
A New Perspective on Regional Inequalities in Russia

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Abstract: Two economic geographers examine trends in economic performance and quality of life of the population in Russia's regions from 1990 to the first years of the 21st century. The paper compares the results of tests for regional inequality according to a wide variety of standardized measures: gross regional product, personal income, unemployment, consumption variables, social and health indicators (educational level, life expectancy, infant mortality), and infrastructure endowment. The authors construct two composite indices of regional inequality that provide a framework for explaining the different development trajectories of Russia's regions following the disintegration of the USSR. *Journal of Economic Literature*, Classification Numbers: I31, O18, R12. 13 figures, 3 tables, 47 references, 3 appendices.

INTRODUCTION

In a country that accounts for roughly one-eighth of the Earth's land surface, and in which half of the territory is sparsely populated, one might expect there to be a certain degree of uneven development. In fact, it is often argued that the level of regional inequality in Russia has increased since the collapse of the Soviet Union. But, pronounced spatial differences are far from new in Russia. Partly for the ideological reasons, Soviet leaders pledged the equalization of socioeconomic conditions across regions, between rural and urban areas, and among the 100-plus nationalities of the Soviet Union as one of their major goals (Liebowitz, 1989). For decades the centrally planned system attempted to reduce inequality. While spatial disparities in parameters such as literacy, educational attainment, and healthcare provision were significantly diminished, by the late 1980s Soviet Russia was still characterized by substantial regional contrasts. Consequently, the process of transformation from the centrally planned system to a market-oriented society is taking place on an already uneven socioeconomic landscape.

Trends in the post-Soviet regional development in Russia have been strongly influenced, and possibly determined, by the processes of economic restructuring. Economic liberalization resulted in a significant decrease in the output in the least competitive branches (manufacturing industries), whereas export-oriented resource-extractive industries were affected less. Post-Soviet transition, therefore, has been characterized by deindustrialization, with industry re-orienting itself toward natural resource production. However, the 1998 financial crisis has been followed by four years of rapid economic growth (at an average annual rate of some 6 percent). Massive devaluation of the ruble has stimulated import-substituting industries, and high oil prices have further boosted revenues. Nonetheless, in 2003 Russian GDP is still well below its 1991 level.

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The restructuring of the national economy has been paralleled in Russia's constituent regional economies. A number of regions containing relatively competitive economic sectors have coped with transition relatively successfully, although the overwhelming majority of regions have faced severe adjustment problems (Sutherland and Hanson, 1996). As a result regional disparities have increased (Dunford and Smith, 2000).

In post-Soviet Russia, the issue of regional inequality has been high on the political agenda from the very onset. The troubled and complicated political relations between the federal center and the regions in the early 1990s, with the Chechen separatist movement serving as an extreme example, posed a real threat to the territorial integrity of the state. Growing socioeconomic contrasts across regions would have strengthened these dangerous tendencies. At present one of the most acute problems is arguably the inability of the most poorly performing regions to provide a nationally accepted minimum level of public service provision. This raises the question of whether some form of state intervention in the distribution of public resources is necessary in order to equalize the capacities of regions to meet at least the minimal needs of their populations.

The most distinct dimension of Russian regional policy is the system of fiscal federal relations in general and the distribution of federal financial assistance to the regions in particular. A lack of objective principles for the allocation of federal assistance has resulted in the distribution of resources according to the "lobbying abilities" of regional leaders rather than regional fiscal needs and the degree of territorial inequality (see, for example, Treisman, 1996). In the mid-1990s, a new system of formula-driven equalization transfers was introduced, known as the Fund for the Financial Support of the Regions (FFSR). The new methodology is based on the evaluation of regional tax capacities and fiscal needs, and thus is intended to reduce the influence of political lobbying. Whether the current Russian fiscal federalist system is now able to effectively address increasing regional inequality in tax revenues and is potentially capable of diminishing broader spatial economic disparities remains unclear, inasmuch as the actual degree and dynamics of regional socioeconomic differences have yet to be systematically evaluated.

The apparent unevenness of socioeconomic activity and the problems it causes has stimulated a number of attempts to record and analyze the patterns of regional development in Russia. The examination of the relative regional performance, and the factors underpinning it, is one of the key concerns of an increasing volume of research on Russia's regions.² Although the evaluations of Russian spatial contrasts differ, most authors argue that the last decade has been characterized by growing economic inequality among regions. Lavrovsky (1999), for example, demonstrated growing disparities in industrial output and the consumption of foodstuffs, while Treivish (1999) observed rising disparities in gross regional product and per capita monetary income for the period 1990–1996 period. Mikheeva (1999) developed a detailed statistical test of neoclassical growth theories and found no evidence of regional convergence in terms of per capita gross regional product and personal incomes. Hanson (2001, 2002) has performed one of the most detailed analyses of personal income differentiation among regions, and reported a divergent trajectory of regional development. Finally, Fedorov (2002) distinguished between regional inequality and regional polarization in Russia based an analysis of monetary income and expenditures per capita. His findings were similar—regional inequality increased during the 1990s.

²See, for example, Expert Institute (1996), Predprinimatel'skiy (1997), Hanson and Bradshaw (2000), Westlund et. al. (2000), Popov (2001).

However, these studies share some common drawbacks. First, all use a limited number of primarily economic indicators without taking other important aspects of regional evolution into consideration. Second, none attempt to position the analysis of Russia's spatial disparities in the framework of the relatively developed Western theoretical debate on regional development. Third, there has been no attempt to gain a more rigorous understanding of the general relationship between post-communist transformation and regional inequality. Given these limitations, it is difficult to identify whether the present policies of the Federal Government are effectively responding to changing regional disparities.

The present paper attempts to address these issues by providing a theoretically informed analysis of trends in regional inequality in Russia during the 1990s and early years of the 21st century. The first section provides a brief overview of regional development theories and empirical research conducted within their context. A second section of the paper addresses the choice of regional variables and outlines specific techniques utilized in measuring regional disparities. The third section presents some empirical evidence relating to the different dimensions of regional inequality in Russia, and a fourth section attempts to integrate these diverse regional variables within a composite index of regional performance. Finally, a fifth section outlines the possible reasons for (sources of) the regional trends identified, and a sixth evaluates the effectiveness of state policy designed to facilitate regional equalization.

THEORIES OF REGIONAL DEVELOPMENT

Different scholars suggest various classifications of regional growth and regional development models.³ However, broadly speaking, the majority of these theories can be divided into two basic approaches: the spatial equilibrium (convergence) and the disequilibrium (divergence) schools.⁴ The guiding principle of the former is the claim that regional growth inequality is a temporary phenomenon deriving from “wrong” state policies preventing market forces from the rational spatial distribution of economic activity. Proponents of this approach argue that technological improvements operate in such a way that in the presence of free trade and unrestrained market competition, economic convergence eventually takes place.⁵ The disequilibrium approach holds that economic development is inherently uneven, leading toward interregional inequality, and that market forces tend to increase spatial disparities rather than decrease them. State intervention is therefore regarded as a key element of balanced spatial development.⁶

³See, for example, Holland (1976), Browett (1984), and Higgings and Savoie (1995).

⁴A more thorough review of regional development theories is presented in an unabridged version of this paper, which is available upon request from the authors.

⁵Neo-classic growth theory is essentially a convergence model of regional development, which considers regional disparities to be a result of the failure of free market forces to function properly. The conventional classical theory of regional growth also is considered a convergence model. There is an extensive body of empirical research supporting these theories. The most celebrated analyses have been performed by Kuznets (1955) and Williamson (1965). See also Solow (1956), Vanhove (1999), and Armstrong and Taylor (2000). The 1990s witnessed the appearance of revised versions of neoclassical growth theory (Barro, 1991; Sala-i-Martin, 1996).

⁶Disequilibrium models predict that, under conditions of market competition, convergence cannot spontaneously take place. Of the classical economists and their critics, who were essentially interested in growth and its distribution, Malthus and Marx saw economic growth as a process that was inherently uneven and that could lead to cumulative growth and decline (Dunford and Smith, 2000). “Weak” versions of the divergence hypothesis have also been advanced by Keynes's followers (see, for example, Harrod, 1939; Domar, 1946; Robinson, 1956; see also Richardson, 1973). The influential approach offered by Myrdal (1957) partly overlaps with the disequilibrium models. He argued that once regional disparities occur, there is a strong tendency for these inequalities to be reinforced by the processes of cumulative causation. Of the most recent theories, the “new economic geography” or “geographical economics” developed by Krugman (1991) is noteworthy. This model does not posit that divergence is inevitable, although the basic thought underpinning this analysis appears to be that whatever the actual source of increasing returns may be, any increase in the degree of trade openness is likely to encourage the most productive factors to flow toward the advanced regions, where returns are higher.

It is important to recognize that both of the theoretical positions discussed above are based on obvious simplifications. Which approach is more useful is arguably determined by the specific features of the regions/nations under study. What is clear, however, is that both types of forces—leading either to regional convergence or to divergence—seem to be at work simultaneously. Perhaps equally important, the particular theoretical framework underlying the analysis directly informs the policy recommendations that follow. Convergence theorists would see no role for state intervention, as only the market is capable of allocating resource efficiently, thus enabling convergence between regions. Divergence theorists, by contrast, would suggest that only state intervention to assist lagging regions can bring about convergence. Obviously, this is as much an ideological position as a theoretical one. The Soviet case is instructive, as divergence occurred in a situation in which state intervention was total. Of key interest for the current discussion is that the analytical models employed in these works can be useful in the case of post-Soviet Russia. An attempt to apply them in an examination of Russian regional trends is presented below.

MEASURING REGIONAL INEQUALITY

Data on Russian Regional Development: Availability and Limitations

The analysis of regional development levels that follows is based on the official data published by the Russian State Statistical Agency (Goskomstat Rossii). However, the reliability of Russian statistical data remains a major concern. Utilization of Russian regional statistics entails at least four major difficulties. First, although Russia comprises 89 constitutionally equal administrative regions, socioeconomic data for them are not uniformly available. The main problem is related to the existence of nine autonomous okrugs (districts) that are politically independent but are at the same time a parts of larger regions (oblasts and krays). Data on okrugs are extremely inconsistent, with full data sets available only for the late 1990s. Regular data for two other regions—the Chukotka autonomous okrug (which is no longer a part of Magadan Oblast) and war-ridden Chechnya, also are missing for the most of the 1990s. Because of this, the present analysis is focused on 78 regions (federal subjects).

Second, there is a problem of inconsistent temporal coverage. A number of the essential regional indicators provided by Goskomstat are available only for a limited time period.⁷ So, for example, figures on Gross Regional Product (GRP) have only been compiled by Goskomstat Rossii and reported since 1994. In addition, some parameters were re-defined during the 1990s.

Third, the official data still suffer from typically Soviet statistical shortcomings. Regional statistics are overburdened with specific industrial and agricultural data (most of which are reported in physical terms), but detailed figures for the service sector are lacking. Finally, Goskomstat's data do not fully record the size of the “black” or shadow economy, which is a widespread phenomenon in post-communist nations (Nikolayenko et al., 1997). For Russia, the estimates of the size of the “unregistered” economy range from some 40 percent (Alvater, 1998) to 53 percent (Eilat, 2002) of official GDP. Consequently, any figures on relative wealth and labor market should be treated with caution. The extent to which the contribution made by the shadow economy varies regionally also is little understood. With these considerations in mind, the next section presents some empirical evidence regarding trends in Russian regional inequality over the past decade.

⁷Data for this study were obtained from Goskomstat Rossii (2000, 2001a, and 2001b).

Table 1. Groups of Regional Variables

1. Economy	3. Demography
Real GRP per capita	Death rate
Real GRP in industry per capita	Birth rate
Real GRP in agriculture per capita	Dependency ratio
Real income per capita	4. Transportation and communication
Regional income divided by expenditure	Population density
Real monthly wage	Rural population density
Number of small enterprises per capita	Number of telephones per capita of urban population
Unemployment rate	Number of telephones per capita of rural population
Retail turnover per capita	Density of motor roads
Fixed capital investment per capita	5. Educational level
Foreign direct investment per capita	Number of researchers holding a degree per capita
Share of loss-making enterprises	Number of students per 10,000 population
Real industrial output per capita	Number of postgraduates per 10,000 population
2. Health	6. Other socioeconomic indicators
Life expectancy	Share of urban population
Infant mortality	Automobiles per capita
Number of hospital beds per 10,000 population	Share of households with incomes below subsistence level
Number of doctors per 10,000 population	Meat consumption

EMPIRICAL TRENDS IN INEQUALITY

Most analyses of regional inequality employ data on either real GRP per capita or real income per capita. Yet detailed analyses show that these variables are not always highly correlated with other important variables of a non-economic nature, and, therefore, cannot be regarded as satisfactory indicators of overall regional socioeconomic performance. At the same time, multi-variable indexes comprising tens of variables do not necessarily represent a better alternative, as the explanatory power of such indicators does not tend to increase with the number of variables. The most plausible approach, therefore, is to employ statistical techniques designed to reduce the number variables from a given set of indicators, such as principal components analysis.

Choice of Variables

Taking into account the limitations of official Russian statistics, a set of variables reflecting different sub-dimensions of regional socioeconomic inequality was compiled and subjected to principal components analysis (Table 1). Each variable has its own geography, and is worthy of separate examination. However, such an approach is beyond the scope of the present paper, which is focused on the identification of the key characteristics of Russian regional inequality.

To reduce the number of variables the data for 1998 (the only year for which the data for all the variables are available) were subjected to principal components analysis (Appendix

1). The first factor appears to capture variations in economic performance of Russia's regions. Its highest loadings are with real income, real GRP per capita, retail turnover per capita, etc. This factor accounted for 28.4 percent of regional variation in variables under consideration. The second factor (explaining 15.3 percent of variation) is composed of indicators characterizing the density of communications and transportation links, as its highest loadings are with density of motor roads, density of population, etc. The nature of the third factor is somewhat unclear. This factor comprises such variables as unemployment rate; number of hospital beds per 10,000 population, life expectancy, etc. and explains about 11.5 percent of the variation. Presumably, these variables reflect the level of the social development (human capital) of a region.

To clarify the nature of this factor, highly correlated variables were excluded and the principal components analysis was performed on the reduced data set (Appendix 2). The results of this analysis clarify the nature of the third factor. It captures variations in levels of social development and has the highest loadings with health indicators—life expectancy, death and birth rates, and the number of hospital beds per 10000 population. The unemployment level variable is now linked with the first “economic” principal component.

Measures of Russian Regional Inequality

Before using the results of the principal components analysis above to construct an integral index of regional inequality for Russia during the 1990s, it is useful to briefly examine the magnitude of that inequality using a variety of individual variables, each representing a different dimension of regional inequality.

Gross Regional Product (GRP). Per capita GRP has been the focus of most studies of comparative regional development in Russia. As mentioned above, however, this measure has only been available since 1994, which does not allow for an analysis on the entire transition period. One possible solution might to utilize an estimate. Mikheeva (1999) attempted to reconstruct the 1990–1996 GRP figures on the basis of data for industrial, agricultural, construction and transport activity, and trade and service sector output. However, the application of Soviet-era data at the beginning of this period is somewhat questionable, as prices were then set and controlled by the state and shortages were not recorded in the official statistics. Bearing in mind the apparent unreliability of these data, Figure 1 presents a crude picture of real per capita GRP inequality for the 1990–2001 period.

As can be seen, regardless of the statistical technique selected, the result appears to be similar. Until 1993 regional inequalities in real per capita GRP diminished. After 1994, however, divergence clearly was the trend, the exact magnitude of which depends upon the statistical measure employed. Slight convergence occurred in 1998 and 2000, but more recently disparities have continued to increase.⁸ So the overall picture is presented clearly: a period of long-term regional divergence gave way to a short phase of slight convergence followed by stronger increases of GRP inequalities post 2001.

⁸It is important to recognize that as the distribution of economic activity in Russia is extremely uneven, with the degree of variation in the parameter under consideration being strongly influenced by the inclusion of outliers. The two most prosperous regional economies, oil-rich Tyumen' Oblast and Moscow City, and the poorest region Ingushetia are the obvious extremes. (Readers are reminded that Chechnya and Chukotka, for which data are not available for most of the period, are not included in this assessment.) Real per capita GRP figures for 1999 were 3.72 and 2.37 times the Russian average in the former and 0.23 times in the latter. Such a significant dispersion inevitably increases the measures of variation. Although the scale of deviation of extremes varies over time, the list of the “outliers” remains the same.

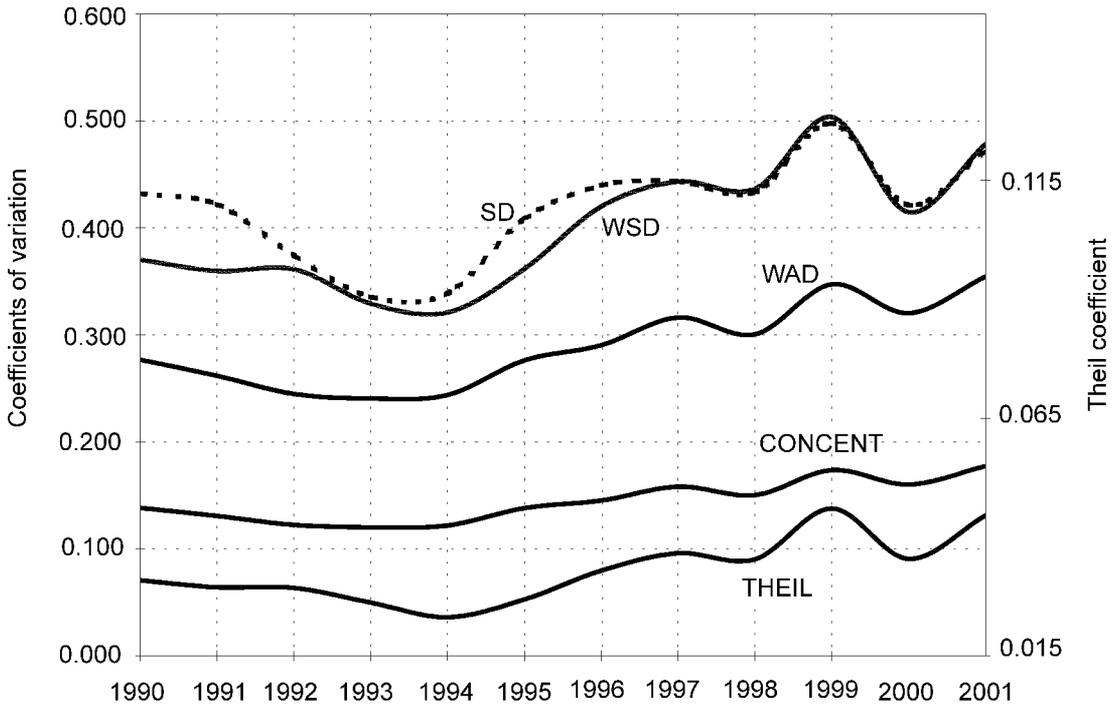


Fig. 1. Regional inequality in real per capita GRP, 1990–2001. Data for the 1990–1993 GRP per capita were obtained from Mikheeva (1999). Data for 2000 and 2001 are from Russian Ministry of Economy and Trade (2001), and Valovyy (2002), respectively. In each case, regional GRP figures are adjusted to the local cost of living. For 1992–1993 and 2000–2001 interregional price levels are measured on the basis of a 19/21-item “food basket”; for 1994–1999 data on the regional “subsistence minimum” are used. These data are not available for all regions for 1992–1994, so the number of regions varies over the period (76 in 1992–1994, and 78 in 1995–2001). Data for 1990–1991 were not adjusted to the regional price level, as the Soviet statistics did not provide these figures. For an explanation of the acronyms (SD, WSD, WAD, etc.), see Appendix 3.

These observations suggest that, in terms of GRP inequality, a number of wealthy regions were able to improve their relative positions significantly, while the rest of the country lagged behind. More specifically, the trend for the full data set suggests that before the 1998 financial crisis, regions containing export industries and commercial hubs managed to cope with the restructuring of the national economy more effectively than others, resulting in the striking divergence in regional economic performance. The fourfold devaluation of the ruble in 1998, however, led to growth of import-substituting industries in Russia and to the improvement of regions dominated by them (typically not the same as the resource-extracting/exporting regions), resulting in a degree of convergence. But as Figure 1 shows, although some signs of convergence were apparent in 2000, they were muted relative to the preceding year. Post-2001, the strengthening of the ruble has served to dampen growth in the import-substitution element, at the same time that high resource export prices (particularly for oil and gas)—and service- and consumption-led growth in the commercial hubs—intensified the pre-1998 trend toward divergence. This hypothesis is tested by examining trends manifest in other indicators.

Personal Money Incomes. Regional personal incomes are another important component of regional variations in living standards. Like per capita GRP, this variable has been analyzed extensively in the literature on Russia's regional performance (Mikheeva, 1999;

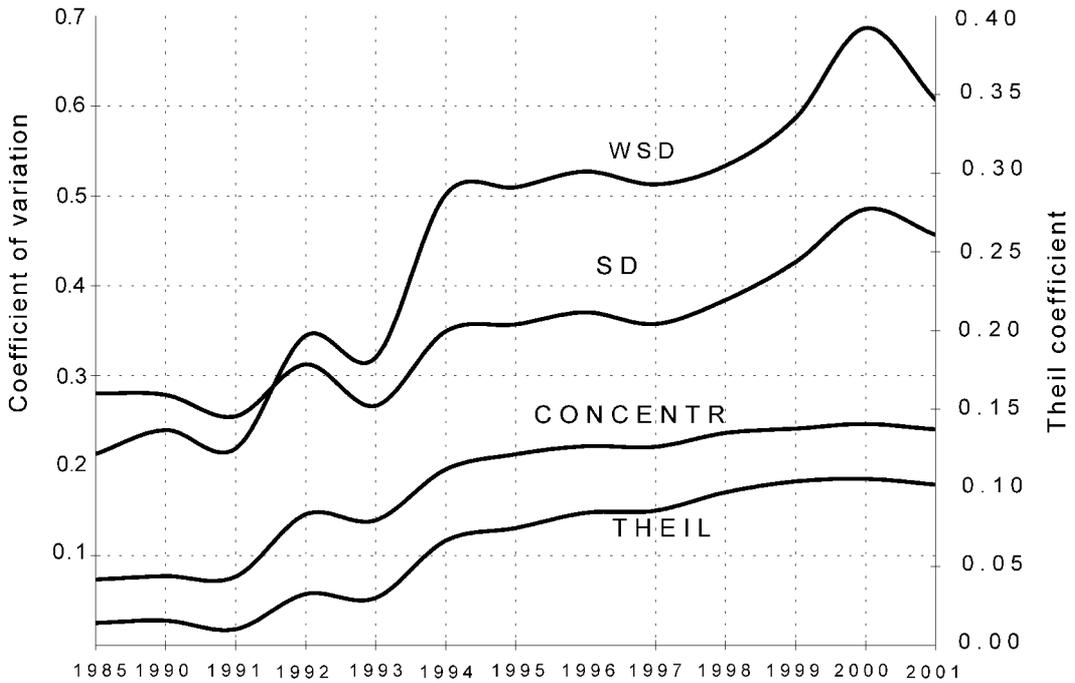


Fig. 2. Regional inequalities in per capita real personal income, 1980–2001. Data for 1985–1991 were not adjusted to the regional price level. The number of regions varies, depending on data availability. *Source:* Goskomstat Rossii, 2001a, various pages.

Hanson and Bradshaw, 2000; Hanson, 2001, 2002; Fedorov, 2001; and others). For this reason the calculations presented in this paper, based on a new data set, are of particular interest.

Figure 2 presents the regional dynamics in per capita real personal income. Trends over time tend to correspond generally with those manifest in per capita gross regional product. The coefficients of variation—weighted and unweighted—increased sharply between 1990 and 1994 (with a slight decrease in 1993) before stabilizing somewhat in 1995–1998. These measures increased significantly in 1998–2000, and then decreased in 2001. The other statistical indicators charted (Theil and concentration coefficients) display more smoothed, but nonetheless divergent trends.

Figure 3 plots unweighted coefficients of variations calculated for all regions in the data set except for Moscow city, Tyumen' Oblast, and Ingushetia, the two richest and the poorest regions of Russia, respectively (just as in the case for per capita GRP). As can be seen, the trajectories differ dramatically. Trends for the data set without outliers suggests that convergence occurred throughout the entire period 1990–1997, after which a slight divergence occurred. In contrast, the trend for the entire data set indicates increasing inequalities among Russia's regions. This suggests that the overall divergence was in all probability the result of a rapid relative economic improvement (or, putting it more correctly, less deterioration) of a number of “successful” regions: Moscow, Tyumen', Samara, Tatarstan, etc. It also indicates that the deterioration in well-being before the 1998 crisis and the growth that has occurred after it exhibit a high degree of spatial variability.

Unemployment Rates. Russian statistics provide two commonly utilized measures of unemployment: the level of unemployment and the rate of “officially registered” unemployed. The former is derived on the basis of special surveys conducted by local statistical

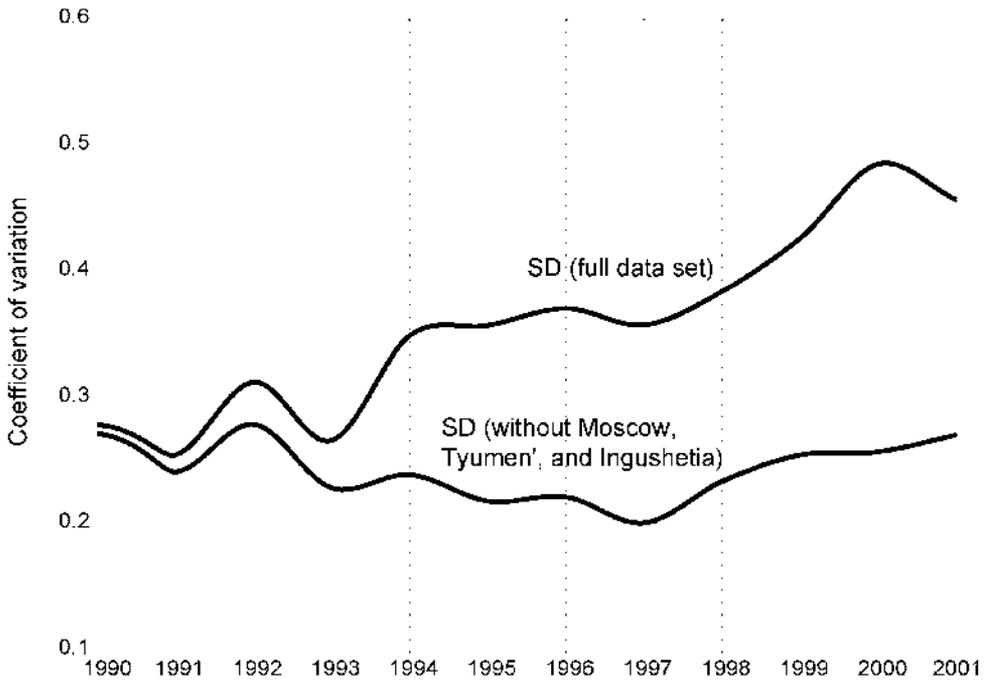


Fig. 3. Regional disparities in personal income, excluding/including statistical outliers, 1990–2001. *Source:* Goskomstat Rossii, 2001a, various pages.

agencies according to standards of the International Labor Organization (ILO), whereas the latter reflects the number of people who register themselves as unemployed in the state labor agencies. Because of the undeveloped labor market, and the importance of the shadow economy, actual unemployment is significantly greater than the officially reported figure. Arguably, the unemployment rates calculated by international standards are more reliable, and therefore are used in the current analysis.

Figure 4 shows territorial disparities in unemployment rates. All of the statistical measures plotted on the figure indicate roughly similar trends. Overall, unemployment has not displayed significant variations over the period examined. However, one can identify a period of relative divergence in 1995, and a subsequent phase of slight convergence that occurred until 2000. Nevertheless, these trends were much less pronounced than those of economic variables considered earlier. This suggests that the geographical pattern of employment change was quite stable, reflecting the low level of labor mobility and a general commitment of Russian enterprises to labor retention.

Consumption Variables. It is equally important to analyze inequalities in the consumption of wealth, particularly because the geographies of production and consumption in Russia do not tend to coincide. Given the relative lack of regional consumption data, one possible solution is to use a number of proxy variables. Relying on the literature on comparative regional/national development and taking account of the data limitations, the following three indicators were chosen: per capita retail trade, the number of private cars per 1000 population, and the level of per capita meat consumption. These variables considered together can arguably provide a surrogate measure of personal consumption in Russia's regions.

Figure 5 illustrates trends in the spatial variation of the various consumption variables. For the sake of clarity, the differences are measured by the unweighted coefficient of variation. The most remarkable trend is displayed by the retail trade variable: the late Soviet

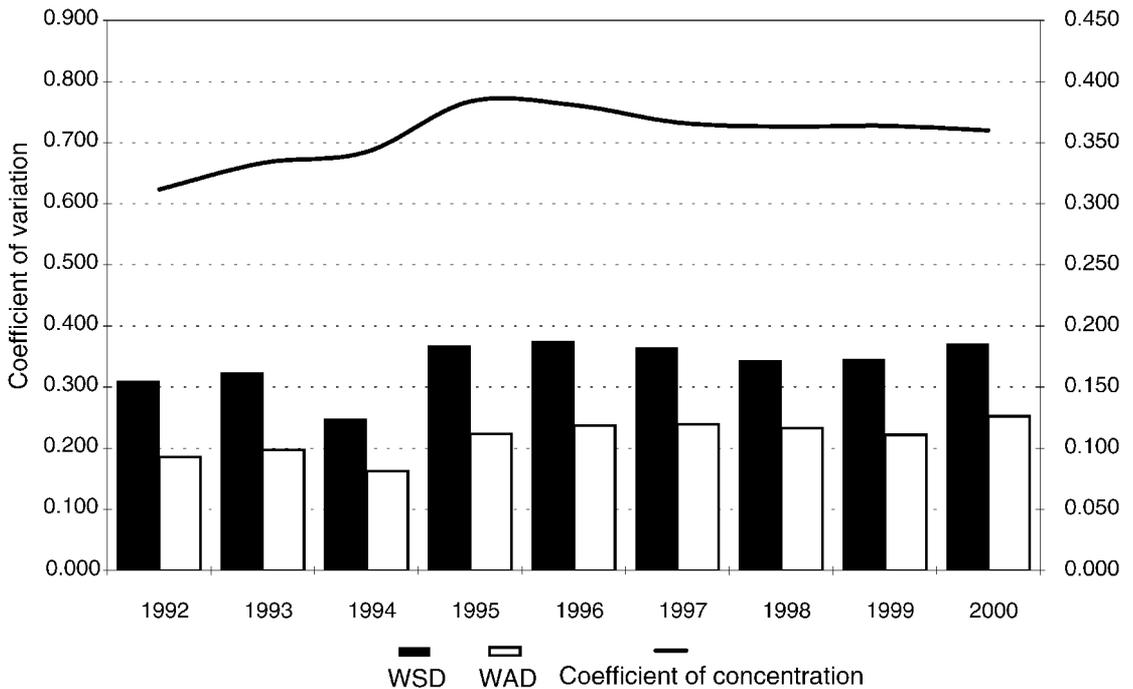


Fig. 4. Regional inequality in unemployment rates, 1992–2000. *Source:* Goskomstat Rossii, 2001a, various pages.

period of gradual reductions in inequalities was followed by a period of marked and increasing divergence.⁹ This increase in inequality was partly caused by a growing concentration of retail trade in a limited number of relatively prosperous regions (Moscow, Samara, Tyumen', Perm', Lipetsk). The coefficient of concentration of retail trade more than doubled between 1991 and 2000 (Fig. 5).

Trends in per capita meat consumption and the number of cars per 1000 population reflect somewhat different trajectories in that there was a clearly distinguishable period (1994–1998) of a relatively stable level of spatial inequality. However, overall, these variables exhibit a divergent trend. Thus, the analysis reveals that during the 1990s regional contrasts in consumption have increased. This process was also characterized by a growing concentration of consumption in a small number of “wealthy” regions.

Health Indicators. The principal components analysis performed earlier in the paper suggested that most of the variance in regional social performance is explained by such variables as life expectancy, educational attainment, as well as a number of “health” indicators. Regional inequalities in the following parameters were analyzed and plotted in Figure 6: life expectancy, infant mortality, medical facilities (number of hospital beds per 10,000 population), and medical personnel (number of physicians per 10,000 population).

To make the trends more demonstrable, only the unweighted coefficients of variation are charted in Figure 6.¹⁰ What emerges from the analysis is that the absolute values of variation coefficients are quite low, reflecting the relatively more even spatial distribution of these variables in contrast to the parameters analyzed above. Second, apart from infant mortality, regional differences in the variables did not display any sharp fluctuations. Third, the

⁹It should be noted that these data do not capture the goods and services obtained from the unofficial economy.

¹⁰Weighted coefficients display similar trajectories.

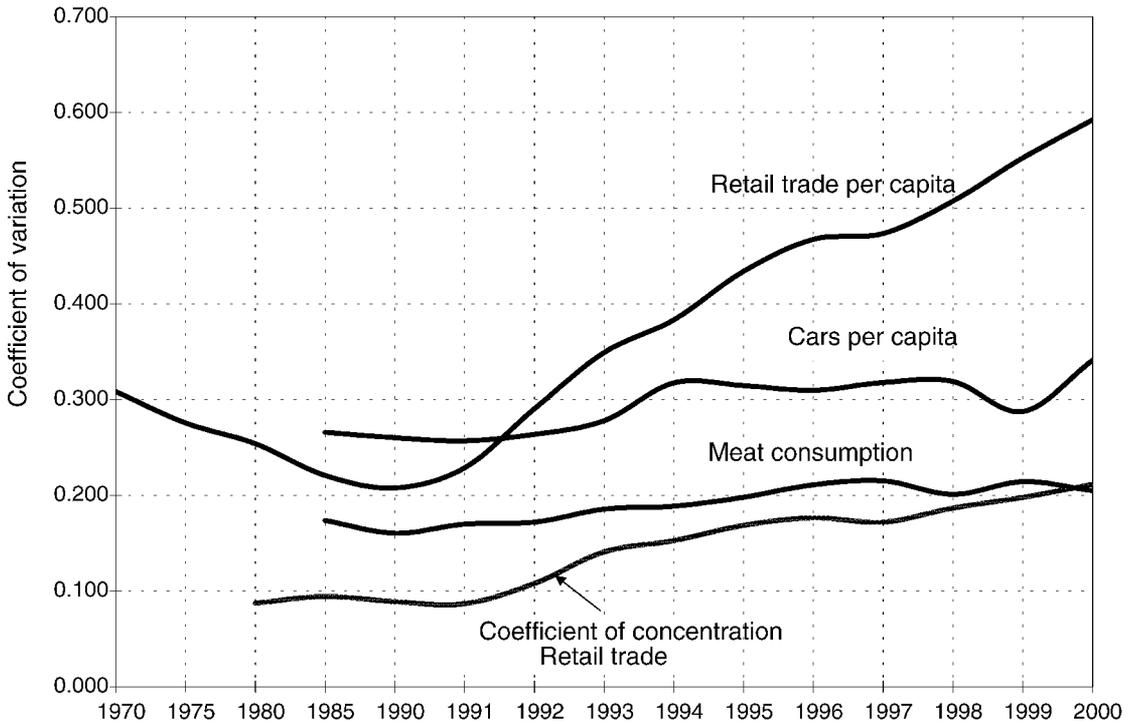


Fig. 5. Trends in territorial inequalities in consumption variables, 1970–2000. The data on retail trade for the Soviet period are not adjusted to reflect regional price differences. *Sources:* Goskomstat Rossii, 2001a, various pages and Goskomstat SSSR, various years.

trajectories of the parameters are not similar. While the regional levels of both medical personnel and hospital beds tended to stabilize after 1994–1995, the former had tended to converge and the latter to diverge in the 1985–1994 period. As noted above, there is overall divergence in infant mortality rates, whereas life expectancy does not show any clear trend.¹¹ These quantitative indices indicate very little about the quality of health care. Consequently, it is difficult to evaluate spatial disparities in the health of a given regional population and to conclude whether divergence or convergence has occurred following the collapse of the Soviet Union.¹²

Educational Attainment. In theory, educational attainment variables should characterize differences in the quality of the labor force and in regions' potential for innovation. However, inasmuch as the Soviet educational system managed to provide a 100 percent literacy level, such standard measures of educational attainment as the literacy rate are of little use. One possible alternative is to use data on the number of students (Fig. 7), postgraduates, and researchers holding a university degree (all measured as ratios to regional population). Spatial disparities in the number of students (postgraduates in particular) measured by various statistical techniques show the same trend—the decade of the 1990s was a period of significant convergence, with coefficients of variation falling by half in some cases. With the loss of the state's monopoly in education provision, new, largely private, educational facilities

¹¹It should be noted, however, that despite a stable degree of difference over time, total (male and female) life expectancy varies significantly across the country, with its maximum of over 73 years in some of the republics of the North Caucasus republics, to a minimum of 58 in the Tuva Republic in East Siberia.

¹²It is more clear, however, that the overall level of health in Russia has declined since the USSR's disintegration (see Feshbach, 2003)—*Ed., EGE*.

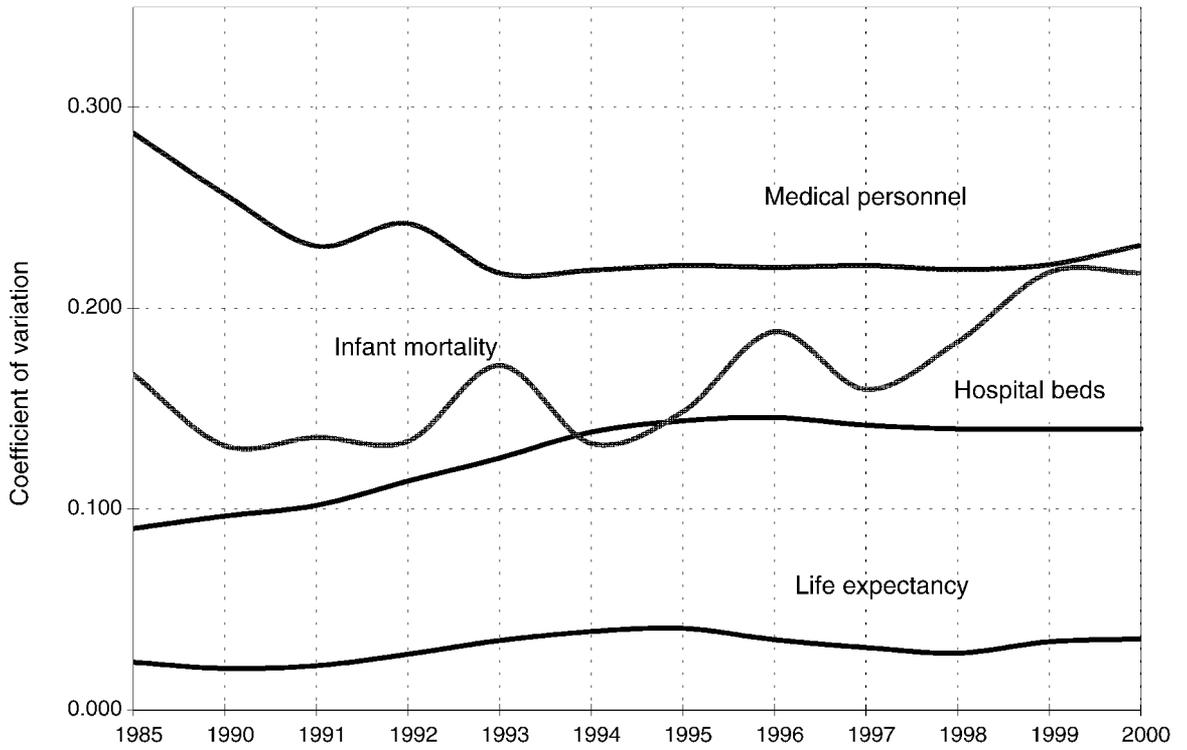


Fig. 6. Regional inequality in health indicators, 1985–2000. *Source:* Goskomstat Rossii, 2001a, various pages.

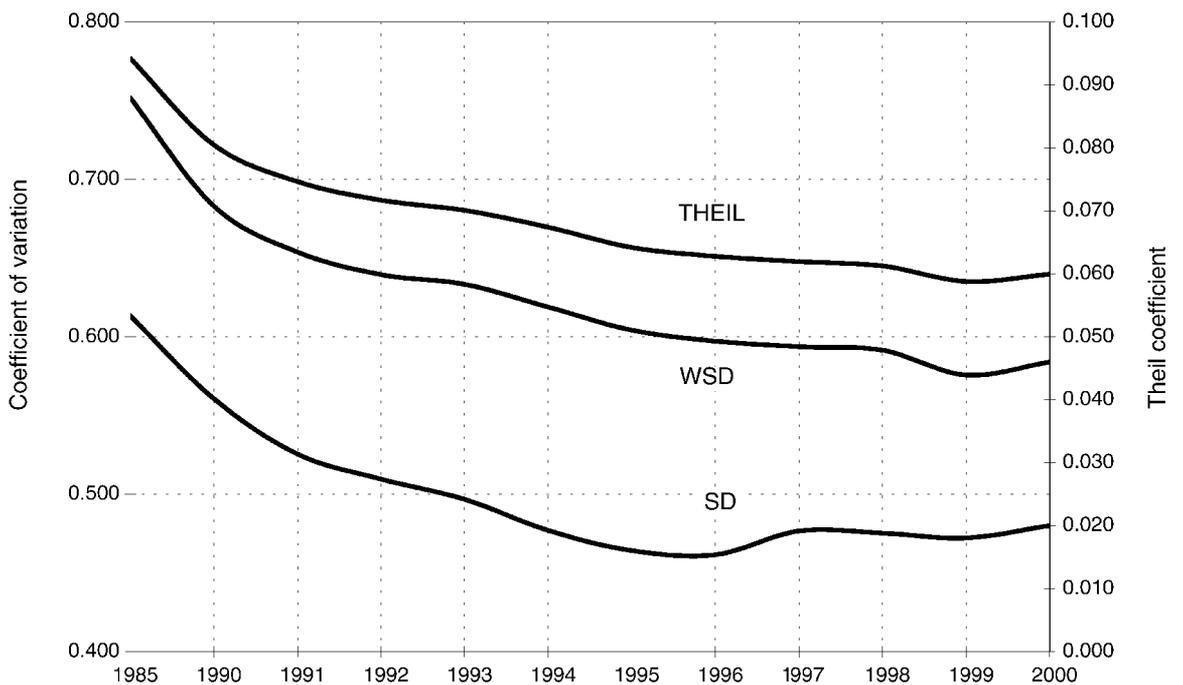


Fig. 7. The development of territorial inequalities in the number of students per 1000 population, 1985–2000. *Source:* Goskomstat Rossii, 2001a, various pages.

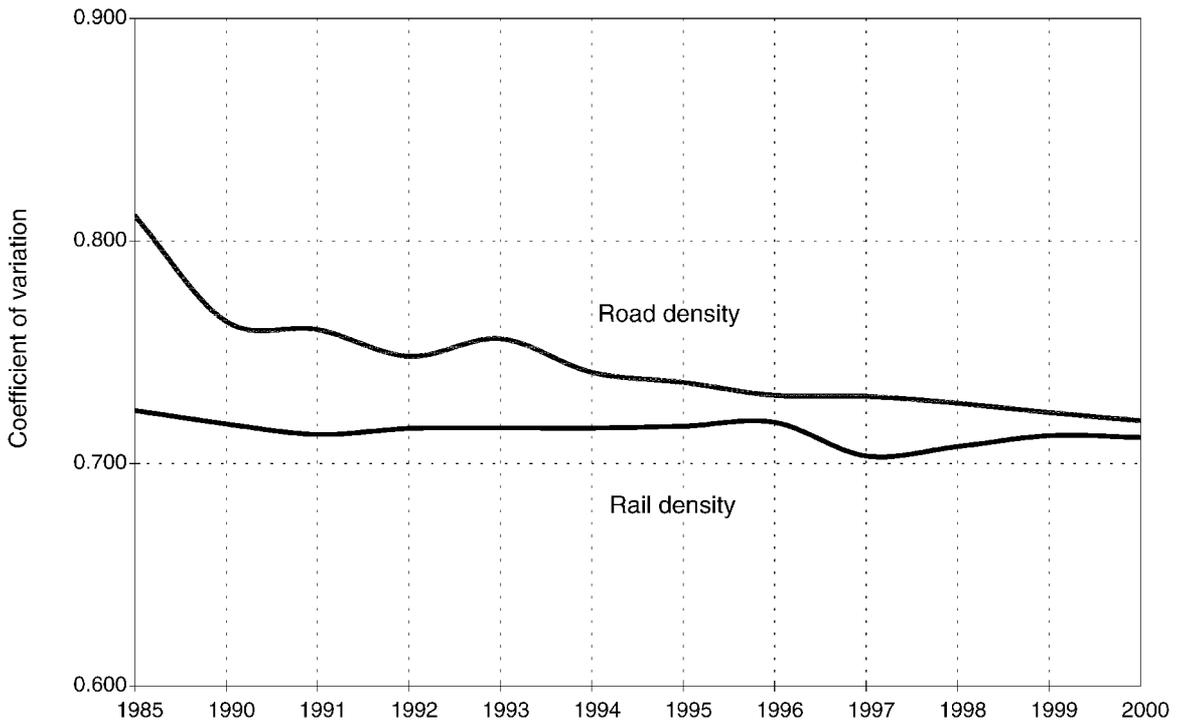


Fig. 8. Regional inequalities in density of the road and rail networks, 1985–2000. *Source:* Goskomstat Rossii, 2001a, various pages.

emerged in many regions.¹³ This led to a striking de-concentration of the educational opportunities and a reduction in regional disparities in educational attainment. As in the previous case, however, these figures do not suggest that spatial differentiation in the *quality* of education has similarly been on the decrease.

Infrastructure Endowment. Simple measures of infrastructure endowment relate the physical scale of provision to potential use, such as the length of roads per square kilometer or per capita. Figure 8 depicts trends in the degree of spatial disparity in road and railway network densities. Predictably, transport and communication disparities have tended to be quite stable. Between 1985 and 1998 the unweighted standard deviation changed modestly for both road and rail networks. The overall trend is somewhat convergent. At the same time there are enormous variations among regions. This stability reflects the collapse of state investment in infrastructure; again it cannot show the extent to which the network has deteriorated.

Summary. To conclude the evaluation of individual measures of Russian regional inequality, the following should be highlighted. First, there is evidence of varying trajectories of inequality, of two different types of variables. Economic variables on the whole display a clearly divergent trend of increasing regional inequality. The level of inequality in social indicators, on the other hand, has remained relatively stable over time and in some cases has exhibited convergence. Thus, what emerges is a pattern of diverging regional economic conditions that is not accompanied by similar trends in the social sphere. The spatial structure of

¹³Interestingly, the absolute numbers of both students and postgraduates increased over the last decade, perhaps in response to young people's uncertainty about the job market or, conversely, desire for training in new curricula not available during the Soviet period.

social inequalities therefore tends to be more inert. The robustness of social capital (partly accumulated under the Soviet system as, for example, in the case of health provision) to a certain extent may cushion the impact of rapidly declining regional economic fortunes.

Second, if the assumption of the divergent trajectories of social and economic regional performances is correct, the overall trend of regional inequality in post-communist Russia is rather complicated. Indeed, it depends on the relative importance attributed to the different dimensions of inequality. To gain a better understanding of this issue, a composite index may be useful. The development of such an indicator is the focus of the following section of the paper.

COMPOSITE INDEX OF REGIONAL INEQUALITY¹⁴

In the present study, two different approaches toward compiling an integral index of regional inequality are suggested. The first involves utilizing a number of indicative variables, and more specifically those having the highest loadings within the appropriate principal components. As the real income indicator has the highest correlation with the first factor (see Appendix 1), it is this variable that should be used to account for economic inequality. The density of the road network indicator clearly best represents the second principal component (density of transport and communications linkages). The third (social) dimension of total variance is best explained by life expectancy, by the unemployment rate, or the student numbers variable. However, the analysis in the previous section showed that the degree of regional variation in life expectancy changed very slowly over the time period studied. Thus, should this variable be included in the composite index? Furthermore, the unemployment rate had a higher loading on factor 1 than on factor 3. For this reason, the ratio of student numbers to regional population seems to be the most appropriate variable for factor 3.

If one assumes that all variables with loadings less than those of the leading/representative indicator are equally unimportant, then this may allow us to use the weights of the principal components in which the variables are included—that is, the proportion of total variance explained by each respective factor.

Thus, the composite index can be given as follows:

$$I_i = 0.286Income_i + 0.152Road_i + 0.131Student_i,$$

where I is the index of regional performance in the i -th region, $Income$ is per capita personal income, $Road$ is the density of road networks in the i -th region, and $Student$ is the ratio of the number of students to the population of i -th region.

Another way of constructing a composite index is on the basis of the leading principal component. More specifically, the variable loadings on the strongest extracted factor (the principal component accounting for the largest share of total variance) are used. This approach begins by reducing the number of regional variables used in the analysis to seven—real incomes, life expectancy, unemployment rate, number of doctors, number of students, density of roads, and infant mortality. These six variables all showing low correlations with

¹⁴The bulk of the analysis in this study was completed when the most recent information available was for 2000; however, during 2003, data for 2001 became available. We have used the more recent data to update the analysis using the composite index, rather than the entire analysis. The purpose of the initial analysis was to identify those variables that could be used to create an effective composite index, thus removing the need to constantly update a wide range of data sets.

Table 2. Factor Loadings from Principal Components Analysis of Seven Variables

Variable	Loading on Factor 1 (unrotated)
Life expectancy	0.3278647
Infant mortality rate	-0.6406643
Unemployment	-0.5408876
Road network	0.2175851
Doctors	0.7020996
Students	0.7277051
Real incomes	0.7710817
Percent of total variance explained	35.356

each other (correlation coefficients are less than 0.50 in all cases) and supposedly represent different dimensions of regional inequality. This data set (six variables, all regions) was then subjected to principal components analysis. The purpose of this procedure was to obtain the weights of already classified variables (the groups of which represent different dimensions of regional performance). For this reason only one principal component was extracted (see Table 2).

The formula can therefore be expressed as:

$$I_i = 0.328Life\ Expectancy_i + 0.641(IIInfant\ mortality_i) + 0.541(1/Unemployment_i) + Roads_i + 0.702Doctors_i + 0.728Students_i + 0.771Income_i,$$

where each term is a correspondent regional variable in Table 2.

The dynamics of the degree of spatial inequality determined by the two indexes are depicted in Figure 9. For illustrative purposes variation in regional personal incomes also is plotted. A simple juxtaposition of the trajectories of real personal income and regional performance measured according to the developed composite indices leads to the following preliminary conclusions.

First, the level of regional disparities in per capita incomes was higher than the degree of overall inequality in all years of the post-communist transition decade. Second, regional inequality measured by the first index mainly follows the dynamics of personal income disparities. This is apparently due to the highest “weight” attributed to the income variable in composite Index I. In addition, this regional parameter has the greater variation compared to the other two. However, there is an important difference in the 1994–1999 period—spatial socio-economic disparities tended to remain relatively stable, while regional income inequalities rose significantly. Third, regional performance disparities measured by Index 2, incorporating a wide range of regional indicators, do not display sharp deviations over the time period studied. The overall trend was somewhat divergent—regional inequalities somewhat increased in 1992–1999 (after a decline in the late Soviet period) with a slight fall in 1997. However, in 1999–2001 there was clear convergence. Moreover, in contrast to regional personal income inequality dynamics, regional performance measured by this index displayed convergence a year earlier (in 2000, rather than in 2001).

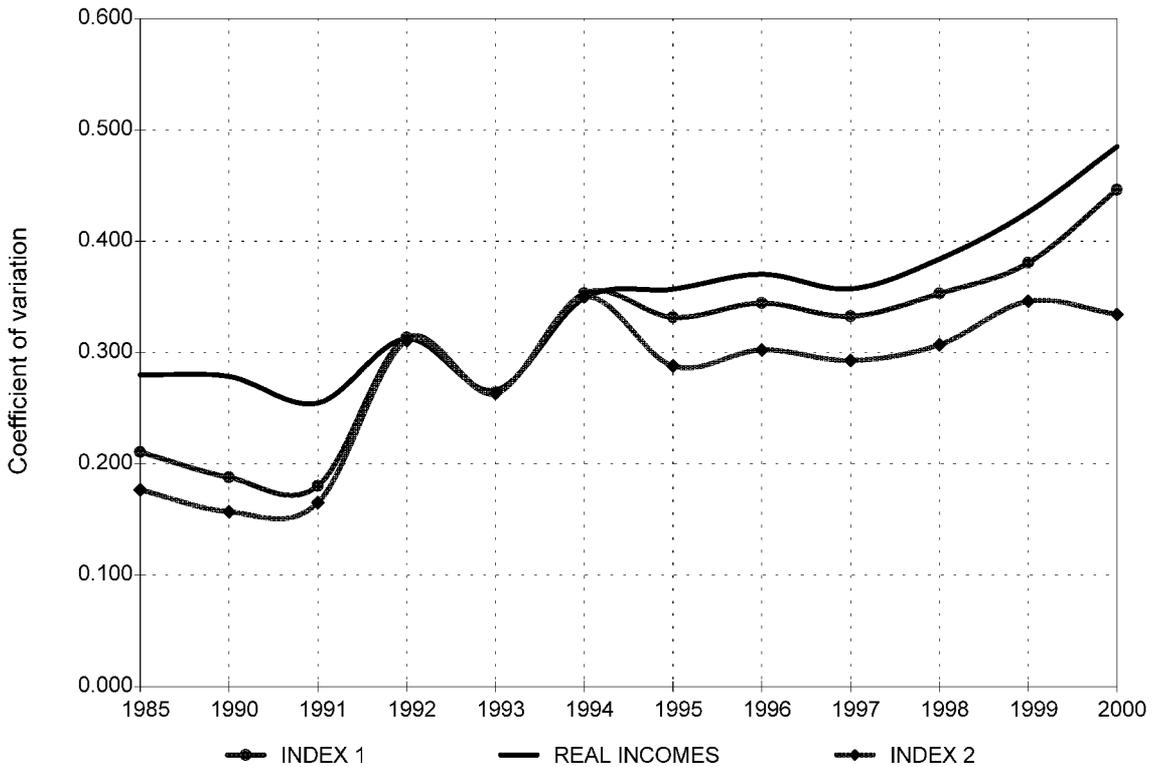


Fig. 9. Regional inequality measured by composite indexes, 1985–2000. *Source:* Goskomstat Rossii, 2001a, various pages.

All in all, despite the fact that the modeling of composite indexes is somewhat arbitrary, as it depends strongly on the technique used, what this analysis suggests is that regional inequality measured by a multivariable index differs significantly from that evaluated by a single indicator. More importantly, as the regional dynamics measured by both indexes demonstrates, the trajectory of spatial inequalities in development in Russia contradicts the widespread conception of a rapidly growing gap among the regions. Clearly, if the social and infrastructural characteristics are taken into account, territorial disparities display a somewhat more complicated pattern.

This raises the question of what might be creating such diverse multi-dimensional trajectories in the fortunes of Russia's regions. The next section of the paper examines some approaches for better understanding the nature of Russian regional development.

EXPLAINING PATTERNS OF REGIONAL INEQUALITY

Productivity and Employment Differentials

To help to identify the causes of uneven economic development, variations in real GRP per capita can be partitioned into two elements—productivity differentials and the employment rate, which are given by the following formula (after Dunford and Smith 2000):

$$\frac{GRP}{RP} = \frac{GRP}{E} \times \frac{E}{RP},$$

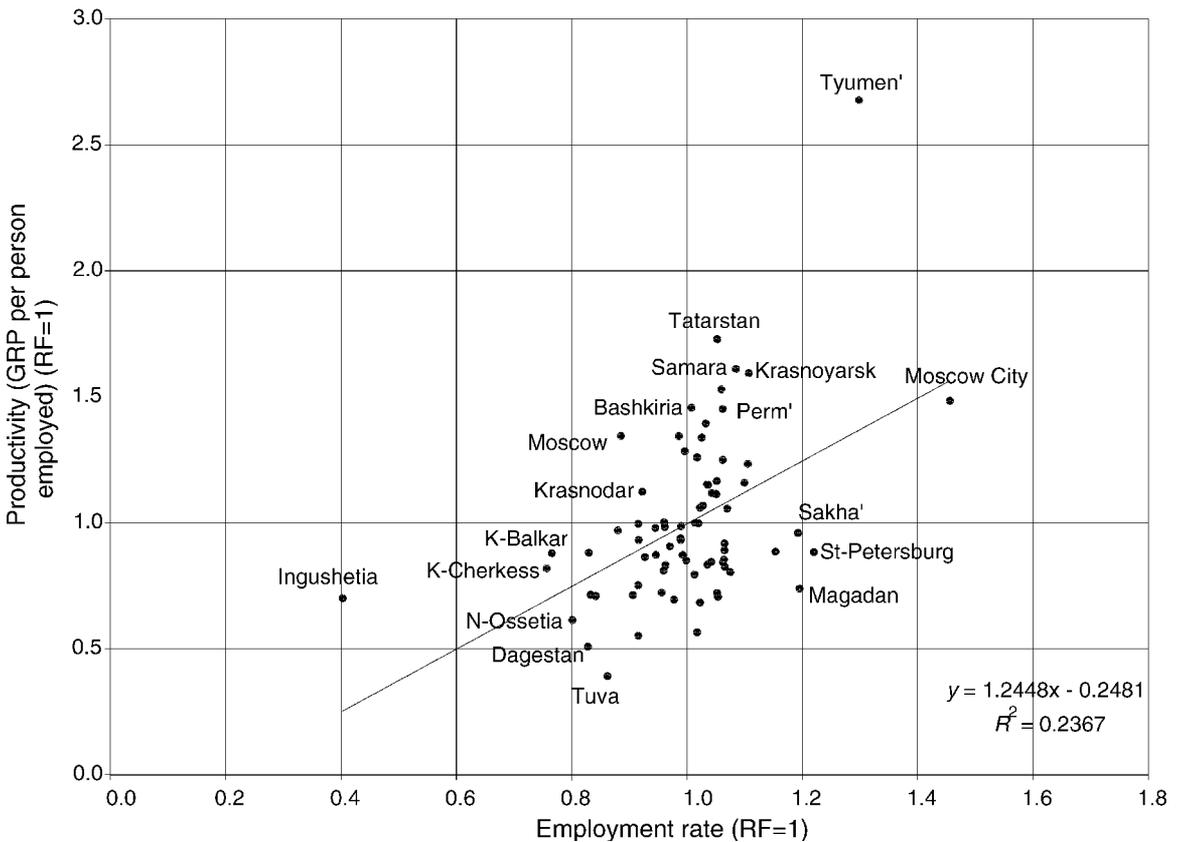


Fig. 10. Productivity and employment rate differentials among Russia's regions, 1998. *Source:* Goskomstat Rossii, 2001a, various pages.

where RP is regional population and E is regional employed population.

Figure 10 plots regional productivity and employment rates in 1998. What is seen is that clearly pronounced divides existed in Russia in that year, with all regions divided into one of four groups. First, within a number of the wealthiest regions, high productivity rates are combined with relatively high employment levels. These regions include: oil-and-gas-rich Tyumen' Oblast (2.7 times the Russian average and 129 percent in productivity and employment, respectively), Moscow City (148 percent and 145 percent), industrially diversified (with significant export capabilities) Tatarstan and Bashkortostan, Samara, Perm' in the Urals, and other regions. These regions are normally considered the “success” stories of Russian transition. All were fortunate enough to have favorable initial conditions at the start of post-communist transformation.

Second, in a number of regions productivity rates are below average (90–70 percent), but employment rates are among the highest in the country (118–122 percent). St. Petersburg, Magadan, and the Sakha Republic in the Far East are the best examples. The relative prosperity of these regions is based on either a single export-oriented industry (diamond and gold extraction in Sakha) or on the growth of service sector (St. Petersburg).

Third is a group of relatively highly productive regional economies (100–135 percent of the national average) with employment rates below the Russian average (85–95 percent), including, among others, industrially developed and beneficially located Moscow Oblast (surrounding Moscow City) and Krasnodar in the North Caucasus. The latter contains the country's largest oil-export port and extensive recreational infrastructures. Low employment

rates and therefore low mobilization of human capital can be attributed among other things to a limited number of competitive economic activities that cannot provide employment for large populations. It is possible that the shadow economy plays a part in absorbing these workers, as official unemployment rates remained relatively low.

Fourth, in more than one-third of Russia's regions productivity and employment rates are lower than the mean (40–99 percent and 39–96 percent, respectively). However, this group is rather heterogeneous, containing the extremely poor ethnic republics of Ingushetia (40 percent of the average employment rate), Tuva (39 percent of the mean productivity level), as well as relatively prosperous Leningrad Oblast (one of the leaders in foreign investment attraction), Ryazan' (oil refinery capabilities), and Khakassia (non-ferrous metal export industries).

Our assessment of trends in regional inequality for productivity and employment considered separately for Russia's regions from 1990 to 2000 reveal that the two variables behaved in roughly similar fashion. There was pronounced convergence of disparities in employment rates in 1990–1992, while a similar convergence in productivity differentials prevailed until 1994. Hence, during 1990–1992 both indicators contributed to the decline of inequality in per capita GRP in 1990–1994 identified above. After 1994 regional inequality in both indicators tended to increase, with a slight convergence in productivity levels after 1998, the year of the financial crisis.¹⁵ All in all, the analysis suggests that both variations in employment and productivity rates are equally important in explaining the patterns of regional development in Russia.

Empirical Tests

As noted previously, currently one of the most influential theories of regional growth is the neoclassical one, which posits that with decreasing returns to reproducible factors of production, poorer regions will gradually reduce the distance that separates them from wealthier regions. Is this assumption applicable to Russia? Since data for calculating indices of physical change in GRP are available only for 1997–2000, attention is focused on variation in real personal incomes. Figure 11 depicts average annual real rates of income growth (decline) against 1994 real income levels in the regions.

From examining the figure, it is apparent that the relationship between the two variables is statistically significant and has a positive trend. In other words, the wealthiest regional economies in Russia in 1994 fared better during the period 1994–2000, and divergence rather than convergence is indicated. This may reflect the fact that macroeconomic restructuring has generated a relatively long period of regional change, during which the forces promoting potential convergence have not yet become active. Thus, regional economic indicators such as GRP per capita and its components (productivity and employment levels), together with personal incomes, exhibit a divergent trend. Moreover, at least until 1999, relatively strong regional economies (some of them containing Russia's largest cities, or these cities themselves¹⁶) have tended to perform better than the rest of the country. This suggests that clear

¹⁵The economic collapse affected all branches of economic activity except for a number of export-oriented industries (in 1998 slight growth was recorded only in the gas and timber industries) and light (mainly, clothing) and food industries. The spatial distribution of the latter is somewhat more even compared to the other three. This, together with a rise in the prices of imported goods (foodstuffs in particular) led to an increase in productivity in the food subsector and a slight regional equalization.

¹⁶The cities of Moscow and St. Petersburg, as subjects of the federation, have the status of regions in Russia.

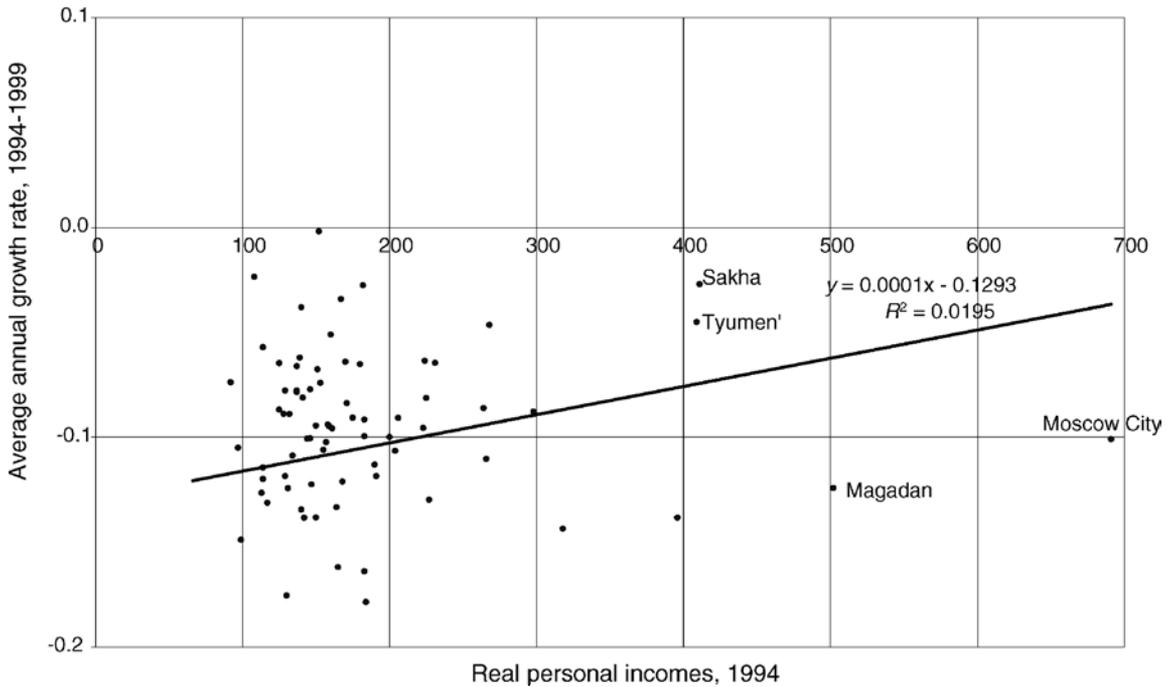


Fig. 11. Relationship between average income growth rate (1994–2000) and initial levels of personal income (1994). *Source:* Goskomstat Rossii, 2001a, various pages.

Table 3. Relationship between Presence/Absence of Large Cities and Regional Economic Performance

Indicator	Dummies for presence of cities (pop., thous.)		
	100	500	1000
Real GRP per capita	0.398	0.362	0.316
Real income per capita	0.389	0.259	0.269

center-periphery spatial relations, generated under central planning and as such a legacy of the command economy, have continued to play an important role in shaping Russian regional performance.

To quantify and test this assertion a dummy variable distinguishing regions containing cities of more than 100,000, 500,000, and one million population from other regions was used. Correlation coefficients between these variables and real per capita income and GRP in 2000 are displayed in Table 3. To make the analysis more demonstrable, the cities of Moscow and St. Petersburg and the respective oblasts surrounding them (Moscow and Leningrad) were excluded from the analysis, as well as Tyumen' Oblast, which because of its petroleum wealth is an apparent outlier. The results presented in the table show that the presence of urban agglomerations has a positive effect on regional economic performance. The relationships are relatively strong and highly significant at the 5 percent level. Such a core-periphery divide, however, is far from a new phenomenon in Russia. It is along this axis that regional economic inequality is most pronounced (Gritsai et al., 1991; Treivish 1999). In addition, it is often argued that large cities with a population of over one million developed differently from medium-sized cities and smaller urban settlements (Vardomsky and Samburova, 1995).

To summarize, the economic performance of Russian regions during the 1990s has been characterized by divergence. Those regions that fared better were those with the most favorable initial conditions. The factors that appear to have contributed to the relative “success” of a number of regions whose economies surged ahead include export capability, diversified economic structure, and the presence of an urban agglomeration. However, trends in other (social) dimensions of regional development are strikingly different. Although regional disparities in such indicators as educational attainment, health care provision, and infrastructure endowment are significant, they have remained relatively stable over time and, in some cases, even exhibit convergence.¹⁷

It is now possible to evaluate the applicability of the two basic types of regional development models to the Russian case. Clearly, the neoclassical predictions of regional convergence (thus far) have not proven correct. Thus, the net balance between the magnitude of the two types of forces—centripetal and centrifugal—seems to favor the latter. This question is of fundamental importance in Russia, as it is not clear how long the temporarily stable level of inequality in social characteristics will persist in light of the diverging economic conditions. This highlights the importance of public policy—whether Russian authorities can effectively respond to the challenge of a widening gap between regional economies. This question is considered in the next section of the paper.

DO FEDERAL FISCAL TRANSFERS IN RUSSIA EQUALIZE?

One of the most obvious channels of state regional policy is the system of financial support for the regions. In Russia, since 1994, considerable effort has been expended in attempts to reform fiscal federal relations in the direction of a more regionally equalizing system (Lavrov, 1999, 2001). Given the scarcity of public resources, it is important to know whether the system of regional financial support has been distributing them in the right direction. Employing the results of the analysis thus far, this final section compares actual patterns of federal budgetary transfers with trends in regional inequality over the transition decade of the 1990s.

In evaluating the equalizing effects of Russia's these transfers, the following points should be made. First, the official objective of federal financial support for the regions is the reduction of inequality in regional tax capacities. The latter parameter are currently calculated on the basis of GRP data. Obviously, tax potential does not capture the entire range of regional characteristics considered above, so it should be made clear *a priori* that the goals of fiscal leveling are rather limited. Second, although fiscal transfers constitute the largest part of federal-to-regional financial flows, they are only one of the many other channels of federal support. Thus, the evaluation of the fiscal equalization effect is made only for the case of the most obvious part of federal financial assistance.

The equalization effect of federal transfers can be assessed in at least two ways. The first is to compare the per capita tax revenues collected from the regions with the share that federal transfers constitute in the region's revenues. The second is to compare the level of inequality in real per capita revenues across Russia's regions before and after the transfers.

Figure 12 plots regional real per capita tax revenue against the shares of the federal transfers in regional revenues in 1999. As is apparent, there is a strong negative statistical relationship between the two parameters. If Moscow and Tyumen' are excluded (as in Fig. 12) the

¹⁷However, this may be a process of “leveling down” rather than “leveling up.”

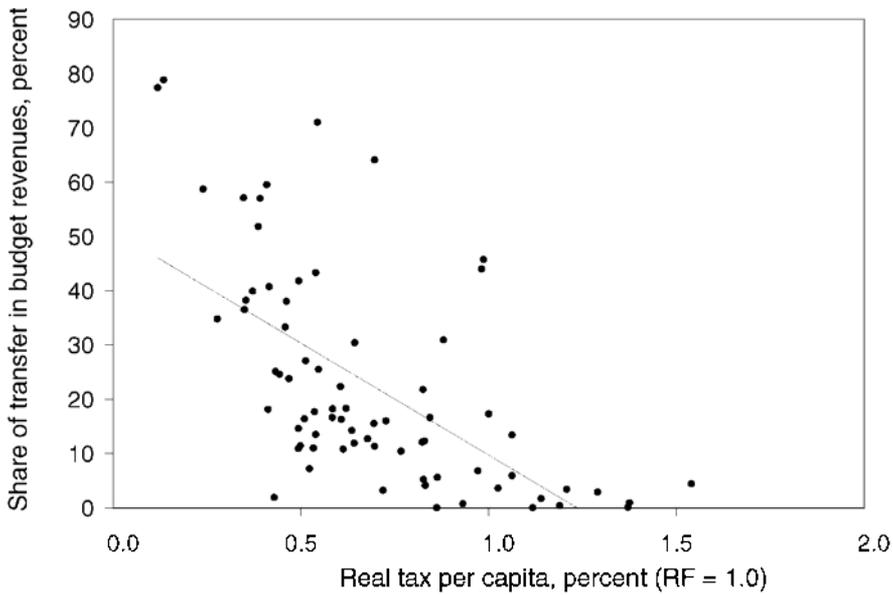


Fig. 12. The relationship between regional tax revenues and the share of federal transfers in regional revenues, 1999. *Sources:* Goskomstat Rossii, 2001a, various pages; Lavrov, 2001.

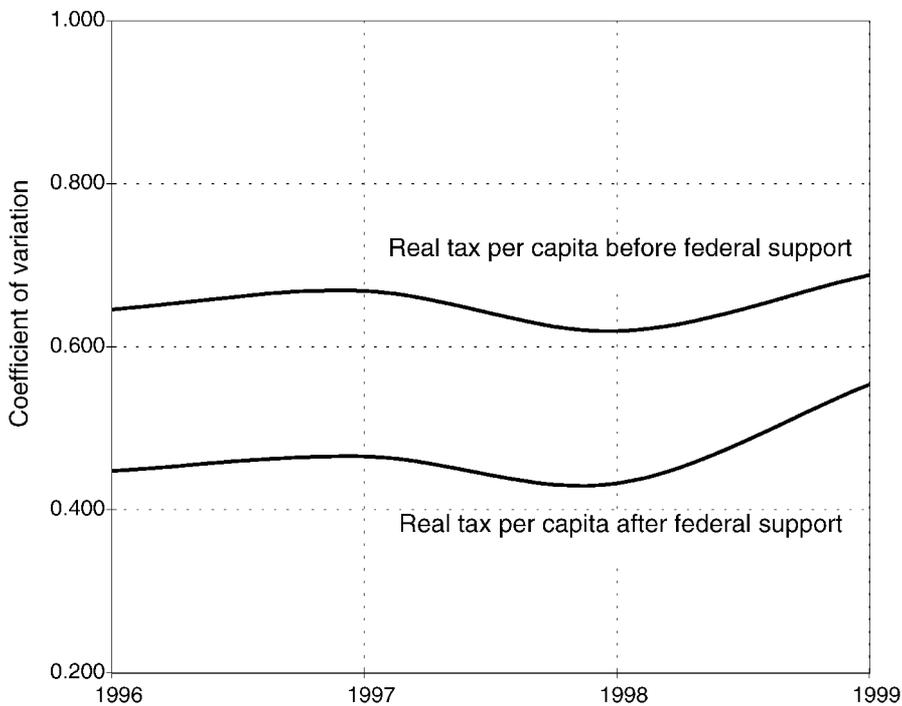


Fig. 13. Inequality in regional budget revenues before and after federal assistance, 1996–1999. *Sources:* Goskomstat Rossii, 2001a, various pages; Lavrov, 2001.

coefficient of correlation increases from -0.492 to -0.621 . Clearly, there is strong statistical evidence for transfers of federal financial support to the poorest regional economies. A relationship of similar magnitude is observed for the entire period 1995–1999 period.

But does federal aid equalize? Figure 13 charts the dynamics of variations in regional per capita tax revenues before and after transfers for the period 1996–1999. Trends in

regional tax revenues after financial support tend to follow those before fiscal transfers rather closely. However, the *magnitude* of disparities in regional revenues falls dramatically after the distribution of federal support. More strikingly, the ratio between extremes for individual years decreases from 25–30 times to 6–9 times after fiscal transfers. These calculations clearly suggest that federal transfers do have a leveling effect.

However, more importantly, the overall picture of regional inequality in per capita revenues does not change. Most of the recipient regions remain relatively poor even after the distribution of federal aid, whereas the number of comparatively wealthy regions remains unaltered. Obviously, the scale of fiscal equalization depends on the resources available. For this reason, given the current size of the Fund for the Financial Support of the Regions (FFSR; 1.5 percent of Russia's GDP in 1999), the only manageable objective appears to be reduction of extremely sharp contrasts in regional tax potentials. Although federal transfers are only a part of broader center-to-region financial flows, the divergence of regional economic indicators during the 1990s suggests that these channels of federal assistance do not change the direction of the forces underlying regional development.

CONCLUSIONS

Regional development in Russia continues to be characterized by substantial territorial disparities. The process of post-communist transformation has led to a number of distinct socioeconomic trends, which form a complex picture of regional change. An increase in levels of regional inequality usually demands a response by the state to equalize living standards. What this response might be depends on how one measures, analyses, and explains the patterns of uneven development, in other words, on how one defines the regional problem. This study has outlined some basic approaches to examine and account for regional inequality in Russia, with a main focus on understanding whether regional differentiation or equalization is occurring.

Employing principal component analysis, we identified three major dimensions that appear to be involved. The available data suggested that although there was a pronounced divergence of the *economic* fortunes of Russia's regions, spatial disparities in *social* and *infrastructure* indicators remained relatively stable or even selectively indicated convergence. In most cases, the findings were not sensitive to the measuring techniques used. By building different dimensions of inequality into the analysis, it was possible to identify a more complicated trend in regional inequality, in contrast to the purely divergent one that is often suggested.

Disaggregation of regional production levels in terms of productivity and employment differentials revealed clear divides across Russian regions. A number of relatively wealthy regions were well ahead of their neighbors in terms of both employment and productivity rates. Clearly, the uneven development inherited from the Soviet period is one of the key factors in shaping contemporary regional trajectories. Overall, however, it can be argued that post-communist transition tends to enforce centrifugal tendencies that have been moderated but not yet counterbalanced by income transfers via Russia's system of federal support for regions.

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Appendix 1. Results of Principal Components Analysis

Factor	Extracted factor loadings		
	1	2	3
Life expectancy	0.079	0.346	0.487
Population density	0.026	0.834	0.077
Rural population density	-0.188	0.817	0.239
Urban population	0.759	-0.028	-0.245
Birth rate	-0.514	-0.422	0.528
Death rate	0.081	0.566	-0.493
Dependency ratio	-0.427	0.706	0.102
Infant mortality	-0.556	-0.371	0.187
Unemployment	-0.556	-0.295	0.568
Real expenditure	0.860	-0.142	0.320
Income/expenditure	0.529	0.539	0.019
Real monthly wage	0.571	-0.439	-0.333
Share of the "poor"	-0.708	-0.073	0.357
Real GRP per capita	0.765	-0.067	-0.281
Real GRP, industry, pct.	0.504	-0.167	-0.522
Real GRP agriculture, pct.	-0.277	0.428	-0.236
Number of SMEs	0.666	0.030	0.501
Automobiles, per 1000	0.606	-0.028	0.101
Density of motor roads	-0.060	0.882	-0.050
Telephones (urban)	0.672	0.132	0.296
Telephones (rural)	0.296	-0.420	0.252
Retail turnover, per capita	0.835	-0.082	0.304
Number of researchers	0.704	0.074	0.528
Unprofitable enterprises	-0.586	-0.585	0.005
Fixed capital investment	0.503	-0.348	-0.004
FDI per capita	0.140	-0.225	0.032
Number of doctors	0.564	-0.001	0.375
Number of hospital beds	0.001	-0.113	-0.404
Industrial output	0.545	-0.155	-0.534
Number of students	0.508	0.199	0.543
Meat consumption	0.291	0.036	-0.120
Real incomes	0.848	0.033	0.076
Pct. of variance explained	28.357	15.334	11.506

**Appendix 2. Results of Adjusted Principal Components Analysis
(reduced data set)**

Factor	Extracted factor loadings		
	1	2	3
Life expectancy	0.135	-0.508	0.572
Population density	0.215	-0.874	-0.015
Urban population	0.742	0.223	-0.193
Birth rate	-0.632	0.169	0.611
Death rate	0.242	-0.309	-0.688
Infant mortality	-0.652	0.278	0.197
Unemployment	-0.635	-0.010	0.497
Share of the “poor”	-0.721	-0.064	0.214
Real GRP per capita	0.712	0.239	-0.101
Number of SMEs	0.643	0.118	0.489
Automobiles, per 1000	0.577	0.138	0.151
Density of motor roads	0.160	-0.885	-0.175
Telephones (urban)	0.691	-0.050	0.269
Number of researchers	0.667	0.108	0.470
Unprofitable enterprises	-0.716	0.483	-0.011
Fixed capital investment	0.444	0.386	0.130
FDI per capita	0.127	0.256	0.043
Number of doctors	0.546	0.162	0.366
Number of hospital beds	0.003	0.264	-0.536
Industrial output, pct.	0.515	0.221	-0.286
Number of students	0.523	-0.049	0.538
Meat consumption	0.209	0.125	-0.201
Real incomes	0.804	0.157	0.149
Pct. of variance explained	28.641	15.237	13.131

Appendix 3. Statistical Techniques for Measuring Regional Inequality

This study uses the following techniques to measure the level of regional inequality. The *mean absolute deviation* is defined as:

$$\bar{d} = \sum_{i=1}^n |x_i - \bar{x}|,$$

where x_i is the value of an examined indicator in region i ; \bar{x} is the average of a chosen regional variable x .

The *mean weighted deviation* (WAD) is given by the following equation:

$$\bar{d}_w = \frac{\sum_{i=1}^n |x_i - \bar{x}| \cdot \frac{p_i}{n}}{\sum_{i=1}^n p_i},$$

where p_i is the share of a region in the total population.

The *standard deviation* and its weighted variant (WSD) are defined by the equations:

$$d = \sqrt{\sum_{i=1}^n (x_i - \bar{x})^2}, \quad d_w = \sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \cdot \frac{p_i}{n}}.$$

In some cases the standard deviation and the mean absolute deviations are expressed as percentages of the mean to give a coefficient of variation (CV).

The Lorenz curve-based coefficient of concentration (Vanhove, 1995) is defined as:

$$R = \frac{\sum_{i=1}^n |p_i - x_i|}{\sum_{i=1}^n p_i}.$$

In the context of regional inequality the Gini coefficient (Cowell, 1995) can be given by the following equation:

$$G = \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n p_i p_j \left| \frac{x_i}{p_i} - \frac{x_j}{p_j} \right|.$$

Theil's index is defined as:

$$I_T = \sum_{i=1}^n \frac{x_i}{X} \log \frac{x_i/p_i}{X/P},$$

where x_i and X are the shares of the region in the total value of the examined phenomenon and the total value of the phenomenon, respectively.