (1) for cities and urban settlements (pgt) in the federal districts of Russia

	Central	North West	South	Volga	Ural	Sibir	Far East
1	$\hat{\beta}_0$	4,70 (5,78)*	0,097 (0,16)	1,05 (2,94)*	-0,52 (-1,76)	1,31 (3,99)*	1,04 (3,24)*
π_c	$\hat{\beta}_1$	-0,027 (-1,89)	-0,0038 (-0,43)	0,016 (3,33)*	0,022 (3,21)*	0,017 (2,34)*	0,040 (4,16)*
δ_{ci}	$\hat{\beta}_2$	-0,033 (-1,95)	-0,041 (-4,11)*	-0,0023 (-0,35)	-0,032 (-3,71)*	-0,028 (-3,38)*	-0,032 (-3,25)*
Lo_c	$\hat{\beta}_3$	-0,015 (-3,86)*	-5,3e-04 (-0,08)	-0,0094 (-4,22)*	0,012 (3,63)*	-0,0057 (-2,73)*	-0,0065 (-3,16)*
La_c	$\hat{\beta}_4$	-0,055 (-4,76)*	-0,0035 (-0,39)	-0,0075 (-1,20)	-0,0030 (-0,63)	-0,012 (-3,11)*	-0,0043 (-0,88)
$\mu_{i,intra}^{2c}$	$\hat{\beta}_5$	-0,012 (-1,98)*	-0,011 (-2,65)*	0,0021 (2,23)*		7,4e-04 (0,49)	-0,0061 (-2,12)*
$\mu_{i,intra}^{c2v}$	$\hat{\beta}_6$	0,015 (2,12)*	0,012 (2,89)*	-0,0046 (-2,90)*		-0,0014 (-0,40)	0,0063 (1,70)
$\mu_{i,betw}^{2c}$	$\hat{\beta}_7$	0,0028 (0,27)	0,0049 (1,44)	0,0049 (1,82)		0,0018 (0,46)	0,0067 (1,97)*
$\mu_{i,betw}^{c2v}$	$\hat{\beta}_8$	-0,0052 (-1,13)	-0,0023 (-0,43)	-0,0074 (-2,81)*		-0,0029 (-0,51)	-1,1e-04 (-0,05)
$\mu_{i,ext}^i$	$\hat{\beta}_9$	-0,0081 (-4,91)*	-0,0025 (-2,90)*	-0,0016 (-1,25)		8,4e-04 (0,57)	-0,0012 (-0,73)
$\mu_{i,ext}^o$	$\hat{\beta}_{10}$	0,0099 (2,25)*	0,020 (3,21)*	0,0067 (2,30)*		-0,0011 (-0,74)	-3,1e-04 (-0,34)
ν_i	$\hat{\beta}_{11}$	0,0073 (2,95)*	0,0020 (2,55)*	0,0028 (5,62)*	7,4e-04 (2,05)*	0,0014 (1,20)	0,0027 (2,01)*
R^2	0,111	0,198	0,413	0,192	0,278	0,255	0,439
n	730	316	245	568	286	408	296

t -values in parentheses. * significant for 5% significance level. Source: Kauffmann (2010a).

Among the control variables, the coefficient estimators for natural growth $\hat{\beta}_{11}$ display throughout positive and (with the exception of FD "Center") significant values at the 5% level. The coefficient estimators for the intra-regional rural-urban migration $\hat{\beta}_5$ and vice versa $\hat{\beta}_6$ differ in parts significantly over the FD: In the case of FD "Volga" is $\hat{\beta}_5 > 0$ and $\hat{\beta}_6 < 0$, in contrast to the FD "North", "South" and "Far East". This could lead to the insignificance of these estimators in the regressions for the national population of the cities. However, the signs of the coefficient estimators of interregional rural-urban/ urban-rural-migration $\hat{\beta}_7$ and $\hat{\beta}_8$ are uniformly over all FD. The estimators $\hat{\beta}_9$ and $\hat{\beta}_{10}$ (external migration) point for the FD "Siberia" and "Far East" with the opposite sign as for other FD (though not significantly). This can lead to unstable behavior of these estimators in the regressions for the cities as a whole.

For the FD, the coefficient estimators of the explanatory variables generally have the expected sign. Deviations from the model predictions can be explained by regional peculiarities.

The second hypothesis to be tested is directed to possible causes of the concentration process: are regional differences in changes in the population concentration positively correlated with the volume of migration (i.e., the sum of migration flows in both directions), especially between the cities? Here, the changes of three concentration measures are used as dependent variable: the Herfindahl coefficient (sum of the squares of the shares of the urban population of FS), the proportion of the population of the two largest cities (C2) at the urban population of each FS, and the share of the two largest cities in its total population. Into the Herfindahl coefficient, the population shares of all units of each FS get entry. On the other hand, it reacts very sensitive to changes in the number of units that may be caused e.g. by elimination or consolidation particularly of smaller units. The two C2 measurements are more robust with respect to such changes. If the C2-measure refers only to the urban population, this can lead to problems if the number of cities in a FS is small and some of them are disappearing during the period of investigation. This can be mitigated if the population of the two largest cities is related to the entire (including rural) population of the FS. In this model, explanatory variables are the migration volumes between cities belonging to the same FS (intraregional) as well as between cities belonging to different FS (interregional). Control variables are the migration volume between urban and rural populations of the same FS, the volume of migration between urban and rural populations of different FS, the volume of external migration, the net amount of ATCh and the natural population growth in each FS.²⁰

$$\begin{aligned}
y_i = & \beta_0 + \beta_1 \mu_{i,intra}^{c2c} + \beta_2 M_{i,betw}^{cc} + \beta_3 M_{i,intra}^{cv} + \beta_4 M_{i,betw}^{cv} + \beta_5 M_{i,ext} \\
& + \beta_6 \nu_i + \beta_7 A_i + \varepsilon_i, \\
y_i \in & (\Delta H_i, \Delta C_i^{2c}, \Delta C_i^{2a}).
\end{aligned} \tag{2}$$

The oppositely directed migration streams are aggregated to migration volumes because walks in both directions equally contribute to the growth or shrinkage of individual units, hence systematically related effects on certain groups of cities may occur (e.g. by size). The regression results are summarized in Table 5.

²⁰ For an explanation of symbols see tab. 2 above.

The coefficient estimators of the explanatory variables are consistent for all three independent variables. Intra-regional migration flows (i.e. flows within one and the same FS) are in no case significantly correlated with the change in concentration. A possible explanation would be that migration flows from shrinking cities in growing cities of the same FS are balanced by migration flows in the opposite direction, so effects on concentration cannot be displayed in this simple framework of analysis.²¹ However, inter-regional migration of urban dwellers significantly contributes to the change in the Russian system of cities. In all three regressions $\hat{\beta}_2$ is significantly positive.

Table 5: Estimations of regression (2) for 75 Russian federal subjects

		Dependent variable:					
		ΔH_i		ΔC_i^{2c}		ΔC_i^{2a}	
1	$\hat{\beta}_0$	5,0e-03	(0,39)	3,4e-03	(0,30)	-1,2e-02	(-1,10)
$\mu_{i,intra}^{c2c}$	$\hat{\beta}_1$	-9,8e-05	(-0,71)	1,5e-04	(1,22)	6,5e-05	(0,54)
$M_{i,betw}^{cc}$	$\hat{\beta}_2$	2,9e-05	(3,60)*	2,9e-04	(4,05)*	2,7e-04	(3,90)*
$M_{i,intra}^{cv}$	$\hat{\beta}_3$	4,7e-05	(0,78)	-4,9e-05	(-0,93)	8,6e-05	(1,64)
$M_{i,betw}^{cv}$	$\hat{\beta}_4$	-3,7e-04	(-1,46)	-5,1e-04	(-2,31)*	-3,4e-04	(-1,55)
$M_{i,ext}$	$\hat{\beta}_5$	-1,4e-04	(-2,31)*	-5,9e-06	(-0,11)	-8,2e-05	(-1,59)
ν_i	$\hat{\beta}_6$	2,8e-05	(0,29)	1,6e-04	(1,86)	-1,9e-05	(-0,23)
A_i	$\hat{\beta}_7$	-5,4e-04	(-3,20)*	-6,8e-04	(-4,61)*	3,9e-05	(0,27)
R^2		0,415		0,637		0,435	

t-values in parentheses. * significant for 5% significance level. Source: Kauffmann (2010a).

Among the control variables, interregional rural-urban/ urban-rural migration and external migration point for all three regressions uniformly negative estimates, although not always significant. This could e.g. be due to the fact that the immigration flows mainly lead into smaller cities or are more frequently registered in smaller units, while migration into the big cities – especially in the capital city of Moscow – frequently remains unregistered.²² Natural population growth is not significantly correlated with the change in concentration of the urban population. ATCh are negative when urban units (usually urban-type settlements) disappear out of the stock. This is by far the most common case. Each of them increases the concentration. Therefore, the expected sign of $\hat{\beta}_7$ is negative, if only the urban population is considered. In the case of ΔC_i^{2a} as the independent variable, this is not true. Here, changes to the numerator and denominator size don't matter at all if small units change their status from ural to rural settlements. Accordingly, here the null hypothesis can not be rejected.

²¹ A more comprehensive study of the intra-regional migration flows in Russia as already asked by Andrienko/Guriev (2004) remains an open topic of research until now.

²² According to Rybakovskii / Ryazantsev (2005) there are nine illegal to any registered temporary migrants from the CIS who do not appear in any statistics (p. 4).

Thus, the contribution of migration flows particularly between cities (including urban settlements) to changes in concentration of urban population has been confirmed empirically, at least for flows between different FS.

6. Conclusions

NEG models that can explain the emergence of core-periphery structures by pure economic forces differ regarding their assumptions to model monopolistic competition in the market of goods. Particularly, the properties of the utility function that displays “love for variety” significantly influences the outcomes of NEG models. In Kauffmann (2010b) rising costs of freight transportation result in reduced supply of goods in the peripheral regions, simultaneously, competitive pressure to the firms located in the more central regions is reduced. The mobile workforce increasingly moves into these cities. In Russia, in the wake of price liberalization at the beginning of the transition period, the costs of transporting goods have risen sharply. At the end, this should lead to stronger concentration of the urban population in the large central cities.

With respect to these predictions, the population development of Russian cities (including urban settlements) was analysed, together with other relevant data from population statistics and geographical data. In the preparation phase of the data, the distortions caused by manipulations in the Russian statistics aimed to the redistribution of the inhabitants of “closed cities” (ZATO) were largely eliminated.

The results of the regression calculations seem to confirm the model predictions:

1. Since the collapse of the planned economy system, the population of the peripheral cities, especially the Far North and the Far East and Eastern Siberia decreases, while the centers in European Russia grow.
2. Smaller cities shrink more than larger cities (also in European Russia with the exception of the North Caucasus).
3. The regional centers and their satellites grow faster than the small cities located in their more peripheral hinterland.
4. Although the intensity of internal migration in Russia has been relatively weak in the period of consideration, the impact of internal migration is significantly visible.

The first part of this finding is already well known and has been studied in the literature. It is obvious that for the flight from the most inhospitable regions of Russia, especially the harsh climate may play a role. More interestingly appear the points 2 to 4: The trend towards divergence has implications for land use planning both in smaller and in larger cities. With regard to the smaller settlements of urban type this trend would more clearly come to light if not among these units a relatively large part of them fell out due to their conversion to rural settlements. For urban settlements (pgt) which did not tread the path of urban development, this is a reasonable option. On the other hand, the growth of large urban areas is associated with the growth of congestion and other urban costs that need to be kept low, to avoid that the advantages of large urban areas – particularly as centers of innovation – are at stake.²³

The stronger growth of satellite towns and the incorporation of suburbs, as well, are signs of suburbanisation in the Russian system of cities. With regard to the predictions of TTZ

²³ See World Bank (2011) ch. 4.

(2005) for the case of increasing costs of freight transportation, it must be considered that for special transportation services in Russia a decrease in costs of overcoming distance has already taken place. The improved transport options, which were created by the market economy allowing operating carriers to compete with state-monopoly companies also in cargo traffic, can be interpreted as a reduction of transport costs, particularly in supplying goods to suburbs.

The observed coherence of concentration of and migration flows between cities of different FS (which are generally over greater distances than migration flows within the FS) should serve as an opportunity to discuss the often as too low perceived mobility of Russians²⁴ more relaxed. Given the difficulties in coordinating the housing and labor markets, the effects of partial measures to increase spatial mobility on the economic performance of the country are limited. Instead, it is possible to overcome regional disparities in the medium term even with relatively low mobility.²⁵

The effects of falling transport costs were not considered in Kauffmann (2010a, b). However, this option can (and should) get relevance for Russia in the near future. For the case of three regions, Ago et al. (2006) in a similar approach show that a fall in transport costs only initially gives incentive to mobile workers to leave the central city, but if costs of freight transportation fall below the initial level, mobile workers completely move to the centre. Thus, from the perspective of the NEG, a fall in transportation costs in Russia – as a result e.g. of the modernization of roads – does not induce a return of mobile workers to remote areas. Rather, it promotes the development of agglomerations that are competitive in a world scale.

In the medium term, the improvement of transportation conditions should be an important goal for regional as well as for structural policies of the Russian state. To get access to the natural resources of Siberia and the Far East by sending only a minimum of human labour to unfavorable climatic regions, transportation routes are required on which large quantities of raw materials may be moved unprocessed. On the other hand, to reduce congestion costs and keep them low in large cities deserves a top priority.

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²⁴ See e.g. World Bank (2011) ch. 2, and Andrienko/Guriev (2004, 2005) as well.

²⁵ In their recent analysis, Guriev/Vakulenko (2013) conclude, that migration in Russia increased in the end of the 2000s. According to Heleniak (2012) tendency for migration in Russia is not substantially lower than in other developed countries. Some differences are due to peculiarities of statistical recording of migration in Russia.

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Appendix:

Abbreviations of federal subjects (FS) of Russia

Belgorodskaya oblast'	BEL	Nizhegorodskaya oblast'	NIZ
Bryanskaya oblast'	BRY	Orenburgskaya oblast'	ORE
g. Moskva	GMO	Penzenskaya oblast'	PEN
Ivanovskaya oblast'	IVA	Permskaya oblast'	PER
Yaroslavskaya oblast'	YAR	containing:	
Kaluzhskaya oblast'	KAL	Komi-Permyatskiy A. Okr.	KOP
Kostromskaya oblast'	KOS	Samarskaya oblast'	SAM
Kurskaya oblast'	KUR	Saratovskaya oblast'	SAR
Lipetskaya oblast'	LIP	Resp. Tatarstan	TAT
Moskovskaya oblast'	MOS	Udmurtskaya Resp.	UDM
Orlovskaya oblast'	ORY	Ulyanovskaya oblast'	ULY
Ryazanskaya oblast'	RYA	Chelyabinskaya oblast'	CHK
Smolenskaya oblast'	SMO	Kurganskaya oblast'	KUN
Tambovskaya oblast'	TAM	Sverdlovskaya oblast'	SVE
Tul'skaya oblast'	TUL	Tyumenskaya oblast'	TYU
Tverskaya oblast'	TVE	containing:	
Vladimirskaia oblast'	VLA	Khanty-Mansiiskii (Yugra) A. Okr.	KHM
Voronezhskaya oblast'	VOR	Yamalo-Nenetskii A. Okr.	YAN
Arkhangel'skaya oblast'	ARK	Resp. Altai	ALT
containing:		Altaiiskii Krai	ALK
Nenetskiy A. Okr.	NEN	Resp. Buryatiya	BUR
g. Sankt-Peterburg	GSP	Resp. Khakasiya	KHA
Kaliningradskaya oblast'	KAG	Chitinskaya oblast'	CHI
Resp. Kareliya	KAR	containing:	
Resp. Komi	KOM	Aginskii Buryatskii A. Okr.	ABU
Leningradskaya oblast'	LEN	Irkutskaya oblast'	IRK
Murmanskaya oblast'	MUR	containing:	
Novgorodskaya oblast'	NOV	Ust'-Ordynskii Buryatskii A. Okr.	UOR
Pskovskaya oblast'	PSK	Kemerovskaya oblast'	KEM
Vologodskaya oblast'	VOL	Krasnoyarskii Krai	KRY
Resp. Adygeya	ADY	containing:	
Astrakhanskaya oblast'	AST	Taimyrskii (Dolgano-Nenetskii) A. Okr.	TAI
Chechenskaya Resp.	CHE	Ewenkiiskii A. Okr.	EWE
Resp. Dagestan	DAG	Novosibirskaya oblast'	NSI
Resp. Ingushetiya	ING	Omskaya oblast'	OMS
Kabardino-Balkarskaya Resp.	KAB	Tomskaya oblast'	TOM
Resp. Kalmykiya	KAY	Resp. Tyva	TYV
Karachaevo-Cherkesskaya Resp.	KCH	Amurskaya oblast'	AMU
Krasnodarskii Krai	KRA	Khabarovskii Krai	CHA
Rostovskaya oblast'	ROS	Chukotskii Avtonomnyi Okrug	CHU
Resp. Severnaya Osetiya-Alaniya	SEV	Evreiskaya avtonomnaya oblast'	EVR
Stavropol'skii Krai	STA	Kamchatskaya oblast'	KAM
Volgogradskaya oblast'	VOG	containing:	
Resp. Bashkortostan	BAS	Koryakskii A. Okr.	KOR
Chuvashskaya Resp.	CHV	Magadanskaya oblast'	MAG
Kirovskaya oblast'	KIR	Primorskii Krai	PRI
Resp. Marii El	MAR	Resp. Sakha (Yakutiya)	SAA
Resp. Mordoviya	MOR	Sakhalinskaya oblast'	SAN

Abbreviations:

- g. gorod (city)
A. Okr. Avtonomicheskii Okrug (autonomous district)
Resp. Respublika (republic)