Spatial Development of Russia: Does Geography Matter?[1]

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We study the dynamics of inter-regional economic disparities for a number of development characteristics, test the hypothesis of the new economic geography and connect the results with the prediction of the bell curve describing spatial concentration over time. Empirical analysis shows that the spatial concentration of economic activity continues in Russia and that the rate of inter-regional divergence is rather high. The factors that affect spatial concentration and regional disparities in Russia are population density, size and accessibility of markets, as well as the level of diversification.

Key words: regional disparities, economic geography, empirical estimates

1. Introduction

The problem of high and increasing regional disparities was a focus of the Russian political agenda at the beginning of the transition period, when regional polarization combined with the transformational decline and weak position of the federal center resulted in the development of strong regional separatism. The changes in economic dynamics, the general macroeconomic stabilization and the strengthening of federal power have mitigated the political aspects of this problem.

However, uneven spatial development in Russia remains a serious problem, causing enormous inter-budgetary redistributions aimed at mitigating regional differences. In recent years, the government has outlined several approaches to the regional policy, all of which have proposed different support schemes for lagging regions, but none of these schemes have succeeded. These failures pose a question about the mechanisms of the spatial development of economic activity and the steps that governments can take to achieve more balanced development.

The evolution of regional disparities in the Russian Federation has received significant attention in the academic literature. Gluschenko (2010) provides a detailed review of 31 papers devoted to interregional inequalities in Russia. A significant portion of these studies analyze σ-convergence, estimating conditional and unconditional β-convergence regressions to test the predictions of the Solow model. Several studies apply the transition probability matrix proposed by Quah (1997) to diagnose polarization. Other studies (Berkowitz and DeJong 2002, 2003, 2005; Berkowitz and Jackson 2006; Ahrend 2005) based on casual cross-sectional analysis aim to explain interregional differences as a consequence of initial conditions, entrepreneurial climate, and economic and institutional reforms. The authors use data on the regional value-added (gross regional product), personal incomes and manufacturing output. The conclusions of the reviewed studies differ depending on the observed period and the research design, such as the type of data and econometric techniques used and model specifications.

The present paper contributes to the study of spatial development in Russia. Despite the vast literature on the regional disparities in the country, we have not seen any empirical study devoted to testing the new economic geography theories on the case of Russian regional divergence. New economic geography explains the spatial distribution of firms and jobs, attributing important roles to: 1) the cost of trade (Helpman and Krugman 1985); 2) the mobility and cost of production factors (Fujita et al. 1999), 3) market size and access to markets (Krugman 1980; Head et al. 2002); 4)

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competition within and structure of the local market (Fujita and Thisse 2002); and 5) quality and size of labor market (Tabuchi and Thisse 2002).

One of the fundamental outcomes of economic geography models is the prediction of a long wave or bell-shaped curve in the evolution of the spatial concentration of economic activity (Combes et al. 2008). High transport costs force producers to locate closer to resources and local markets. At the first stage of economic development, falling trade costs cause spatial agglomeration as proximity to resources becomes less important. Economies of scale, which provide a variety of inputs, skilled workers and growing demand for goods, make large markets more attractive. At the second stage, further agglomeration and the decrease in interaction costs result in spatial dispersion. The concentration of firms and workers is connected with urban costs, congestion, fierce competition, higher wages and growth of land rents. Low transport costs allow producers to benefit from relocating to the periphery (Figure 1). The rule is not universal for all sectors, however, and it works best for industries that are characterized by increasing returns. Firms with decreasing or constant returns (mostly agriculture) can be dispersed; sectors dealing with immobility (such as construction) follow the evolution of the immobile factors. A number of empirical studies based on long-run historical data confirm these relationships for different countries (Combes et al. 2011; Paluzie et al. 2004; Roses et al. 2010).

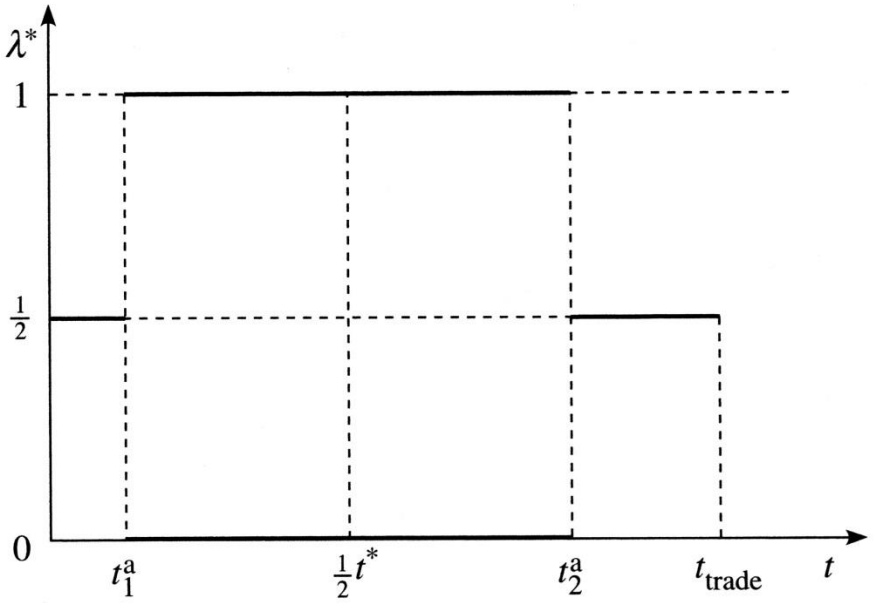

Figure 1. Configuration of a two-region economy; t – trade cost, λ – share of a region. Source: Combes et al. (2008)

The new economic geography considers uneven regional development to be a result of technological progress and economic development and treats the spatial evolution of business activity as an inherent market process. In this paper, we apply these ideas to the analysis of regional disparities in Russia. We first examine tendencies in the spatial concentration of economic activity at the aggregate level and for different sectors (Section 2). Then, we estimate the contribution of the various factors to the spatial distribution of the total production and determinants of the productivity level (Section 3). Finally, we present conclusions and practical interpretations.

2. Spatial dynamics

Data

We rely on official data from the Federal State Statistics Service of the Russian Federation. The variables of interest are regional production, employment and capital in the aggregate and by sector. We also use data on territory size, population, number of firms, and interregional distances. The data have a panel structure with 77 regions (several regions were excluded due to omitted values for some periods

and variables). Data for the aggregated variables cover 1995 – 2011, and data for the sectorial variables cover 1998 – 2011.

New economic geography emphasizes the importance of trade costs and the profound influence of transport and communication infrastructure on the spatial shape of economic activity. To test the ideas of economic geography, it is reasonable to make a distinction between the western and eastern parts of Russia. The western regions are smaller, have a higher density of population and a more developed infrastructure. In contrast, most of the eastern regions are vast and have poor infrastructure. The Theil index allows us to decompose the interregional disparities in Russia into the inequality within and between these two macro-regions. The list of the western and eastern regions of Russia is presented in Appendix 1.

An additional reason to distinguish between the two parts of the country is that some studies postulate the spatial distribution of production in Russia as being irrational, the result of socialist centralized planning, restrictions on migration and the gulag system. These arguments lead to two conclusions: first, the "overpopulating" of the northern and eastern regions of Russia, and second, the artificially low population and production in the western part of the country (Hill, Gaddy, 2003). Statements on the irrationality of location in the Soviet period suggest a strengthening of inter-regional migration in the transition period and a growing divergence between the western and eastern macro-regions.

All data sources are open, and we present the summary statistics for the variables only in the Appendix 2. The western regional population is decreasing, while its variance is increasing; however, the eastern region is characterized by a reduction in variation among geographical units. In other words, the rate of population decline in the western regions is higher in its smaller regions, whereas in the East, large regions experience more intensive population loss; in addition, the spatial population concentration is primarily a feature of western Russia. Population is a source of labor; however, the spatial distribution of employment differs to some extent from the spatial distribution of the population. The average figure for total Russian employment and total employment for the western regions is increasing, while the median is decreasing, which can be explained by the rapid concentration of employment in the limited number of large regions, particularly Moscow and St. Petersburg. In eastern Russia, the average and median employment figures are fairly stable. The variance is growing everywhere. This phenomenon prompts us to conclude that although we observe spatial divergence of employment overall, its internal structure differs from West to East. The concentration of employment occurs more rapidly in the western regions.

The average and median number of firms, value-added and productivity are growing simultaneously with increasing variance over the analyzed period. These statistics also support the idea of dynamic spatial concentration and the growth of interregional differences in Russia. Quantitative estimates of spatial concentration are presented below.

Measures of spatial concentration

We use the Theil index to analyze the spatial distribution of economic activity. One of the appealing properties of this indicator of concentration is its ability to divide the whole inequality into different contributors and groups, which allows us to consider two geographical levels: macro-regions and regions (subjects of the Federation).

The Theil index is defined as follows:

$$T = \sum_{r=1}^{R} \left(\frac{Y_r}{Y} ln \frac{Y_r}{Y/R} \right).$$

Where

$$Y = \sum_{r=1}^{R} Y_r.$$

Y_r is the value of a variable in region r, Y is an aggregate level of the variable, and R is the number of regions. The Theil index varies between 0 and lnR. The extreme values conform to absolute interregional equality ($Y_r=Y/R$) and the corresponding concentration of all activity in one region. The higher the Theil index, the higher the spatial disparities.

The Theil index's property of separability means the decomposition of the inequality into a degree of the difference between the macro-regions and a degree of the difference within each of them:

$$T = T_{between} + T_{within},$$

$$T_{between} = \sum_{m=1}^{M} \frac{Y_m}{Y} ln \frac{Y_m/R_m}{Y/R}.$$

Where Y_m is the value of variable in macro-region m, R_m is the number of regions in macro-region m, and $Y_m = \sum_{r=1}^{R_m} Y_r$.

$$T_{within} = \sum_{m=1}^{M} \frac{Y_m}{Y} T_m.$$

Where T_m is the Theil index for macro-region m only:

$$T_m = \sum_{r=1}^{R_m} \frac{Y_r}{Y_m} ln \frac{Y_r}{Y_m/R_m}.$$

Aggregate gross regional product and productivity

We analyze trends in the spatial concentration of economic activity in Russia for the period 1995 – 2011. The geographical units of the analysis are two macro-regions and 77 regions. The first macro-region includes 53 western regions of Russia, and the second includes 24 eastern regions. Table 1 presents the Theil indices obtained for the aggregated data for population, employment, number of firms, value-added and productivity.

Table 1. The Theil indices.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Population																	
T	0.280	0.265	0.266	0.267	0.268	0.298	0.302	0.305	0.307	0.309	0.312	0.314	0.315	0.318	0.320	0.337	0.341
T_w	0.276	0.261	0.262	0.263	0.264	0.293	0.297	0.300	0.302	0.304	0.306	0.308	0.310	0.312	0.314	0.330	0.334
T_b	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.007	0.007
Employment																	
T	0.305	0.308	0.315	0.324	0.320	0.325	0.329	0.333	0.340	0.343	0.345	0.347	0.351	0.357	0.353	0.354	0.359
T_w	0.301	0.305	0.312	0.320	0.315	0.319	0.324	0.328	0.334	0.338	0.340	0.342	0.346	0.352	0.348	0.349	0.354
T_b	0.004	0.003	0.004	0.004	0.005	0.006	0.005	0.006	0.005	0.005	0.005	0.005	0.006	0.006	0.005	0.005	0.005
Number of firms																	
T	0.542	0.588	0.633	0.671	0.698	0.726	0.754	0.779	0.809	0.844	0.873	0.821	0.843	0.820	0.833	0.846	0.881
T_w	0.533	0.576	0.619	0.655	0.681	0.707	0.735	0.759	0.787	0.822	0.851	0.801	0.824	0.804	0.816	0.829	0.863
T_b	0.009	0.011	0.014	0.016	0.017	0.018	0.019	0.020	0.021	0.022	0.022	0.020	0.019	0.016	0.017	0.017	0/818
Gross regional product (value-added)																	
T	0.462	0.565	0.607	0.623	0.657	0.778	0.755	0.774	0.784	0.809	0.918	0.918	0.914	0.912	0.835	0.845	0.845
T_w	0.460	0.561	0.605	0.623	0.657	0.778	0.755	0.774	0.784	0.809	0.918	0.918	0.914	0.910	0.834	0.844	0.844
T_b	0.003	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.001	0.001	0.001
Gross regional product (value-added) per capita																	
T	0.111	0.144	0.148	0.150	0.168	0.188	0.187	0.186	0.193	0.193	0.219	0.206	0.200	0.194	0.211	0.202	0.197
T_w	0.093	0.121	0.126	0.132	0.153	0.170	0.162	0.161	0.167	0.171	0.198	0.185	0.181	0.178	0.184	0.173	0.170
T_b	0.018	0.024	0.022	0.018	0.015	0.018	0.024	0.025	0.026	0.022	0.022	0.021	0.019	0.016	0.027	0.025	0.027
Gross regional product (value-added) per employee																	
T	0.082	0.096	0.097	0.101	0.122	0.138	0.130	0.128	0.129	0.135	0.159	0.149	0.143	0.133	0.137	0.141	0.140
T_w	0.068	0.078	0.080	0.086	0.108	0.123	0.112	0.109	0.111	0.120	0.143	0.134	0.129	0.123	0.120	0.123	0.123
T_b	0.014	0.018	0.018	0.015	0.014	0.015	0.018	0.019	0.018	0.015	0.016	0.015	0.014	0.010	0.017	0.018	0.017

The figures reveal a tendency towards increases in the spatial concentration of economic activity and a growing divergence in productivity among Russian regions in the observed period. Between 1995 and 2011, the total Theil index for population rises by 22%, for employment, by 18%, and for number of firms, by 63%. Over the course of 17 years (1995-2011), the total Theil index for gross regional product (value-added) increases by 83%, while the regional difference of productivity per capita rises by 77% and that of productivity per employee, by 71%. These figures show that Russia

experiences the spatial concentration of production and the most efficient sectors. Taking into account the rather short period of time, the revealed rate of divergence is very high.

Over the entire period and for all variables, spatial inequality is primarily due to interregional disparities. The difference between the western and the eastern regions does not contribute in a significant way; however, the difference is increasing for all indicators except gross regional product. The highest levels of the between-Theil indices are obtained for the productivity variables both per capita and per employee, the shares of which in the total Theil index range from 8% to 19%. It is worth mentioning that average productivity levels both per capita and per employee in the eastern part of Russia are significantly higher than those in the western part. The reason for this outcome is that a major share of firms extracting natural resources, including oil and gas, are located in the East. The variable for number of firms demonstrates the most rapid growth levels of the between-Theil index, however, suggesting that despite its lower average productivity, the western regions of Russia are progressively more attractive to business and population than the eastern regions.

We observe the largest values of the total Theil index for gross regional product and number of firms, which are approximately 0.88 in 2011; however, these values remain much lower than the maximum ln(77)=4.344. The spatial concentration of the labor force is less expressed. In 2011, the total Theil index for population is equal to 0.341, while employment is equal to 0.359. The average productivity of labor exhibits even less dispersion. The difference between the Theil index values for gross regional product per capita and per employee is rather large in 2011--the former is 0.197 and the latter is only 0.14--which means that the unoccupied population is concentrating in less productive regions. One explanation for this phenomenon may be the movement of retirees to Russia's west and south, where the climate is better.

The period from 1995-2011 was a time of radical transformation for the Russian economy and included internal financial and structural crises, macroeconomic stabilization and growth, and the recent global financial crisis. These events exerted different influences on the structure and rate of development of different sectors; the most obvious influence is the rapid growth of the service economy.

Value-added (gross regional product) and productivity of sectors

Table 2 illustrates that spatial concentration does not affect all sectors of the economy. The spatial distribution of employment in agriculture and construction is generally stable with little tendency to dispersion. The dynamics of the Theil index for value-added in agriculture is rather changeable; this finding is clearly due to agriculture's vulnerability from and dependence on climate conditions; however, there is no trend towards divergence in agricultural production. The Theil index for value-added of construction demonstrates a distinct decrease over the observed period, which indicates a more even spatial distribution of the sector's product. Compared to manufacturing and services, agriculture and construction use land-intensive technologies and are more sensitive to land price and tightness. These properties can determine the absence of spatial concentration in sectors.

In contrast to agriculture and construction, manufacturing and services are sectors where the spatial concentration of employment and value-added are observed. However, the evolution of interregional inequalities is not monotonic. An increase in concentration occurs at the beginning of the period, but by the end of the period, the trend is reversed.

Similarly to estimates for aggregated data, the difference between the western and eastern regions contributes little to the total divergence; this difference is more pronounced for employment in agriculture, which is understandable due to the less favorable climate conditions in the eastern regions. We also do not observe an increase of the Theil between-index for either sectorial employment or value-added; the only exception is services.

We expected to find the highest level of the Theil index for agriculture, in which climate and soil quality play a crucial role. In fact, the most striking interregional differences in employment are

observed in construction (this phenomenon is likely one of the reasons for the revealed de-concentration in the sector) and in value-added, in services. Levels of employment concentration are almost the same for manufacturing, agriculture and services in 1998 and change essentially due to different trends by 2011. Interregional disparities in the value-added of manufacturing and services are higher than the corresponding disparities in employment and grow more rapidly, which implies growing differences in labor productivity of these sectors.

Table 2. The Theil indices for employment and value-added of different sectors

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Employment in manufacturing														
T	0.319	0.317	0.309	0.309	0.308	0.314	0.325	0.341	0.343	0.343	0.341	0.331	0.324	0.324
T_w	0.316	0.314	0.306	0.307	0.305	0.312	0.323	0.338	0.340	0.340	0.338	0.328	0.322	0.322
T_b	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.002	0.002	0.002
Employment in agriculture														
T	0.314	0.311	0.315	0.320	0.321	0.317	0.321	0.280	0.278	0.276	0.284	0.287	0.291	0.299
T_w	0.298	0.294	0.300	0.303	0.304	0.302	0.305	0.268	0.266	0.264	0.272	0.274	0.278	0.287
T_b	0.016	0.017	0.015	0.017	0.017	0.015	0.016	0.012	0.012	0.012	0.012	0.013	0.012	0.012
Employment in construction														
T	0.543	0.588	0.584	0.585	0.562	0.573	0.577	0.558	0.544	0.539	0.544	0.533	0.550	0.551
T_w	0.536	0.582	0.575	0.574	0.552	0.563	0.567	0.547	0.535	0.531	0.537	0.527	0.542	0.543
T_b	0.006	0.007	0.009	0.010	0.010	0.010	0.010	0.010	0.009	0.008	0.007	0.007	0.009	0.008
Employment in services														
T	0.361	0.364	0.365	0.364	0.369	0.372	0.386	0.394	0.394	0.399	0.406	0.404	0.405	0.413
T_w	0.358	0.360	0.362	0.360	0.365	0.368	0.381	0.390	0.389	0.393	0.400	0.398	0.400	0.408
T_b	0.003	0.003	0.004	0.003	0.004	0.004	0.005	0.005	0.005	0.006	0.006	0.006	0.005	0.005
Value-added of manufacturing														
T	0.558	0.605	0.704	0.682	0.693	0.710	0.749	0.916	0.902	0.890	0.850	0.844	0.795	0.810
T_w	0.543	0.589	0.671	0.651	0.665	0.683	0.722	0.883	0.874	0.876	0.839	0.831	0.776	0.793
T_b	0.015	0.016	0.033	0.031	0.028	0.027	0.028	0.033	0.028	0.014	0.010	0.012	0.019	0.017
Value-added of agriculture														
T	0.301	0.324	0.340	0.345	0.328	0.335	0.367	0.280	0.285	0.314	0.348	0.315	0.315	0.332
T_w	0.300	0.317	0.334	0.340	0.323	0.330	0.361	0.279	0.284	0.313	0.345	0.314	0.315	0.328
T_b	0.001	0.008	0.006	0.005	0.005	0.006	0.007	0.001	0.000	0.001	0.003	0.001	0.000	0.004
Value-added of construction														
T	0.772	0.824	0.850	0.836	0.830	0.807	0.707	0.735	0.699	0.693	0.683	0.637	0.627	0.565
T_w	0.771	0.823	0.848	0.823	0.820	0.804	0.707	0.734	0.698	0.693	0.683	0.637	0.627	0.564
T_b	0.001	0.001	0.002	0.013	0.009	0.003	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001
Value-added of services														
T	0.779	0.895	1.117	1.053	1.039	1.036	1.082	1.204	1.200	1.171	1.198	1.054	1.113	0.832
T_w	0.778	0.890	1.105	1.043	1.029	1.028	1.076	1.193	1.187	1.157	1.177	1.038	1.095	0.832
T_b	0.002	0.005	0.012	0.009	0.010	0.008	0.006	0.011	0.013	0.014	0.021	0.016	0.018	0.000

The analysis of spatial differences in value-added per employee of these sectors (Table 3) confirms our suggestions. The total Theil index for manufacturing and services is increasing, while agriculture and construction is decreasing. The spatial concentration is combined with the growth of differences in labor productivity, whereas de-concentration is combined with a reduction of interregional disparities in the productivity.

Table 3. The Theil indices for value-added per employee of different sectors

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Value-added per employee in manufacturing														
T	0.220	0.276	0.344	0.271	0.273	0.270	0.314	0.336	0.324	0.348	0.323	0.339	0.357	0.368
T_w	0.186	0.243	0.302	0.231	0.236	0.241	0.290	0.308	0.299	0.324	0.305	0.309	0.308	0.319
T_b	0.034	0.033	0.041	0.040	0.036	0.029	0.024	0.028	0.025	0.024	0.019	0.030	0.049	0.049
Value-added per employee in agriculture														
T	0.175	0.109	0.091	0.088	0.085	0.081	0.069	0.153	0.163	0.179	0.143	0.166	0.178	0.136
T_w	0.160	0.107	0.088	0.081	0.079	0.073	0.064	0.144	0.155	0.165	0.134	0.152	0.152	0.126
T_b	0.015	0.001	0.003	0.007	0.005	0.008	0.005	0.009	0.009	0.014	0.008	0.014	0.026	0.010
Value-added per employee in construction														
T	0.151	0.364	0.230	0.218	0.194	0.151	0.150	0.177	0.202	0.130	0.128	0.159	0.152	0.145
T_w	0.128	0.337	0.226	0.196	0.173	0.134	0.140	0.170	0.194	0.128	0.125	0.155	0.140	0.131
T_b	0.024	0.027	0.004	0.022	0.020	0.017	0.010	0.006	0.008	0.001	0.003	0.004	0.012	0.014
Value-added per employee in services														
T	0.075	0.092	0.096	0.092	0.084	0.087	0.104	0.117	0.107	0.101	0.090	0.073	0.085	0.194
T_w	0.073	0.089	0.095	0.091	0.082	0.084	0.099	0.113	0.104	0.098	0.089	0.071	0.081	0.172
T_b	0.002	0.003	0.001	0.001	0.002	0.003	0.005	0.003	0.003	0.003	0.001	0.002	0.004	0.022

The contribution of differences in the value-added per employee between the western and eastern parts of Russia is small and shrinking. The prediction that the transition to a market economy in Russia should be associated with growing differences between the two macro-regions is not confirmed.

3. Determinants of spatial concentration and productivity

New economic geography introduces spatial factors into development theory and emphasizes the importance of transport costs and market accessibility, increasing returns and market size, and agglomeration and density. Agglomeration-related effects may arise from better market access to final and intermediate goods, a broader supply of high-quality infrastructure, better matching between employers and employees, or the more rapid diffusion of information and innovation. Concentration and resource diversity offer opportunities for economies of scale. The advantages of the combination of factors of production, however, are accompanied with higher competition and a deficit of immobile resources. A result of the interaction of costs and benefits, agglomeration economies depend on the density and structure of a network of spatial links, and they differ across countries and regions. In this paper, we estimate the magnitude of agglomeration economies in Russia and their contribution to the evolution of the spatial concentration of economic activity.

To evaluate agglomeration effects, it is customary to regress value-added (Y_{rt}) or labor productivity (y_{rt}) on a density variable. In this paper, we use the population per unit of surface area ($DENS_{rt}$), where r - index of a region ($r=1,\ldots,R$) and t – index of a year ($t=1,\ldots,T$). Variable $DENS_{rt}$ captures the size of the local market and the intensity of interactions between market agents.

It is important to distinguish between the spatial concentration of general economic activity and the concentration of firms in the same sector. Industrial clusters provide opportunities to share specific infrastructure and establish networks that allow for the rapid exchange of information and diffusion of innovation; these gains stimulate spatial concentration. However, regional specialization also brings more intensive competition for specific inputs, labor and market share, and encourages dispersion. To estimate the effect of specialization, we introduce variable $SPEC_{srt}$, measured as the share of employees of sector s ($s=1,\ldots,S$) in the total employment of region r in year t.

Innovation is increasingly stimulated by interactions between different sectors, rather than between firms of the same industry. The concentration of firms of different industries has advantages in terms of the creation and introduction of new ideas and technologies, providing impetus to the dynamics of development and productivity growth. A diversified regional economy is also more resistant to external shocks. Sectorial diversity can be captured by the Herfindhal index H_{rt}, calculated as the sum of squares of each sector's share in a regional economy:

$$H_{rt} = \sum_{s=1}^{S} SPEC_{srt}^2$$

The new economic geography regards transport costs and proximity to markets as critical factors in shaping a spatial economy. To assess accessibility and the capacity of regional markets, the literature proposes the variable market potential; the market potential of region r in year t (MP_{rt}) is defined as the sum of the regional value-added weighed by the inverse of distance to region r.

$$MP_{rt} = \sum_{s \neq r} \frac{Y_{st}}{dist_{rs}}$$

In this paper, distance from region r to region s ($dist_{rs}$) is defined as the shortest distance between the regional centers by highway. AvtoTransInfo is the information source for highway mileage.

The panel structure of the data allows us to introduce regional and time-fixed effects; the former captures all region-specific variables that affect a region in the same way irrespective of time, while the latter reflects temporal variation affecting all regions and all sectors equally. Time-fixed effects

are less arbitrary than choosing a time trend or specific deflator. The regional and time-fixed effects solve, to some extent, the problem of omitted variables.

Spatial concentration

The basic idea of the econometric estimates is to expand the production function $Y = AF(K, L)$ to include the economic geography variables $Y = AF(K, L, DENS, H, MP)$, where A is total factor productivity, K is stock of private capital, and L is employment

Using the log-linear Cobb-Douglas form gives the following empirical model:

$$lnY_{rt} = lnA + a \cdot lnK_{rt} + b \cdot lnL_{rt} + c \cdot lnDENS_{rt} + d \cdot lnH_{rt} + e \cdot lnMP_{rt} + \mu_r + \lambda_t + \varepsilon_{rt},$$
$$\varepsilon_{rt} \sim N(0, \sigma^2 I)$$

Here, μ_r are the fixed regional effects and λ_t are the fixed time effects.

One of the key concepts of the new economic geography is the endogenous nature of the forces shaping the economy's spatial structure. At least two explanatory variables are likely to be endogenous in the regression, as they depend on economic activity: population density ($DENS_{rt}$) and market potential (MP_{rt}). To manage the endogeneity issue, we apply the instrumental variables method. One of the advantages of panel data is the opportunity to use lagged values of variables as instruments. Lags do not correlate with errors but are correlated with instrumented variables due to the high degree of inertia in economic processes.

Table 4 presents the results of the estimates for the whole set of the regions, for the western part and for the eastern part correspondingly.

Table 4. Total value-added.

Variable	All regions	Western regions	Eastern regions
Capital	0.131*** (0.028)	0.070* (0.042)	0.187*** (0.039)
Employment	0.962*** (0.137)	0.972*** (0.164)	1.155*** (0.327)
Population density	0.477*** (0.107)	0.465*** (0.114)	0.655* (0.349)
Herfindhal index	0.286*** (0.075)	0.299*** (0.088)	0.151 (0.195)
Market potential	3.229*** (0.783)	3.578*** (0.929)	12.284*** (4.773)
Number of observations	924	636	288
Number of regions	77	53	24
R^2_{within}	0.979	0.980	0.980

The tested economic geography variables are significant and have a positive effect on value-added. The elasticity of total production with respect to population density is 0.477; a 1% increase in density would raise total production by 0.48%. As expected, the elasticity of production with respect to density is higher in the eastern region. The East is under-populated, and accordingly, density has a higher marginal effect in the East.

The volume of the value-added is highly responsive to the market size and access to markets. Employment, together with population density, is also a proxy for the market size and is a positive and significant factor; the elasticity coefficient for the set of regions is 0.96 and, importantly, is higher for the eastern regions. The market potential, which reflects the accessibility of the external regional markets, is very important; the elasticity is equal to 3.23 for the entire country and to 3.58 and 12.28 for the western and eastern regions, respectively. Once again, the eastern regions react more strongly to improvements in market conditions.

A diversified (specialized) economy demonstrates disadvantages (advantages) in the western part of country; the Herfindhal index is not significant in the eastern regions. A probable explanation is that in a period when the prices of minerals and natural resources are growing (the observed years 1998-2008 are characterized by increasing prices for resources), a resource-oriented economy is less sensitive to diversification (specialization).

The new economic geography predicts different types of spatial evolution for different sectors. We have data on and can run regressions for four sectors: manufacturing, agriculture, construction and services. They differ in the rate of growth, dependence on local markets, immobile factors and sensitivity to transport costs, and they each demonstrate different reactions to the agglomeration economy. We run separate regressions for each sector; the specification of the regression is as follows:

$$lnY_{srt} = lnA_s + a \cdot lnK_{srt} + b \cdot lnL_{srt} + c \cdot lnDENS_{rt} + d \cdot lnH_{rt} + e \cdot lnSPEC_{srt} + \\ + f \cdot lnMP_{rt} + \mu_r + \lambda_t + \varepsilon_{srt},\ \varepsilon_{srt} \sim N(0, \sigma^2 I)$$

Here, index s stands for a sector. We use the instrumental variables method, with the population density and market potential as the instrumented, and the lagged values of the variables as the instruments. The estimates for the sectors' value-added are presented in Table 5.

Table 5. Value-added in different sectors

Variable	Manufacturing	Agriculture	Construction	Services
Capital	0.263***	-0.122***	-0.035	-0.013
	(0.033)	(0.018)	(0.023)	(0.025)
Employment	0.930***	1.420***	0.983***	0.808***
	(0.239)	(0.358)	(0.328)	(0.136)
Population density	1.124***	-1.762***	0.960***	0.471***
	(0.188)	(0.287)	(0.260)	(0.107)
Herfindhal index	0.266**	0.079	0.284	0.188
	(0.132)	(0.198)	(0.181)	(0.179)
Specialization	-0.335	-0.497	-0.726**	-0.787**
	(0.249)	(0.357)	(0.338)	(0.314)
Market potential	4.665***	-4.542**	0.774	4.229***
	(1.375)	(2.057)	(1.892)	(0.785)
Number of observations	924	924	924	924
Number of regions	77	77	77	77
R^2_{within}	0.939	0.866	0.898	0.980

The population density is a significant factor for all sectors of the economy, but the signs change: density has a positive effect in manufacturing, construction and services, and a negative effect in agriculture. These results correspond to the theoretical predictions: agriculture requires a large area and is mostly based on extensive factors of development.

Market potential, which captures access to neighboring regions, plays a positive role in manufacturing and services (the latter includes transport and communications). Both manufacturing and services benefit from the proximity of large regional markets. Construction is oriented to local demand, but market potential has no significant influence on this sector. The elasticity of market potential in agriculture is statistically significant and negative; this result is surprising, although it may be due to the degradation of agriculture, which has a weak competitive position vis a vis large proximate economies in comparison with other sectors.

Localization benefits manufacturing only; for all other sectors, diversity has no significant influence. Specialization is insignificant for manufacturing and agriculture and is negative for construction and services. Competition forces associated with specialization dominate the advantages of intra-sectorial cooperation.

There is a sense along with the determinant of the total production to analyze the factors of labor productivity.

Labor productivity

In the first stage, we estimate the regression of aggregate labor productivity ($y_{rt}=Y_{rt}/L_{rt}$) on the set of geographical variables, fixed regional and time effects, private capital per capita (to capture effect of capital intensive technologies) and education level (to separate the influence of the quality of human capital).

The specification of the estimated model is as follows:

$$lny_{rt} = lnA + a \cdot ln\frac{K_{rt}}{L_{rt}} + b \cdot lnDENS_{rt} + c \cdot lnH_{rt} + d \cdot lnMP_{rt} + \mu_r + +\lambda_t + \varepsilon_{rt},$$
$$\varepsilon_{rt} \sim N(0, \sigma^2 I)$$

To account for the endogeneity problem, we use lags as instruments for variables of population density and market potential. Table 6 presents results of the estimates for the entire sample of the regions.

Table 6. Aggregate value-added per employee.

Variable	All regions	Western regions	Eastern regions
Capital per employee	0.129*** (0.028)	0.069* (0.041)	0.188*** (0.039)
Population density	0.509*** (0.093)	0.477*** (0.101)	0.886*** (0.259)
Herfindhal index	0.251*** (0.054)	0.282*** (0.058)	0.106 (0.190)
Market potential	3.313*** (0.773)	3.627*** (0.907)	11.031** (4.594)
Number of observations	924	636	288
Number of regions	77	53	24
R^2_{within}	0.978	0.978	0.979

Labor productivity depends on population density (characterizing the demand of local markets) and the size of and access to external regional markets. The greater the market capacity, the greater the productivity. The elasticity of labor productivity with respect to density and market potential is slightly higher than the elasticity with respect to the total value-added. A specialized economy raises the total productivity, allowing for innovation and knowledge spillovers. The elasticity of the value-added per capita to the Herfindhal index is slightly lower than the elasticity of total production.

Differences between the macro-regions include first, lower positive marginal effects of density and market potential on productivity in the western regions, and second, insignificance of diversity in the eastern regions. Similar results are obtained for the absolute value-added.

To consider the specifics of the different sectors, we estimate the following regressions:

$$lny_{srt} = lnA_s + a \cdot ln\frac{K_{srt}}{L_{srt}} + b \cdot lnDENS_{rt} + c \cdot lnH_{rt} + d \cdot lnSPEC_{srt} +$$
$$+e \cdot lnMP_{rt} + \mu_r + \lambda_t + \varepsilon_{srt},\ \ \varepsilon_{srt} \sim N(0, \sigma^2 I)$$

The estimates of the labor productivity regressions give results (Table 7) that are fairly similar to the results for total production (Table 5). Population density is positive and significant for manufacturing, services and construction, but negative for agriculture. The results confirm the suggestion that agriculture is more productive when it is spread over large areas; however, other sectors gain efficiency advantages from agglomeration economies.

Access to external markets stimulates productivity growth in manufacturing and services: the former benefits from the expanded market, while the latter meets higher demand for transport and communication services. The variable for market potential is insignificant in construction due to the immobility of the sector's product and has a negative effect on productivity in agriculture.

Specialization is known to have contradictory effects: the scale economy is a positive effect, while a negative effect is more aggressive competition for input and output markets. The estimates show that negative effects are stronger for labor productivity in agriculture, construction and services; services and construction suffer more. Specialization is not statistically significant for productivity in manufacturing.

Table 7. Value-added per employee in different sectors

Variable	Manufacturing	Agriculture	Construction	Service
Capital per employee	0.261***	-0.123***	-0.035	-0.009
	(0.033)	(0.018)	(0.023)	(0.024)
Population density	1.191***	-1.658***	0.942***	0.401***
	(0.161)	(0.247)	(0.224)	(0.092)
Herfindhal index	0.194**	-0.042	0.305**	0.280*
	(0.098)	(0.140)	(0.129)	(0.168)
Specialization	-0.153	-0.206***	-0.778***	-1.011***
	(0.106)	(0.072)	(0.086)	(0.276)
Market potential	4.849***	-4.280**	0.728	4.036***
	(1.356)	(2.028)	(1.868)	(0.773)
Number of observations	924	924	924	924
Number of regions	77	77	77	77
R^2_{within}	0.940	0.867	0.892	0.978

4. Conclusion

The results of our analysis suggest that the concentration of economic activity continues in Russia and that the pace of the interregional divergence is rather high. These findings bring us to the conclusion that the country rests at the left side of the bell-shaped relationship between interaction costs and spatial distribution. Both the western and eastern regions experience centripetal tendencies; however, despite predictions, no essential redistribution of the production factors and outputs from the East to the West is revealed. In other words, first nature (the East's natural resources and raw materials, which are highly valued in the global market) is balanced by second nature (the West's better infrastructure and large markets).

The significant factors in spatial concentration and total productivity growth are density, the size of and access to markets and the specialization of the economy. Insensitivity to the diversification is specific to the eastern regions of Russia. There are also sectorial peculiarities: population density and proximity to markets negatively influences; due to the immobility of supply. external markets have no significant effect on construction. Due to fierce competition, sectorial specialization decreases both productivity and the rate of concentration. These results of the estimates are in accordance with the predictions of the new economic geography.

One of the practical ideas suggested by this analysis is the conclusion that in the near future, we will observe further concentration of economic activity and interregional divergence in Russia. The forces behind the agglomeration economy and regional disparities are market-based (increasing returns to scale and imperfect competition), and they are beginning to play a major role in the country in the transition and in the post-transition period. Despite the active regional policy and the massive redistribution efforts undertaken by the central government, regional disparities continue to grow.

The new economic geography theory describes the mechanisms of agglomeration and provides suggestions for the pro-dispersion forces to countervail centripetal tendencies. Translated into the language of the practical recommendations, they include essential improvement of transport and communication infrastructure, radical decreases in trade cost and the elimination of regional institutional barriers, as well as an active social policy supporting lagging regions.

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Appendix 1

Western regions of Russian Federation	Eastern regions of Russian Federation
1. Belgorodskaya oblast	1. Kurganskaya oblast
2. Bryanskaya oblast	2. Sverdlovskaya oblast
3. Vladimirskaya oblast	3. Tumenskaya oblast
4. Voronezhskaya oblast	4. Chelyabinskaya oblast
5. Ivanovskaya oblast	5. Republic Altaiy
6. Kaluzhskaya oblast	6. Republic Buryatiya
7. Kostromskaya oblast	7. Republic Tyva
8. Kurskaya oblast	8. Republic Khakasiya
9. Lipetskaya oblast	9. Altaiskiy kraiy
10. Moskovskaya oblast	10. Zabaikalskiy kraiy
11. Orlovskaya oblast	11. Krasnoyarskiy kraiy
12. Ryasanskaya oblast	12. Irkutskaya oblast
13. Smolenskaya oblast	13. Kemerovskaya oblast
14. Tambovskaya oblast	14. Novosibirskaya oblast
15. Tverskaya oblast	15. Omskaya oblast
16. Tulskaya oblast	16. Tomskaya oblast
17. Yaroslavskaya oblast	17. Republic Sakha (Yakutiya)
18. City Moscow	18. Kamchatskiy kraiy
19. Republic Kareliya	19. Primorskiy kraiy
20. Republic Komi	20. Khabarovskiiy kraiy
21. Arkhangelskaya oblast	21. Amurskaya oblast
22. Vologodskaya oblast	22. Magadanskaya oblast
23. Kaliningradskaya oblast	23. Sakhalinskaya oblast
24. Leningradskaya oblast	24. Evreiskaya Autonomous oblast
25. Murmanskaya oblast	
26. Novgorodskaya oblast	
27. Pskovskaya oblast	
28. City Sankt-Petersburg	
29. Republic Adygeya	
30. Republic Kalmikiya	
31. Krasnodarskiy kraiy	
32. Astrakhanskaya oblast	
33. Volgogradskaya oblast	
34. Rostovskaya oblast	
35. Republic Dagestan	
36. Kabardino-Balkarskaya Republic	
37. Karachaevo-Cherkesskaya Republic	
38. Republic Severnaya Osetiya	
39. Stavropolskiy kray	
40. Republic Bashkortostan	
41. Republic Mariy-El	
42. Republic Mordoviya	
43. Republic Tatarstan	
44. Udmurtskaya Republic	
45. Chuvashskaya Republic	
46. Permskiy kray	
47. Kirovskaya oblast	
48. Nizhegorodskaya oblast	
49. Orenburgskaya oblast	
50. Penzenskaya oblast	
51. Samarskaya oblast	
52. Saratovskaya oblast	
53. Ulyanovskaya oblast	

Appendix 2

	Mean	Median	Standard deviation	Minimum	Maximum
Population					
1995	1881.9	1395.5	1546.4	84.0	9247.0
1996	1882.8	1406.5	1489.2	97.0	8572.0
1997	1878.0	1402.0	1487.4	92.0	8547.0
1998	1873.1	1397.5	1486.2	87.0	8537.0
1999	1867.9	1393.5	1485.4	83.0	8538.0
2000	1857.2	1348.5	1602.1	57.0	10114.0
2001	1847.7	1335.0	1611.1	55.0	10270.0
2002	1840.8	1325.5	1617.6	54.0	10383.0
2003	1827.8	1311.5	1615.7	52.0	10391.0
2004	1818.6	1302.0	1615.4	51.0	10407.0
2005	1809.0	1291.5	1615.1	51.0	10425.0
2006	1801.8	1283.0	1616.6	50.0	10443.0
2007	1798.7	1277.0	1620.3	50.0	10470.0
2008	1796.9	1270.5	1626.3	50.0	10509.0
2009	1796.5	1266.0	1633.6	49.0	10563.0
2010	1810.6	1240.0	1723.1	51.0	11514.0
2011	1811.3	1230.0	1739.5	51.0	11613.0
Population. Western part					
1995	1998.8	1467.0	1650.9	315.0	9247.0
1996	1992.3	1467.0	1573.0	434.0	8572.0
1997	1988.6	1469.0	1571.1	434.0	8547.0
1998	1983.8	1460.0	1569.5	434.0	8537.0
1999	1978.9	1451.0	1568.7	433.0	8538.0
2000	1985.4	1394.0	1729.8	307.0	10114.0
2001	1977.0	1379.0	1743.9	298.0	10270.0
2002	1970.9	1367.0	1754.4	292.0	10383.0
2003	1957.0	1351.0	1754.4	291.0	10391.0
2004	1946.9	1339.0	1755.7	290.0	10407.0
2005	1936.5	1328.0	1757.1	289.0	10425.0
2006	1928.6	1317.0	1760.0	287.0	10443.0
2007	1924.9	1309.0	1765.2	286.0	10470.0
2008	1922.6	1300.0	1773.0	284.0	10509.0
2009	1921.7	1292.0	1782.3	283.0	10563.0
2010	1954.6	1272.0	1903.9	290.0	11514.0
2011	1955.7	1264.0	1924.1	287.0	11613.0
Population. Eastern part					
1995	1634.0	1090.0	1261.9	84.0	4660.0
1996	1650.6	1111.0	1262.8	97.0	4677.0
1997	1643.6	1106.0	1260.3	92.0	4660.0
1998	1638.4	1104.0	1260.4	87.0	4647.0
1999	1632.6	1102.0	1259.4	83.0	4631.0
2000	1585.4	1054.0	1247.3	57.0	4546.0
2001	1573.6	1050.0	1241.2	55.0	4514.0
2002	1565.2	1046.0	1236.0	54.0	4486.0
2003	1554.0	1041.0	1228.5	52.0	4448.0
2004	1546.6	1037.0	1223.8	51.0	4428.0
2005	1538.7	1034.0	1219.2	51.0	4410.0
2006	1533.2	1033.0	1216.8	50.0	4400.0
2007	1531.2	1035.0	1216.6	50.0	4396.0
2008	1530.4	1038.0	1217.8	50.0	4395.0
2009	1531.2	1043.0	1220.0	49.0	4394.0
2010	1505.2	1046.0	1200.5	51.0	4298.0
2011	1506.8	1058.0	1206.3	51.0	4307.0
Employment					
1995	849.8	614.9	757.7	45.7	5207.4

1996	820.2	592.7	738.0	45.0	5123.7
1997	805.5	573.9	737.4	40.7	5153.2
1998	786.7	566.0	736.9	35.2	5221.4
1999	819.4	600.2	760.3	33.8	5399.7
2000	827.9	610.6	782.2	32.7	5653.1
2001	832.2	606.4	792.0	34.1	5712.2
2002	839.8	608.5	807.0	32.3	5832.4
2003	845.1	605.1	825.6	34.2	5999.3
2004	850.6	600.7	836.9	36.0	6078.7
2005	855.5	602.8	846.6	38.5	6156.8
2006	860.4	604.8	856.0	37.3	6242.9
2007	868.3	607.5	873.4	37.7	6396.8
2008	874.0	606.7	893.6	37.9	6593.2
2009	860.8	588.7	869.9	36.9	6368.1
2010	861.9	581.7	872.7	35.9	6386.9
2011	863.4	583.3	882.5	34.2	6479.6
Employment. Western part					
1995	903.8	642.3	825.1	134.5	5207.4
1996	866.3	627.1	801.9	138.9	5123.7
1997	852.9	582.1	804.4	124.9	5153.2
1998	834.3	571.9	806.6	116.7	5221.4
1999	873.2	606.1	831.2	118.6	5399.7
2000	887.0	616.6	860.3	117.4	5653.1
2001	890.0	609.2	870.4	118.1	5712.2
2002	899.7	611.2	889.0	117.8	5832.4
2003	903.4	609.7	911.1	116.5	5999.3
2004	908.6	601.8	924.3	115.9	6078.7
2005	914.3	604.9	935.9	115.5	6156.8
2006	920.6	610.4	948.5	115.7	6242.9
2007	930.2	612.7	970.8	115.7	6396.8
2008	936.8	611.3	996.3	114.5	6593.2
2009	921.5	596.4	967.4	114.1	6368.1
2010	921.1	598.1	970.5	114.0	6386.9
2011	923.5	589.9	982.8	113.6	6479.6
Employment. Eastern part					
1995	735.1	495.4	573.3	45.7	2044.3
1996	722.5	481.6	567.6	45.0	2031.5
1997	705.0	468.3	556.6	40.7	1976.8
1998	685.7	445.6	547.7	35.2	1953.3
1999	705.2	458.9	565.5	33.8	2000.0
2000	702.6	459.7	562.8	32.7	1987.8
2001	709.6	462.6	573.5	34.1	2039.4
2002	712.8	469.4	576.8	32.3	2040.8
2003	721.4	470.4	586.9	34.2	2056.7
2004	727.6	471.4	593.3	36.0	2088.5
2005	730.8	478.9	597.0	38.5	2093.8
2006	732.7	483.3	595.4	37.3	2085.0
2007	737.1	490.1	597.3	37.7	2092.4
2008	740.7	493.5	600.5	37.9	2093.0
2009	732.1	490.9	593.7	36.9	2060.4
2010	736.3	490.1	597.1	35.9	2064.1
2011	736.1	487.5	598.8	34.2	2047.4
Number of firms					
1995	28789.7	16849	1051594	1126	2245598
1996	31954.0	17734.5	1167182	1216	2492409
1997	34776.5	18093.5	1270291	1283	2712567
1998	37023.9	18754.5	1352386	1349	2887865
1999	39644.3	20299	1448093	1478	3092252
2000	42728.6	21836.5	1560763	1564	3332833
2001	45898.5	23518.5	1676569	1607	3580085

2002	49122.4	24942	1794356	1603	3831545
2003	53032.9	26232.5	1937190	1778	4136566
2004	56441.9	26983.5	2061732	1822	4402471
2005	60922.6	27874	2225424	1881	4751963
2006	57599.2	28067	2104058	1639	4492737
2007	59750.0	28915	2182646	1610	4660497
2008	60983.4	29113.5	2227741	1480	4756703
2009	62706.8	30287.5	2290710	1476	4891132
2010	61656.3	30554	2252357	1356	4809192
2011	62206.1	30363.5	2272460	1309	4852084
Number of firms. Western part					
1995	31439.8	16213	54928.0	6481	397957
1996	35191.4	16910	65927.6	7312	479911
1997	38668.3	18188	76795.7	7419	559975
1998	41413.7	19023	85807.0	7208	625602
1999	44499.4	20773	94524.7	7081	687683
2000	48208.5	22469	104606.6	7243	758699
2001	51928.4	24177	115301.0	7044	834288
2002	55740.4	25657	125948.1	7108	909522
2003	60347.9	26732	139701.6	7526	1008253
2004	64302.5	27399	153461.0	7213	1107108
2005	69386.7	27880	169455.5	7093	1221514
2006	65275.6	28818	147505.8	5934	1041326
2007	67549.2	29053	155533.9	6028	1096883
2008	68381.3	29264	152596.2	6431	1066169
2009	70457.9	30584	158794.3	6613	1106897
2010	69253.0	32341	162309.5	6716	1161505
2011	70005.6	30890	169657	6632	1218656
Number of firms. Eastern part					
1995	23171.6	18057	16965.2	1126	60405
1996	25090.6	18014	18726.5	1216	68657
1997	26526.0	17999	20083.5	1283	74691
1998	27717.5	17978	21364.6	1349	80309
1999	29351.3	18304	23182.5	1478	88932
2000	31111.2	19341	25301.5	1564	98622
2001	33115.3	20260	27767.3	1607	108094
2002	35092.1	21409	30349.9	1603	117674
2003	37525.1	23914	33476.5	1778	129905
2004	39777.4	24268	36742.2	1822	143237
2005	42978.8	25856	40853.1	1881	159754
2006	41325.1	24518	40516.7	1639	156414
2007	43215.6	21065	43757.7	1610	166946
2008	45299.7	22740	47048.1	1480	185576
2009	46274.6	24368	48481.5	1476	194011
2010	45551.4	25742	46859.4	1356	186123
2011	45671.4	25082	48418.7	1309	195670
Gross regional product					
1995	16502.4	10689.0	19326.9	844.6	124738.3
1996	24860.9	14868.7	34975.8	1258.8	236323.0
1997	28515.2	15788.5	43394.7	1423.8	317722.1
1998	31004.9	16884.4	48806.7	1528.3	370599.2
1999	53162.8	28436.2	87729.7	2127.1	677372.2
2000	73731.5	35568.3	144879.3	2737.5	1159034.0
2001	91889.3	47063.3	175245.5	4499.4	1370182.8
2002	112021.0	53046.3	221485.6	5310.6	1767476.7
2003	137662.4	65972.3	274523.5	6539.5	2188231.5
2004	178949.9	88100.6	362115.9	8516.7	2853272.4
2005	230821.4	106559.3	521821.9	8805.8	4135154.6
2006	287830.0	134802.0	652301.9	11609.4	5260232.8
2007	357680.6	165519.9	812588.8	15108.5	6696259.1

2008	433632.2	214339.9	990976.5	18701.0	8248652.0
2009	410125.7	207293.6	870030.4	19858.5	7157536.8
2010	478298.8	234447.7	1018710.3	21635.8	8401858.9
2011	578881.9	266363.8	1224336.1	26472.8	10021556.8
Gross regional product. Western part					
1995	15626.7	10517.5	18685.6	844.6	124738.3
1996	23326.3	14781.9	34038.9	1313.2	236323.0
1997	27265.1	15397.2	44742.3	1659.9	317722.1
1998	30535.3	16803.0	52154.0	1718.1	370599.2
1999	52936.1	27887.7	94599.0	2127.1	677372.2
2000	73378.3	35341.1	157590.9	5461.5	1159034.0
2001	90767.0	42075.4	187111.0	6641.8	1370182.8
2002	112053.2	50359.9	240959.1	7272.3	1767476.7
2003	137880.3	61818.6	298574.6	6539.5	2188231.5
2004	177605.9	80712.4	389514.2	8518.5	2853272.4
2005	228961.9	90442.6	561853.8	9685.7	4135154.6
2006	288453.8	124153.5	715316.3	12844.1	5260232.8
2007	365942.8	156034.6	913662.0	17225.8	6696259.1
2008	453406.9	192283.0	1127265.1	20789.7	8248652.0
2009	424002.6	197892.0	982942.6	23898.8	7157536.8
2010	490924.3	218712.3	1153493.5	24343.5	8401858.9
2011	595592.1	256409.2	1380283.2	28779.4	10021556.8
Gross regional product. Eastern part					
1995	18358.8	11746.7	20497.2	865.9	94835.1
1996	28114.3	17865.2	36671.6	1258.8	183450.9
1997	31165.3	20407.2	40261.3	1423.8	202071.1
1998	32000.4	21233.7	40794.6	1528.3	203825.8
1999	53643.2	31166.3	70999.6	2443.5	356139.0
2000	74480.2	40539.5	113305.3	2737.5	570790.2
2001	94268.5	57041.1	146927.1	4499.4	753119.2
2002	111952.7	73107.4	173102.4	5310.6	898722.4
2003	137200.5	88733.3	214806.0	6903.9	1117514.4
2004	181799.4	114840.5	295732.8	8516.7	1536733.7
2005	234763.4	135686.4	424624.8	8805.8	2215584.4
2006	286507.5	173810.5	492741.8	11609.4	2551355.4
2007	340164.7	223563.4	538476.0	15108.5	2758813.1
2008	391709.8	259343.1	606152.3	18701.0	3121401.3
2009	380706.8	267535.0	558682.2	19858.5	2899567.1
2010	451531.6	299715.3	645003.8	21635.8	3292882.9
2011	543456.2	337722.3	797524.2	26472.8	4091590.0
Gross regional product per capita					
1995	8132.2	6995.0	4160.1	1913.2	29859.9
1996	11536.0	9730.5	7181.2	1675.0	57562.3
1997	13024.0	10995.0	8174.1	2117.2	63206.5
1998	14250.8	12028.2	8838.2	2185.9	63143.1
1999	24156.8	19511.9	15862.0	2706.2	109783.9
2000	33237.3	26266.0	24256.3	8415.6	176496.7
2001	42580.9	33466.5	31396.5	12438.5	231657.7
2002	52164.7	41736.4	38639.2	16081.1	275259.5
2003	64351.3	50438.3	48800.8	22133.3	339670.0
2004	81711.0	64368.1	61652.2	28074.6	464550.7
2005	100882.5	77635.4	84905.6	33514.5	666742.2
2006	125526.3	98314.8	100630.0	44753.0	762737.0
2007	156291.4	127361.1	120943.4	54891.9	817668.4
2008	190120.8	154300.0	143769.6	65127.1	918329.3
2009	193373.3	155425.1	155356.4	74303.2	926469.4
2010	222454.7	181598.5	171020.7	83943.1	989418.3
2011	267374	219185.9	202563	100276.7	1205872
Gross regional product per capita. Western part					
1995	7059.6	6524.5	2867.0	1913.2	15439.8

1996	9766.3	9053.9	4211.8	1675.0	27569.2
1997	11095.9	9969.1	5407.3	2117.2	37173.5
1998	12352.8	11000.1	6344.8	2185.9	43410.9
1999	21222.7	18153.6	11840.6	2706.2	79336.2
2000	28805.1	23810.3	16529.6	8415.6	114597.0
2001	35962.4	31222.7	18759.0	12438.5	133416.0
2002	43935.5	38731.0	23175.7	16081.1	170227.9
2003	54050.8	47649.1	29119.2	22133.3	210589.1
2004	69749.8	57744.4	39983.3	28074.6	274168.6
2005	86127.5	70550.9	54979.2	33514.5	396657.5
2006	107671.7	88843.5	68679.7	44753.0	503709.0
2007	134718.5	110842.5	85796.6	54891.9	639566.3
2008	166388.7	145212.6	104431.0	65127.1	784913.1
2009	161764.3	138715.4	90911.6	74303.2	677604.5
2010	184499.8	152643.6	100909.1	83943.1	729708.1
2011	223902.6	189088.7	120271.3	100276.7	862960.2
Gross regional product per capita. Eastern part					
1995	10406.0	8734.7	5381.7	3563.9	29859.9
1996	15287.9	13194.7	10127.9	4802.9	57562.3
1997	17111.6	14999.6	11040.4	5292.6	63206.5
1998	18274.7	14495.5	11599.3	5943.9	63143.1
1999	30377.2	24642.2	20756.5	8412.5	109783.9
2000	42633.4	31440.6	33563.8	11745.4	176496.7
2001	56612.1	39332.4	45163.5	17040.0	231657.7
2002	69610.4	47848.6	55421.4	22377.1	275259.5
2003	86188.3	59507.7	70220.7	26539.9	339670.0
2004	107068.6	82287.4	86738.8	31943.2	464550.7
2005	132163.1	102135.1	121011.5	37742.7	666742.2
2006	163378.3	127073.6	139592.1	49018.8	762737.0
2007	202026.2	155079.8	164174.9	62128.8	817668.4
2008	240432.9	175190.6	194020.1	76020.7	918329.3
2009	260384.3	181645.4	226214.1	84917.7	926469.4
2010	302919.3	222003.1	245231	99353.9	989418.3
2011	359533.4	269260.3	291295.9	109354.4	1205872
Gross regional product per employee					
1995	17847.1	15804.9	7677.9	5586.4	54615.9
1996	26267.3	23347.0	12759.3	5125.7	102423.6
1997	30286.9	27024.8	14786.0	6668.9	116279.8
1998	34041.8	30141.1	16665.0	7047.2	121614.4
1999	55267.8	47893.4	29685.0	7403.8	203508.0
2000	72764.2	62225.9	44482.0	25632.3	334911.8
2001	91984.0	75779.4	54914.1	38571.8	420126.7
2002	111439.3	95889.8	66104.7	50542.5	491346.8
2003	135187.4	113887.2	80510.6	56133.0	599139.2
2004	170165.5	140498.0	104184.8	73498.7	821914.6
2005	207560.6	174688.0	144115.2	83858.9	1171894.8
2006	256123.8	218953.0	170315.3	111012.1	1359490.3
2007	315545.3	266319.1	201092.2	148883.3	1466829.6
2008	381144.9	317241.0	231664.2	175186.9	1643015.7
2009	389650.7	320647.8	240811.9	176391.2	1502599.9
2010	448760.0	376312.9	278892.5	200344.8	1707573.0
2011	540820.6	449584.8	335801.3	253339.8	2105377.0
Gross regional product per employee. Western part					
1995	15724.5	14761.1	5590.5	5586.4	32882.1
1996	22739.1	21219.9	7732.5	5125.7	46123.5
1997	26285.5	24301.6	9747.8	6668.9	61655.3
1998	29921.1	27541.9	11589.6	7047.2	70977.0
1999	48696.4	42470.0	21696.6	7403.8	125446.3
2000	63979.2	53451.9	29939.2	25632.3	205026.3
2001	79750.6	69299.2	34227.2	38571.8	239869.5

2002	96127.6	84637.5	41139.9	50542.5	303044.5
2003	117038.8	102219.3	50830.2	56133.0	364747.8
2004	149349.1	127986.7	70609.3	73498.7	469388.6
2005	181939.8	149846.8	94944.1	83858.9	671640.2
2006	225244.4	182452.7	116668.8	111012.1	842594.4
2007	278946.4	233498.2	141950.0	148883.3	1046813.9
2008	342822.5	298418.0	169245.9	175186.9	1251084.8
2009	339068.2	296239.7	152923.4	176391.2	1123967.4
2010	389258.7	335323.6	181278.8	200344.8	1315483.0
2011	471703.4	406955.5	216117.6	253339.8	1546632.0
Gross regional product per employee. Eastern part					
1995	22346.9	20788.3	9373.6	7928.5	54615.9
1996	33747.1	31712.3	17287.0	12367.5	102423.6
1997	38769.9	35434.2	19358.7	14242.2	116279.8
1998	42777.5	36211.5	21666.2	17140.5	121614.4
1999	69199.0	57931.8	38285.1	25524.9	203508.0
2000	91388.6	74468.1	61340.4	32511.9	334911.8
2001	117918.9	91317.8	77039.4	51868.3	420126.7
2002	143900.2	109012.6	92168.6	65160.7	491346.8
2003	173662.4	134752.3	112105.4	78693.8	599139.2
2004	214296.2	175177.4	142934.1	94874.6	821914.6
2005	261876.7	223477.6	203340.8	103719.7	1171894.8
2006	321588.2	265201.8	235242.7	132376.3	1359490.3
2007	393135.0	314898.8	273110.5	163689.1	1466829.6
2008	462388.5	367228.6	311457.0	197267.9	1643015.7
2009	496885.7	376046.5	338273.6	210588.5	1502599.9
2010	574903.0	472939.5	386770.8	230413.2	1707573.0
2011	687349.1	547614.8	470321.6	288689.2	2105377.0