

Space – Time approach to Investigation of Interregional Income Inequality across The Subjects of The Russian Federation (1995 – 2010 years)

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Abstract

The Russian Federation occupies a large territory; its aeries have different geographical, natural and social – economic conditions. The state has multi-level administrative subdivision. It consists of nearly the eighty Subjects. The Growth of spatial disparities in social – economic development during the last twenty years determine the needs in more detailed studying of factors and dynamics of interregional income inequality in Russia. The results of our studying in this field have been presented in the paper. The investigation is based on information, regular published by ROSSTAT. The space - time data series about nominal income per capita and income sources for all regions of The Russian Federation for the period 1995 - 2010 years are used for studying.

Three aspects of interregional differentiation have been considered.

The first one is “Dynamics of spatial disparities”. It includes the comparative analysis of income per capita and its structure across the all Subjects of The RF during the time. Further *income pc in region* means average per capita income for the entire population of a Subject or a region.. Income structure includes five components: (1) *business (enterprise) activity*; (2) *wages (salaries)*; (3) *social transfers*; (4) *income from properties*; (5) *other incomes*, including shadow income. Distances between income distributions by sources in The Russian Federation and in each of The Subjects have been considered in dynamics. Methods of descriptive statistics are used for these aspects. Results have been indicated the stable gap between 80 percent regions with low income pc and 20 percent regions with high income pc during the time. It is important to mention two main tendencies in income structure. The first one is decreasing of share of income from *business activity* (enterprise) from 17 percent in 1995 down to 9 percent in 2010. The second one is the stable share of *other incomes*: it is near to 26 percent.

The second aspect is the analysis of dynamics of *CINI* for spatial distribution of Total Monetary Income (*TMI*) across the Subjects of RF and its decomposition by five structural components of income. The analysis enables us to make some conclusions. There is a tendency to decreasing of common GINI (for TMI) after 2000 year. At the same time, one can

observe on enormous value for *GINI-4*, that measures interregional distribution inequality of Total Income from *property*. It is the result of property concentration into some regions of Russia. As to concern *GINI-5* for *other incomes*, it was also very high before the crisis of 2008–2009. Now it decreased, but most Subjects have the shares of this type of income much closer to thirty percent than previously.

The third aspect of research is based on the analysis of the geometry of the *Lorenz curve* for grouped data. *Ratio index* is determined as relationship between *income pc* in region and in Russia (as a whole). $R(t)$ - “*ratio index*” has been used for visualisation of the changes in the position of each Subject in the row of all Subjects ranged by *income pc* at the moment t . The trajectories of $R(t)$ have been compared for all regions of Russia ranged by *income pc* in 2010. Obviously, the dynamics of $R(t)$ is not a Markov process. To estimate trends of $R(t)$, new index $IAP(t)$, named *index of accumulated potential* has been proposed and estimated for *income pc* and its five components for the period 1995–2010 years. The results of the analysis have been presented in the paper more detailed.

Key words: Russia, regions, income per capita, sources of income, structure of income, spatial inequality, *GINI*, Index of accumulated potential, trajectories of dynamics.

JEL classification: C23, D33, D63, R12.

Introduction

The main ideas of Sustainable development were declared at The United Nations Conference on Environment and Development (UNCED), which took place in 1992 in Rio de Janeiro, Brazil. Many researchers pointed at the inter-disciplinary nature of sustainable development. As a result, ideas of spatial scientific investigation, policy and administration combined harmoniously in the early 2000s and formed together a new complex direction of thinking. This mainstream is well known now as Spatial (or Regional) Sustainable Development (S-R SD). A. Sumi emphasized that the environment consists of three components - the natural, social and human - and their interactions [A.Sumi, Akimasa (2007)].

Ideas of Spatial approach to economic development have a long history in the World and in Russia too. A.G. Granberg links the significant progress in this area of economic studies with the first publication of monograph of A. Losh “Die raumlische Ordnung der Wirtschaft” in 1944¹. The different aspects, approaches and results of studying S-R SD have

¹ A.G. Granberg. Preface “The spatial organization of Economy”. See the book: A.Losh. The Spatial organization of Economy”. M.: Nauka, 2007.

been the subjects of many discussions and publications in Russia. Only a few of them indicated below.

The program “Fundamental Issues of Spatial Development: Interdisciplinary Synthesis” launched by the Presidium of the Russian Academy of Sciences for 2009-2011 was based on ideas of Sustainable Development.. A.G. Granberg was its leader in 2009 – 2010. This study brought together researchers from different departments of RAS.

The New Economic Association (NEA) and the Economic Department of Russian Academy of Sciences (RAS) organized the First Russian Economic Congress (REC-2009). It held in Moscow in December 2009. Great attention of participant paid to the problem of sustainable spatial development. There were a variety of round tables and thematic sessions such as “New Stage of Spatial Development of Russia”, “Spatial Development and new Regional Policy”, “International Advances in the Regional Policy and their application in The Russian Federation”, “Spatial Transformations of Russian Economy” and others. Russian authorities and many well-known Russians scientists – O. Kuznetzova, V. Leksin, P. Minakir, A. Shvetsov, S.Valentay, L. Vardomsky and many others took part in the discussions². A.G. Granberg wrote in his report presented at The First Russian Economic Congress (REC-2009), that Spatial Economics is the more integrated scientific direction than Regional Economics [Granberg A.G.(2009)], because the object of its studies is not only regions or regional systems, but all the spatial formations of economy.

In 2011, to continue and to improve processing of this direction of scientific research, and its political and practical application, *The Journal of the New Economic Association* published the proceedings of the Roundtable named “Factors and Tendencies of Regional Development in Russia”. Participants discussed the problems of spatial heterogeneity, interregional cohesion, foundations and tools of regional policy and many others³.

The IX International scientific – practical Conference “Economic Policy and a new Model of Spatial Development of RF”⁴ held in The Ural Federal University in April 2012. The “Social Policy” and “Spatial Development and Regional Cohesion” attracted the attention of the participants⁵. They stressed the importance of close co-operation between scientists and managers.

² <http://www.econorus.org/encongress.phtml>

³ The Journal of the New Economic Association 2011, Issue 10, p.p. 150-182

⁴ <http://urfu.ru/science/conf/ustoichivoe-razvitie-rossiiskikh-regionov/>

⁵ The last is the most topical theme in recent international events as well as Inequality.

Different aspects of spatial development in Russian Federation have been considered in Siberian Branch of RAS for a long time [Kuleshov V.V. Seliverstov V.YE. Suslov V.I. Suspitsin S.A. (2012)]. Different ways of proceeding with previous studies were presented at the program “A new program of basic researches on the Russian spatial development” [Kotlyakov V.M., Glezer O.B. Treyvish A.I. Shvetsov A.N. (2012)].

The New Economic Association (NEA) and the Economics Sector at the RAS held on February 18-22, 2013, at the ancient Russian city Suzdal, the Second Russian Economic Congress (REC-2013). The Congress featured over 1,000 economists engaged in academic centers, research foundations, universities and other higher education institutions as well as post-graduates and senior students. The participants held open discussions addressing the most burning theoretical and practical economic issues. The different aspects of spatial social – economic development in Russia were discussed also

Inequality in the broad context is one of the pillars of sustainable development. It is the well - known problem around the World. The study of Income inequality within populations, across the regions and countries, their factors and tendencies attracts the attention of many International organizations, national scientific centers and institutions, such as World Bank, OECD, European Commission, UNU-WIDER, IARIW, RSAI, ECINEQ and NBER.

Well-known researchers - Atkinson A., Barro R., Birdsall N., Bourguignon F., Cowell F., Duclos J., Ferreira F., Jenkins S., Kaplow L., Kuznets S., Lu M., Milanovic B., Shorrocks A, Wan G., Wang Z., Yitzhaki S., Zhang Y. and many others publish their works in numerous scientific journals. “The Annals of Regional Science”, “Journal of Economic Inequality”, Review of Income and Wealth”, “Empirical Economics”, “Papers of regional science” regularly inform the readers about new results in spatial economics. The leading economist of the WB Francisco Ferreira is concerned about the growing inequality in the United States [Ferreira, Francisco (2012)].

China’s Government pays attention to Income Disparities between and within the Region. The National People’s Congress (NPC) approved China’s *12th Five-Year Plan for National Economic and Social Development* (FYP) (2011-2015) in March 2011. The plan’s key themes are rebalancing the economy, ameliorating social inequality and protecting the environment. The problem of inequality is the focus of many researchers of Chinese. The study of interregional income inequality, its estimation and decomposition over wide range of factors helps to formulate the social and economic policy [Wan Guanghua (2007a, b, c)], [Zhu Cuiping, Guanghua Wan (2012)].

The problem of income inequality is very hard in Russia. The challenge of reducing of inter-regional social – economic inequalities is formulated as a goal of economic development of The Russian Federation in “Conception 2020”, adopted in 2008. The important aspect of this problem is interregional income differentiation. Considering the trend of spatial disparities in The Russian Federation, A.Granberg discussed the possible disintegration of Russia. He indicated three dangerous tendencies in Russia: divergence of regions, economic disintegration and demographic concentration of population [Granberg A.G. (2011)].

Below some result of our study of interregional income differentiation in Russia are presented. The spatial analysis are based on the classical statistical methods of variation row. A new approach to the comparative analysis of income dynamics across the regions is proposed.

Part I. Analysis of inter regional inequality of income measured in nominal rubles.

1.1 Income inequality in Russia across all population

Table 1.

Income per capita and distribution of Total income by 20% groups of population (in month, rubles, before 1998 in thousands of rubles) Russian Federation 1991 - 2010

	1991	1995	2000	2007	2008	2009	2010
income pc	0.5	516	2281	12603	14948	17009	18881
distribution of Total Income by 20% groups of population							
first	11.9	6.1	5.9	5.1	5.1	5.1	5.2
second	15.8	10.8	10.4	9.7	9.8	9.8	9.8
fird	18.8	15.2	15.1	14.8	14.8	14.8	14.8
fourth	22.8	21.6	21.9	22.5	22.5	22.5	22.5
fifth	30.7	46.3	46.7	47.9	47.8	47.8	47.7
SUMM	100.0	100.0	100.0	100.0	100.0	100.0	100.0
GINI	0.260	0.387	0.395	0.423	0.422	0.422	0.421
FUND		13.5	13.9	16.8	16.8	16.7	16.5

Source: http://www.gks.ru/bgd/regl/b11_13_p/Main.htm

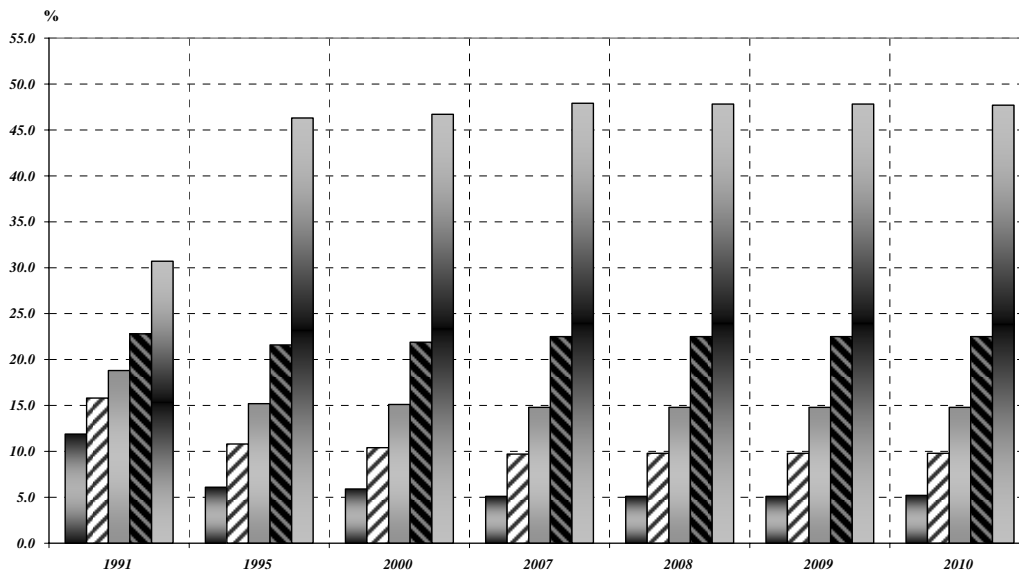


Fig1. Total Income by 20 % groups of population ranged by per capita income. The Russian Federation, 1991 - 2010.

The Data presented in Table1 and Fig1 enable us to say that there have been significant changes in the distribution of population by income level. In 1991 – 1995 years, the nominal ruble has grown a thousand times. At the same time the share of Total income in the first 20% group of population was reduced 2 times and the share of total income in fifth 20% group increased 1.5 times. In the future, this trend will continue. In 2010 year, the 20% of population with low income have had only 5% of Total income. At the same time, the 20% of population with high income have had nearly 50% of Total income. GINI in Russia was growing quickly in 1991 – 1995 and in 1995 – 2007. Now GINI in Russia is consistently higher than in the European Union.

1.2. Actuality of inter regional analysis of income inequality across the Subjects of RF.

There are two approaches to the investigation of this problem for counties having a large territory, different geographical conditions and multi-level administrative subdivision. The first one is to analyze differentiation of population by income within region. The second one is to study inter regional differentiation. They both create a picture showing the distribution of the population by income groups as well as across the country. The decision to analyze the dynamics and factors of inter regional differentiation is based on data concerning the average income in The Federal districts and The Subjects of The RF.

Table 2

Average per capita income in Federal Districts of Russian Federation, 1995 - 2010 (in month, rubles, before 1998 in thousands of rubles)

Federal District	1995	2000	2005	2007	2008	2009	2010
Russian Federation	516	2281	8112	12603	14941	16857	18881
Central FD	692	3231	11084	17085	19105	22215	24525
North West FD	565	2269	9045	13282	15070	17446	19741
South FD	309	1429	5333	8717	10885	12437	15031
Privolzhsky FD	369	1726	6220	9930	12351	13867	15697
Urals FD	605	2744	9507	15025	18685	19848	21586
Siberian FD	494	1933	6680	10286	12889	13491	14892
Far East FD	649	2498	8892	13376	15622	18262	20809
<i>Difference</i> *	383	1802	5751	8368	8220	9778	9633

* *Difference* = *MAX (income pc) - MIN (income pc)*

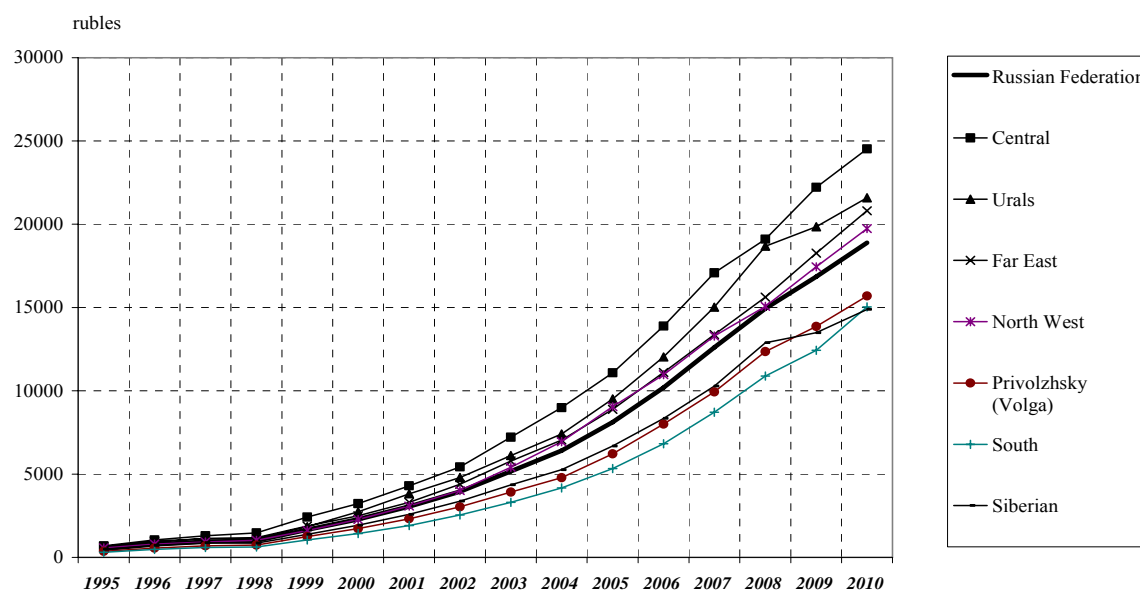


Fig 2. Average per capita income in Federal Districts of Russian Federation 1995 – 2010

Before the crisis of 2008 - 2009, the order of The Federal Districts by the average per capita income (income pc) was stable (Table 2, Fig.2). Differences between them were significant. After the crisis of 2008-2009, trends have changed for Central, Ural and Siberian districts, but now there are no new data to update the trends for 2011 – 2012.

As concerns the 79 subjects of The RF, the average per capita income (*inc*) in the richest regions was 5-10 times more than in the poorest (Table 3, Fig. 3). The difference between the upper and the lower boundaries of the range of variations are two times more than the nominal average income in Russia

Table 3

Range of variation series of per capita income in the subjects of RF (in month, rubles, before 1998 in thousands of rubles). 1995 – 2010

	1995	2000	2005	2007	2008	2009	2010
<i>RF</i>	516	2281	8112	12603	14941	16857	18881
upper bound	1710	7998	24958	35490	34207	41891	43876
lower bound	123	587	2405	4006	5594	6400	7540
Range	1587	7411	22553	31484	28613	35491	36336

Fig. 3 indicates also the changes in the trend of *inc* in 1998 – in this year there was the first crisis of Russia “in transition”, and the next in 2002 year. The last change was determined, probably, by some institutional changes (it needs to be considered).

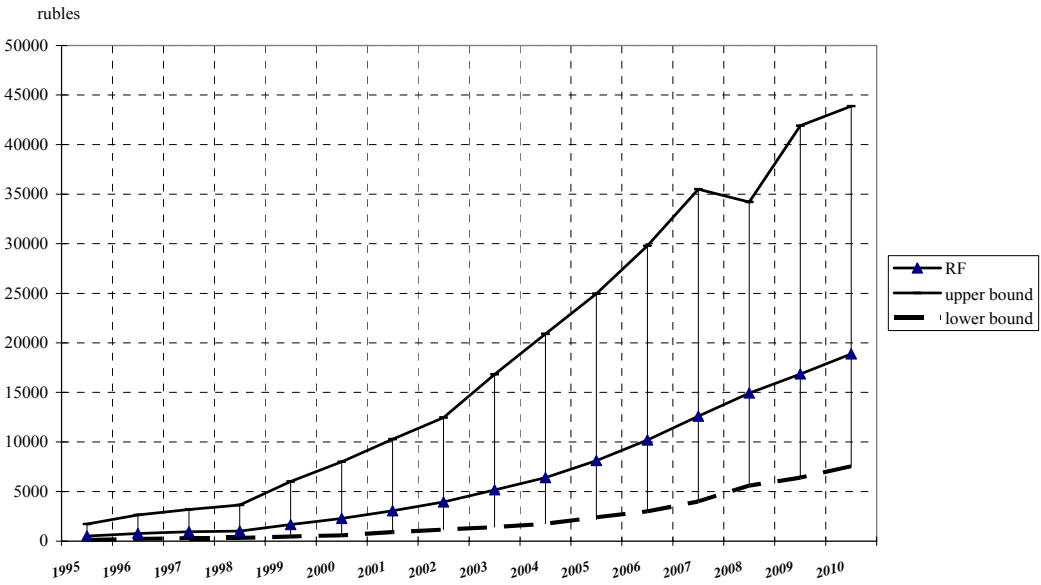


Fig 3 Range of average per capita income (*inc*) in the subjects of RF. 1995 – 2010

The data, presented above, could explain, why inter regional inequality of income in Russia has been choose as the direction of research. For this, the 79 subjects of RF have been taken into consideration. Comparative analysis has been based on the official statistical data, published by the Federal State Statistics Service (GKS). The period of observation includes 1995 – 2010 years.

1.3 Income Sources and Income Structure.

Income sources have been the most important and aggregated factor of the income level. Availability of various sources of income is determined for each person by social – economic development of the country and region of residence and individual social-demographic position (“social capital”) as well as competitiveness in the labor market.

Official statistic of Russian Federation register regular five sources of income and, consequently, five components of incomes structure:

inc1 – income from business (enterprise) activity;

inc2 - wages (salaries);

inc3 - social transfers;

inc4 – income from property;

inc5 – other incomes (incomes from other, not determined sources, shadow income).

Dynamics of Total Income Structure (*TIS*) in The Russian Federation presented below let us speak about its fundamental transformation during the transition period and beyond (Table 4).

Table 4.

Structure of Total Income by sources in Russian Federation (in percent), 1990 - 2010

	business	wage	social transfers	property	other income	Total Income
1990		74.1	14.7	2.5	8.7	100
1995	16.4	37.8	13.1	6.5	26.2	100
1996	13.7	40.7	14.2	5.4	25.9	100
1997	13.0	38.1	15.0	5.8	28.1	100
1998	14.2	37.8	13.5	5.5	29.0	100
1999	12.6	35.3	13.4	7.3	31.4	100
2000	15.4	36.5	13.8	6.8	27.5	100
2001	12.6	38.5	15.2	5.7	28.0	100
2002	11.9	40.9	15.2	5.2	26.8	100
2003	12.0	39.4	14.1	7.8	26.7	100
2004	11.7	40.3	12.8	8.3	26.9	100
2005	11.4	39.6	12.7	10.3	26.0	100
2006	11.1	39.5	12.0	10.0	27.4	100
2007	10.0	41.4	11.6	8.9	28.1	100
2008	10.2	44.7	13.2	6.2	25.7	100
2009	9.7	41.2	14.9	6.5	27.7	100
2010	9.3	40.6	17.8	6.3	26.0	100

It could indicate the main features of changing. Before 1995, there was not any income from “business / enterprises activity”. The main source of income was “wage / salary”, it constituted 75% of Total Income. “Social transfers” played a modest role. “Property” and “other income” together brought only ten percent of Total Income (*TI*).

During 1990 – 1995 income from business grew up to 17%; share of wage / salary decreased two times, share of social transfers was stable, but shares of income from “property” and “other income” increased two – three times. Together they brought Total Income up to 33%.

What are the main features of further transformation of *TIS*?

Shares of income from business activity have been decreasing during all this time; share of wage / salary was stable as a share of “other income”; share of social transfers changed within small limits; share of income from “properties” takes the position near 6-7%. These tendencies may be called negative, because in 2010 less than 10% of *TI* consisted of business, 40% - of wage, 26% - of “other income”, 6-7% of “properties” and 18% - of “social transfers”. Such a quick increase in the share of social transfers has been formed by governmental social policy after the crisis of 2008 – 2009 and redistribution of Federal Budget.

Interregional inequality of income is determined by interregional differences in income structure and average per capita income from each sources. The Structure of Total Income across The Subjects of The RF is very different. One could take a quick look at inter regional differences of *TIS* and their dynamics in 1995 - 2010 (Fig.4). Regional average per capita income from the sources named above differs many times (Table 5, Fig 4-1 – Fig 4-5).

All the data presented below demonstrate that per capita income and its structural components, measured in nominal rubles, were rising rapidly and irregularly. Economic growth is not the only factor determining this movement. Very high rate of inflation is the main cause of these tendencies. Some another methods of statistical and econometrical analysis have to be applied to eliminate the influence of inflation and to produce the investigation of dynamics of interregional differentiation of income correctly.

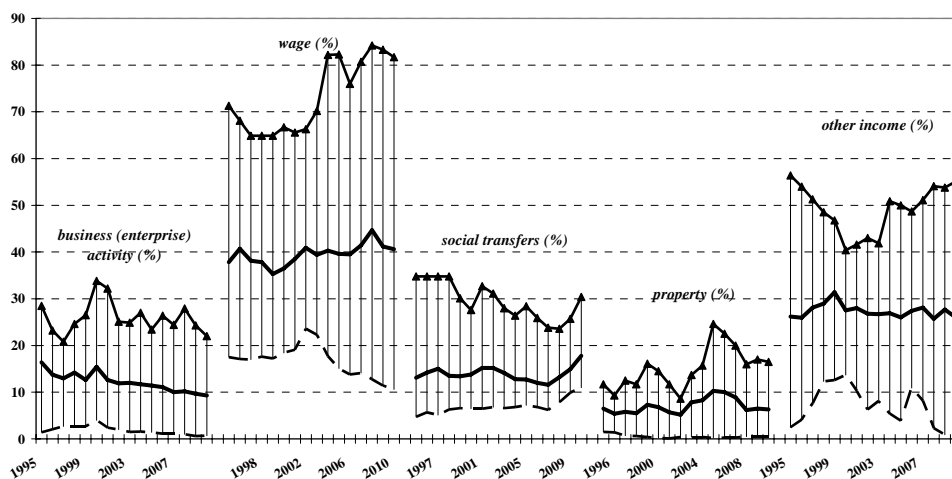


Fig. 4. Upper and lower bounds of variation series of components of Total income across the subjects of RF (in percent). 1995 – 2010

Table 5.

Upper and lower bounds of variation series of per capita income by sources across the subjects of RF (in month, rubles, before 1998 in thousands of rubles). 1995 – 2010

business (<i>inc1</i>)							
RF	85	351	925	1260	1524	1635	1756
upper bound	246	1096	2196	2555	2873	3937	4812
lower bound	14	113	204	306	321	210	262
range	232	983	1992	2249	2552	3727	4550
wage (<i>inc2</i>)							
RF	195	833	3212	5218	6679	6945	7666
upper bound	806	3156	16668	22481	27062	29221	30574
lower bound	34	152	625	989	1197	1338	1613
range	772	3004	16043	21492	25865	27883	28961
social transfers (<i>inc3</i>)							
RF	68	315	1030	1462	1972	2512	3361
upper bound	103	1040	1797	2424	3471	4701	5763
lower bound	39	146	450	689	940	1325	1795
range	64	894	1347	1735	2531	3376	3968
property (<i>inc4</i>)							
RF	34	155	836	1122	926	1096	1190
upper bound	120	1160	6140	7098	5473	7121	7240
lower bound	2	1	5	12	28	32	48
range	118	1159	6135	7086	5445	7089	7192
other sources (<i>inc5</i>)							
RF	135	627	2109	3541	3840	4669	4909
upper bound	964	3231	7388	10789	7392	9635	9653
lower bound	9	161	95	808	690	316	150
range	955	3070	7293	9981	6702	9319	9503

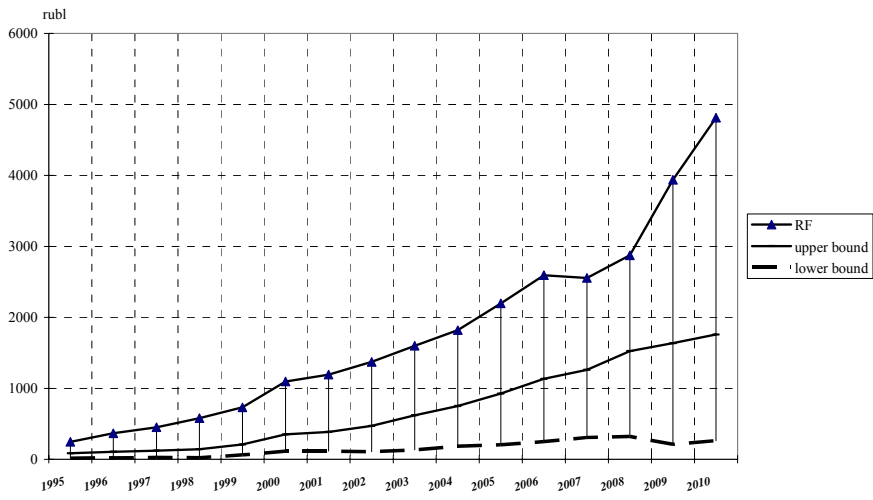


Fig 4-1. Upper and lower bounds of income pc from business (inc1) in the subjects of RF (ruble). 1995 - 2010

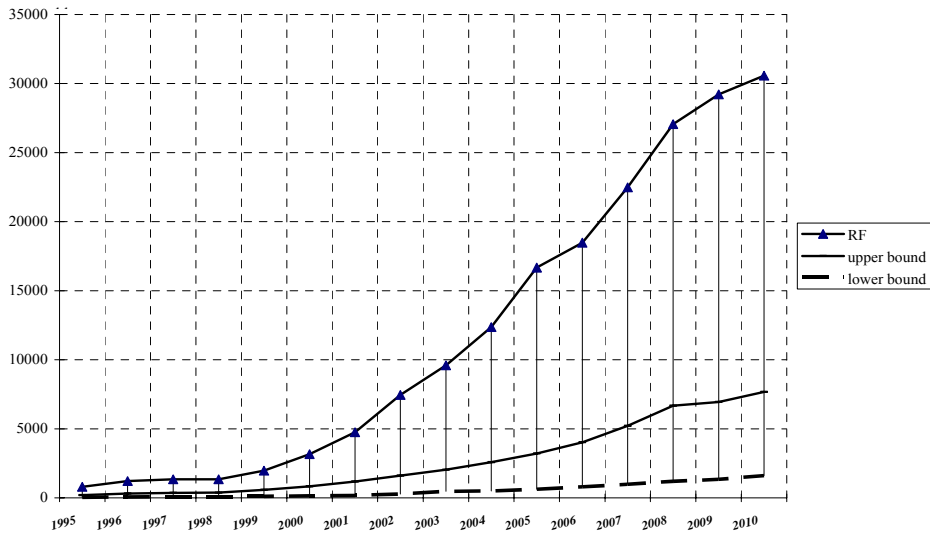


Fig 4-2. Upper and lower bounds of income pc from wages (inc2) in the subjects of RF (ruble). 1995 - 2010

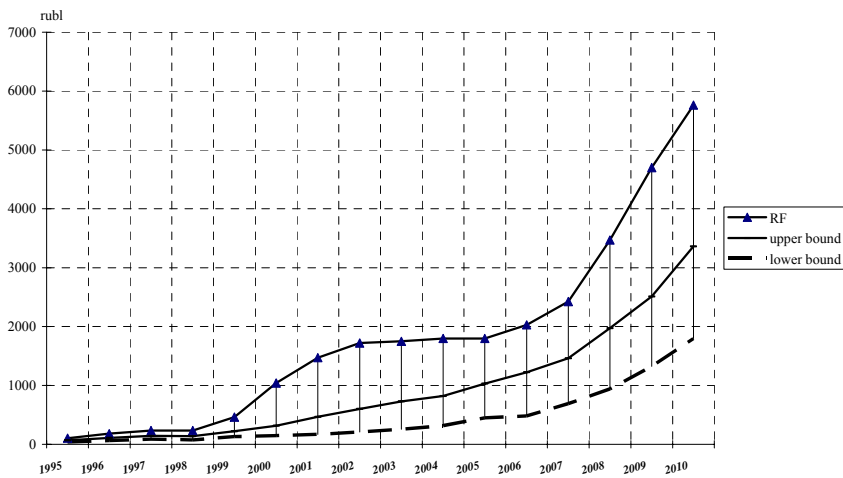


Fig 4-3. Upper and lower bounds of income pc from social transfers (inc3) in the subjects of RF (ruble). 1995 - 2010

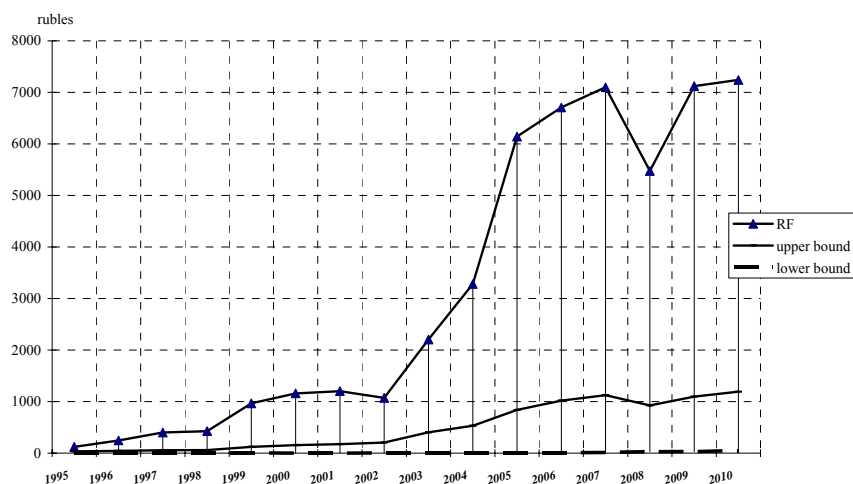


Fig 4-4. Upper and lower bounds the range of income pc from property (inc4) in the subjects of RF (ruble). 1995 - 2010

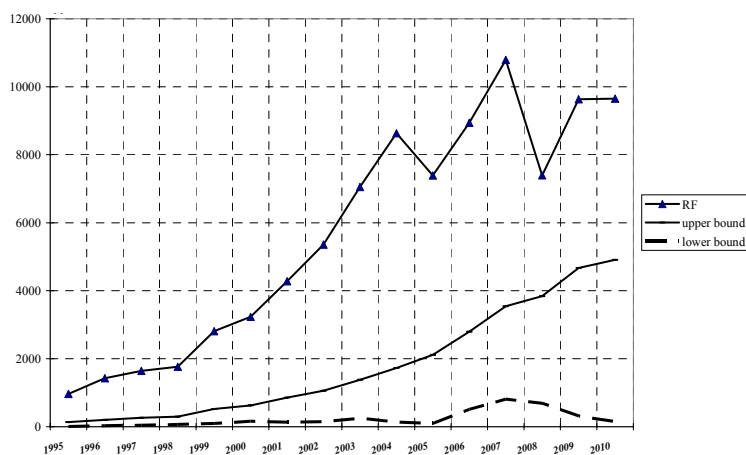


Fig 4-5. Upper and lower bounds the range of income pc from hidden sources (inc5) in the subjects of RF (ruble). 1995 - 2010

Part II. *GINI* and *Lorenz* curve

One of the most frequently applied methods of measuring of income inequality has been coefficient *GINI* (*GINI*). “Common” and “partial” *GINI* are calculated for measuring interregional inequality of income in Russia in 1995 -2010. To estimate “common” *GINI* all subjects of Russia are ranged by income pc (*inc*). To estimate “partial” *GINI*-1, *GINI*-2,, ..., *GINI*-5 the regions are ranged by five components of income pc (*inc1*, . . . , *inc5*) separately. The Values of all *GINI*'s present below (Table 6, Fig.5).

Their comparative analysis enable us to make some conclusions.

There is a tendency of decreasing of common *GINI* after 2000. At the same time, we can observe enormous value for *GINI*-4 measured for interregional inequality of distributions

of Total *income from property - inc4*. It is consequence of early nineties privatization and property institute.

GINI-5 for *other income – inc-5* was also very high before the crisis of 2008 – 2009. Later it decreased but “other earnings” are widespread now (see Part1).

The inequality of interregional distribution of Total *income from business (enterprise) activity – inc1* and from *social transfers – inc3* decreased also.

Table 6.

GINI for distributions of Total Income and its five components* across the Subjects of Russian Federation. 1995 – 2010

	GINI	GINI 1	GINI 2	GINI 3	GINI 4	GINI 5
1995	0.281	0.257	0.249	0.085	0.380	0.547
1996	0.287	0.304	0.247	0.103	0.437	0.536
1997	0.286	0.326	0.248	0.073	0.564	0.477
1998	0.302	0.329	0.248	0.132	0.582	0.466
1999	0.300	0.309	0.248	0.123	0.620	0.448
2000	0.302	0.302	0.269	0.217	0.624	0.403
2001	0.298	0.293	0.275	0.222	0.625	0.406
2002	0.282	0.276	0.265	0.195	0.547	0.422
2003	0.292	0.259	0.271	0.175	0.545	0.428
2004	0.293	0.248	0.293	0.154	0.579	0.440
2005	0.283	0.242	0.283	0.125	0.641	0.371
2006	0.266	0.240	0.282	0.112	0.597	0.322
2007	0.258	0.227	0.287	0.105	0.581	0.305
2008	0.212	0.215	0.289	0.119	0.558	0.204
2009	0.221	0.241	0.286	0.118	0.588	0.241
2010	0.209	0.233	0.289	0.100	0.588	0.259

* GINI - for distribution of Total Income from all sources (Inc)

GINI 1 - for distribution of Total Income only from business (enterprises) (inc1)

GINI 2 - for distribution of Total Income only from wages (salaries) (inc2)

GINI 3 - for distribution of Total Income only from social transfers (inc3)

GINI 4 - for distribution of Total Income only from properties (inc4)

GINI 5 - for distribution of Total Income only from "other income" (inc5)

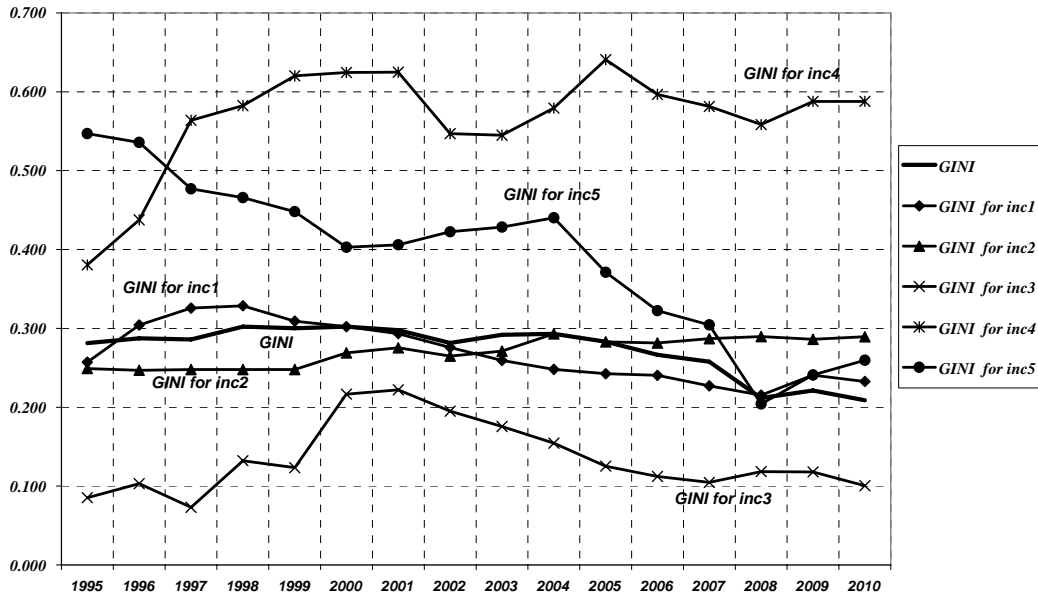


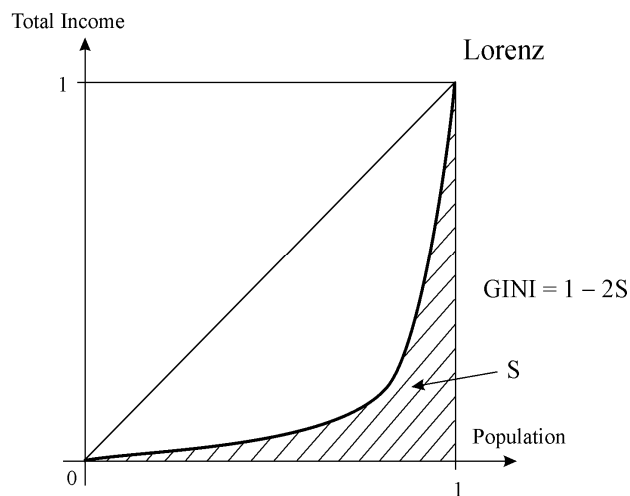
Fig. 5. GINI for distribution of Total Income and its five components across the subjects of The Russian Federation. 1995 - 2010

It is necessary to underline, that reducing inter regional inequalities does not necessarily indicate a positive development. The first phenomenon might be determinate by the reduction of business activity across the all regions of RF (see “structure of income”).

As concerns *social transfers*, *GINI-3* is very low. Because pensions make up nearly 70 percent of the entire social transfers, low value of *GINI-3* might be treat as “no real connection between wages (salaries) and pensions”.

Value *GINI-2* is stable after 2005 and it could indicate that there are not significant changes in spatial diversification of branches of The Russian economy.

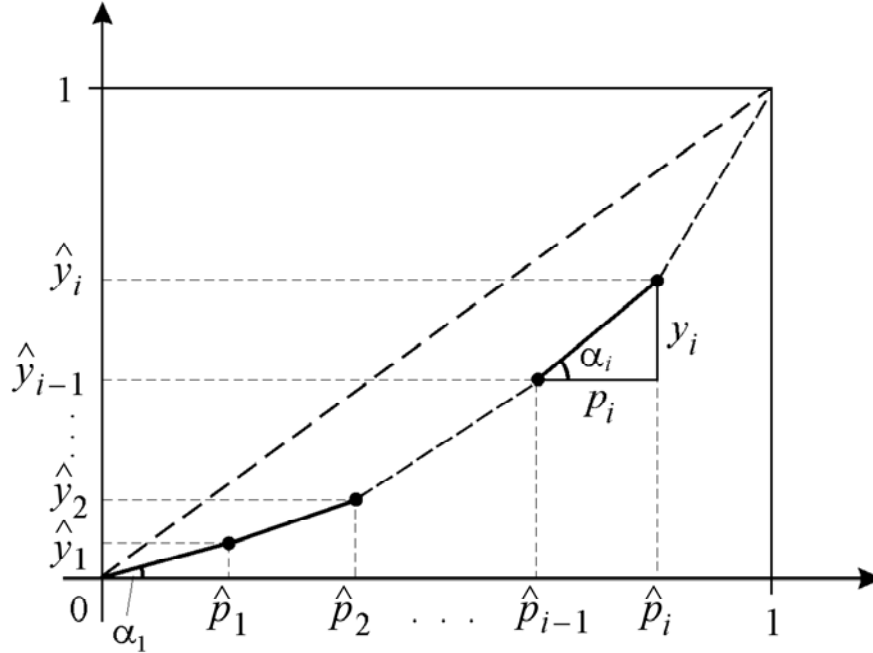
GINI is one of very useful indicators for comparative analysis. To examine trends of inequality it is necessary to consider the geometry of the Lorenz curve carefully.



The ordinary look of Lorenz curve for distribution of population by income is below:

$$GINI = 1 - 2 \times S$$

For grouped data, Lorenz curve transformed:



The comparative analysis of the regions of The Russian Federation is this case of study. Below we use the notation:

n – number of subjects of RF, $n=79$;

t – year (time); $t=1995, \dots, 2010$;

$P(t)$ – population of Russia in t .

$P_i(t)$ – population in Subject i ; $i = 1, \dots, n$;

$inc(t)$ – average income per capita in Russia in year t ;

$inc_i(t)$ – average income per capita in region i in year t ;

$TI(t) = P(t) * inc(t)$ – Total income of Russian Population in year t ;

$TI_i(t) = P_i(t) * inc_i(t)$ – Total income of population in region i in year t ;

$p_i(t) = P_i(t) / P(t)$ – share of population of Subject i in Russia (percentage);

$y_i(t) = TI_i(t) / TI(t)$ – share of Total income of population of subject i in Russia (%)

$\hat{p}_i = \sum_{j=1, K, i} p_j$ - accumulated shares of population in regions $1 - i$ ranged by inc ;

$\hat{y}_i = \sum_{j=1, K, i} y_j$ - accumulated shares of Total income in regions $1 - i$ ranged by inc ;

It is easy to show that

$$\operatorname{tg} \alpha_i = \frac{y_i}{p_i} = \frac{\operatorname{inc}_i}{\operatorname{inc}}; \quad (1)$$

It can be sad that two factors determined the transformation of the *Lorenz curve* and the change in *GINI*:

(*) redistribution of population by regions;

(**) relations between average per capita income in the regions and in The Russia (as a whole).

Estimations of distances between distributions of population by subjects in 1995 – 2010 show that there were not significant changes, although the Russian population decreased. So the main factor of inter regional income inequality is relationship between income pc in the regions and in The Russia and it could replace *income pc* (in nominal rubles) by the new indicator *R* – “relationship”:

$$R_i(\operatorname{inc}(t)) = \frac{\operatorname{inc}_i(t)}{\operatorname{inc}(t)} \quad (2)$$

for investigation of income inequality,

or

$$R(x_{ji}(t)) = \frac{x_{ji}(t)}{x_{\bullet i}(t)} \quad (2a)$$

for many other indicators of regional social – economic development, such as GDP.

Formula (2) is true for all the five components of income.

The graphs below present of dynamics of *R* for per capita income (*inc*) and its five components $\{\operatorname{inc}1, \dots, \operatorname{inc}5\}$. The regions are ranged in each year separately and divided into five equal groups. Distances between regions have been shown in the scale eliminating the effect of inflation (Fig 6, Fig 6-1 – Fig 6-5).

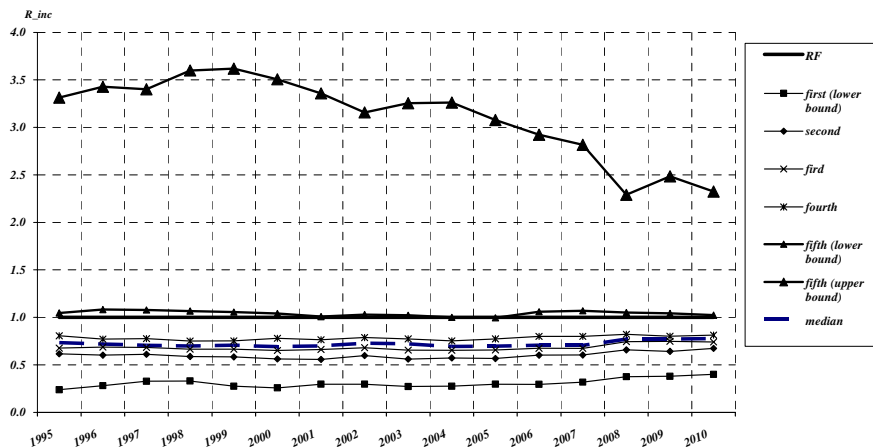


Fig. 6. Value of *R_inc* at the boundaries of 20% groups of Subjects RF, 1995 - 2010

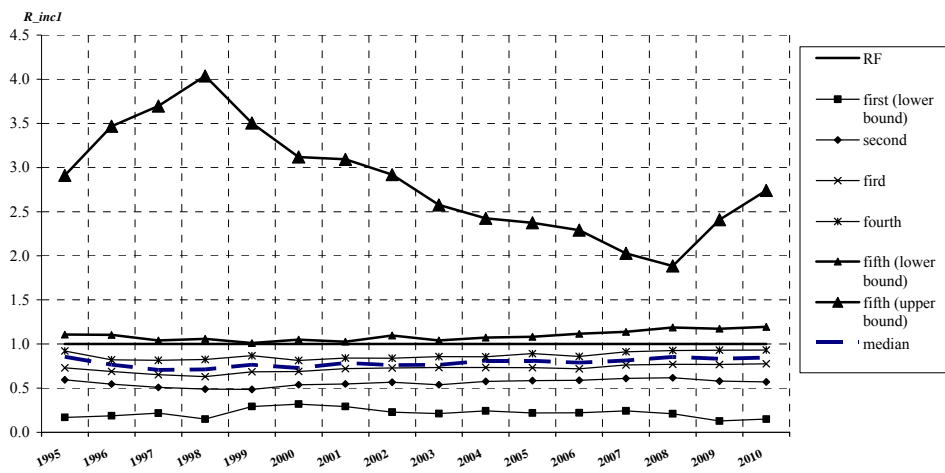


Fig. 6-1. Value of R_{inc1} at the boundaries of 20% groups of Subjects RF, 1995 - 2010

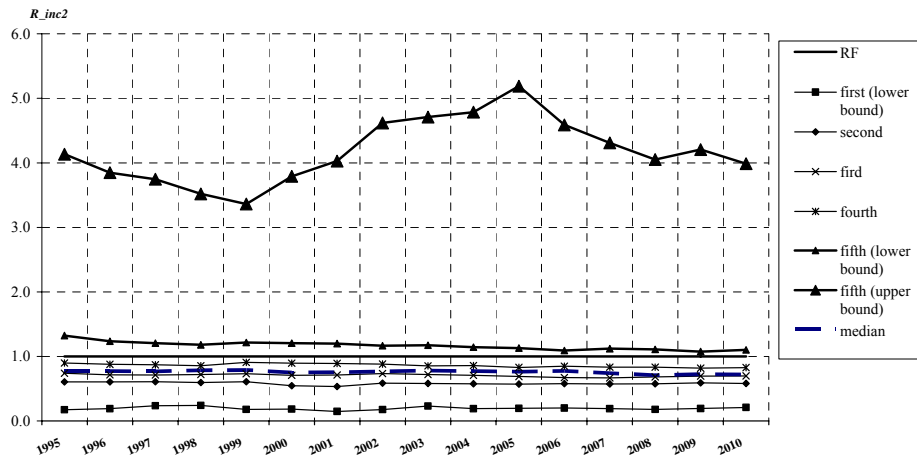


Fig. 6-2. Value of R_{inc2} at the boundaries of 20% groups of Subjects RF, 1995 - 2010

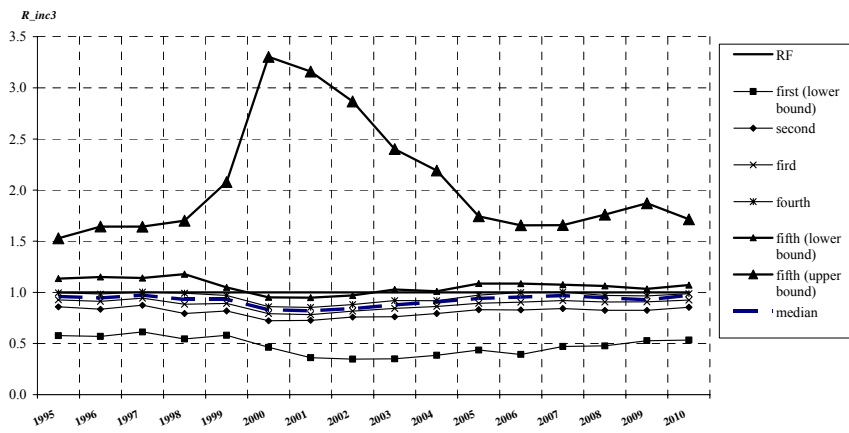


Fig. 6-3. Value of R_{inc3} at the boundaries of 20% groups of Subjects RF, 1995 - 2010

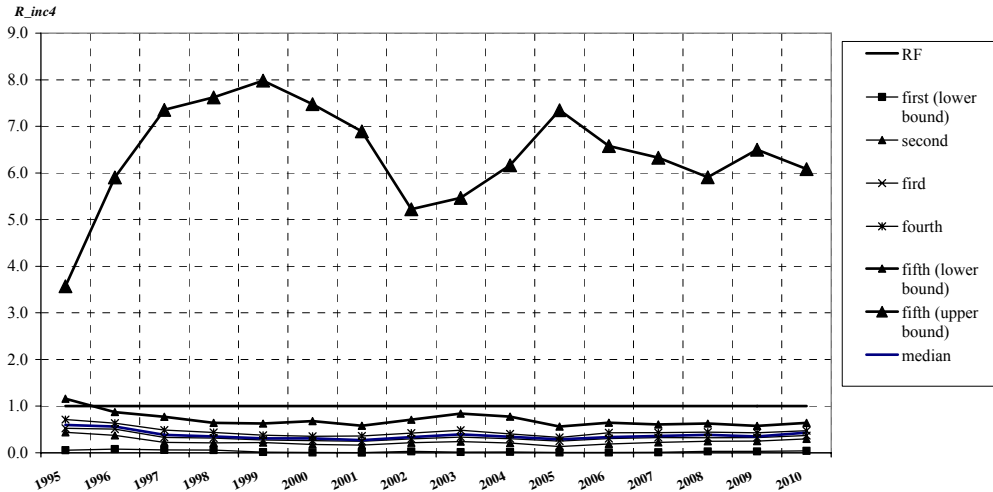


Fig. 6-4. Value of R_{inc4} at the boundaries of 20% groups of Subjects RF, 1995 - 2010

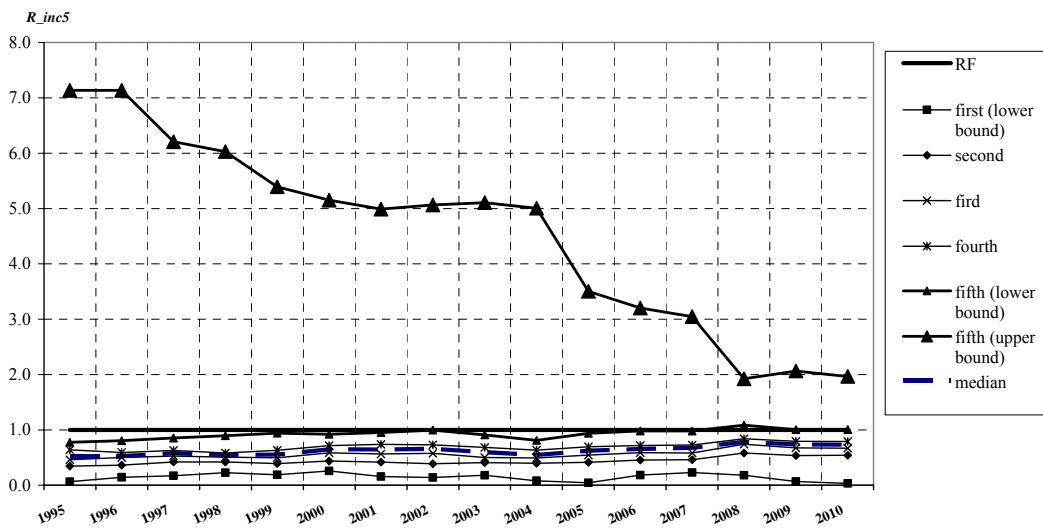


Fig. 6-5. Value of R_{inc5} at the boundaries of 20% groups of Subjects RF, 1995 – 2010

It is clear that all the regions of The Russian Federation are divided into two groups. The first one consists of 80 percent of the regions is below the level of the average income for The Russia ($R=1$). They are very close in the $R(t)$ for the average *income_pc* and all the five components.

The second one consists of 20 percent of The Subjects is upper the level of the average income for Russia. These regions are very different and the distance between the poorest and richest in this group is larger than the distance between the regions in the first group.

It could pose also the questions: “Do regions go from one group to another?” The comparative analysis of the distributions of regions by 20% enable us say that their positions are stable.

These results provide the arguments to speak both about high inequality of Russian population in terms of income, and about inequality in the availability of sources of income

Part III. Dynamics of income in the regions of The Russian Federation.

The above main goal of the study was the comparative analysis of regions of RF by year. The results have been obtained by “spatial approach” to the problem (Part I. and Part II.).

Now we consider The Subjects of The RF ranged by per capita income in 2010. Reconstruction of the process of income fluctuation for the previous period is the task of this part of work. Variation series of *income pc - inc* is divided into five groups by 20% of regions. The dynamics of $R(inc)$ for the groups are placed in Fig 7-1 – Fig 7-5.

Visual analysis confirms the previous findings of the division of the regions into two unequal groups. Most of them lie under $R=1$. Additional information is that regions rarely change their rank especially in lower group. The second finding is the concentration of regions in to two groups. Only 6-8 subjects from richest group of regions demonstrate stable growth of income.

To understand this phenomenon visual analysis has been made for all the structural components of per capita income (subjects ranged by *inc* in 2010 also). The trend of $R_1(t), . . . , R_5(t)$ for the five components of income are very different and less stable than for *income pc - inc*.

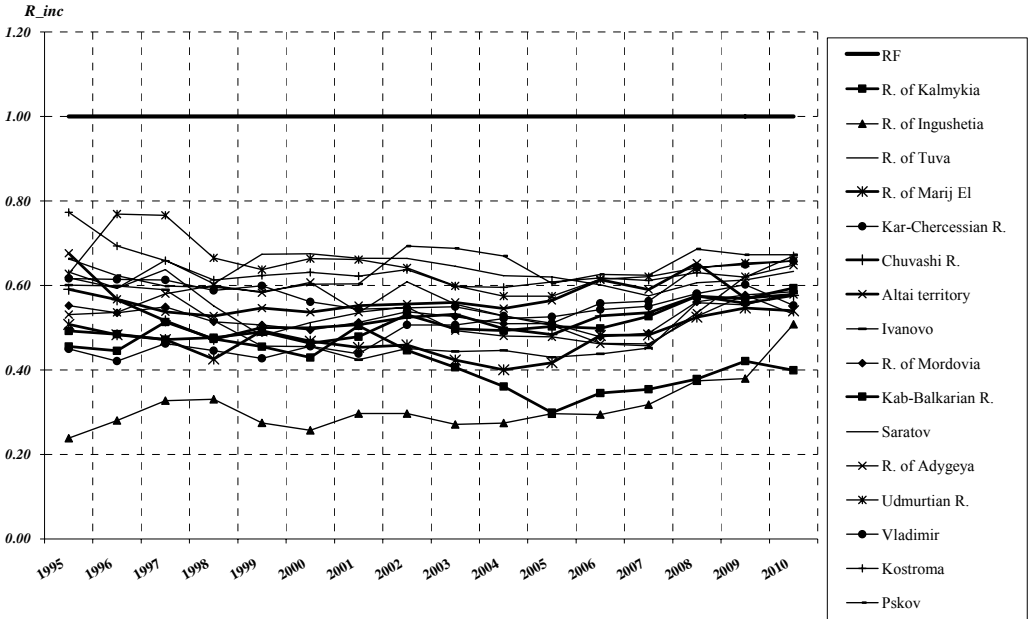


Fig. 7-1. Dynamics of $R(inc)$ in the subjects of the first 20% group, 1995 - 2010

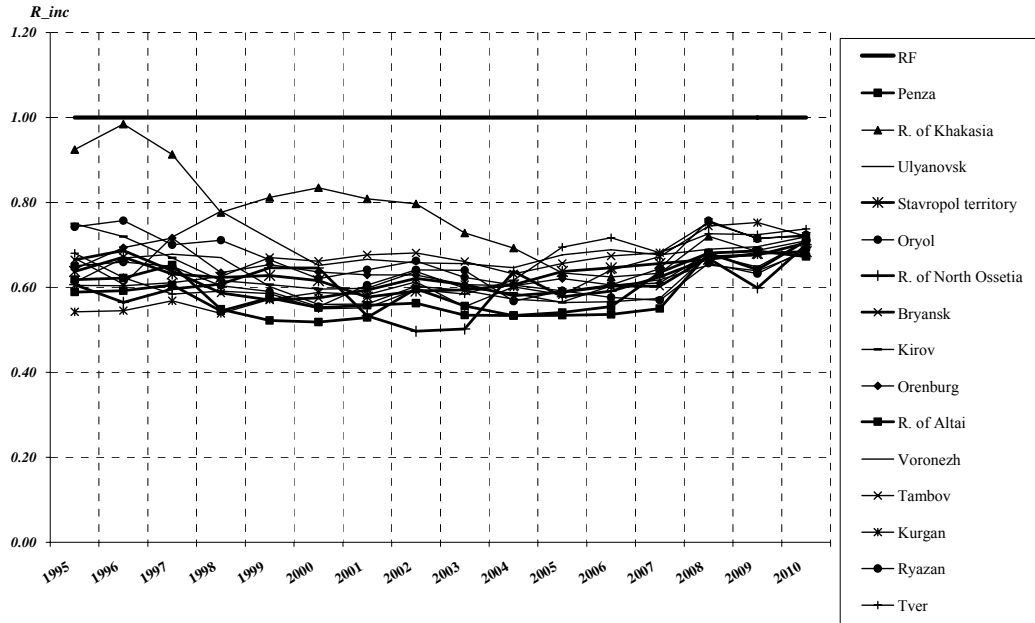


Fig. 7-2. Dynamics of R_{inc} in the subjects of the second 20% group, 1995 - 2010.

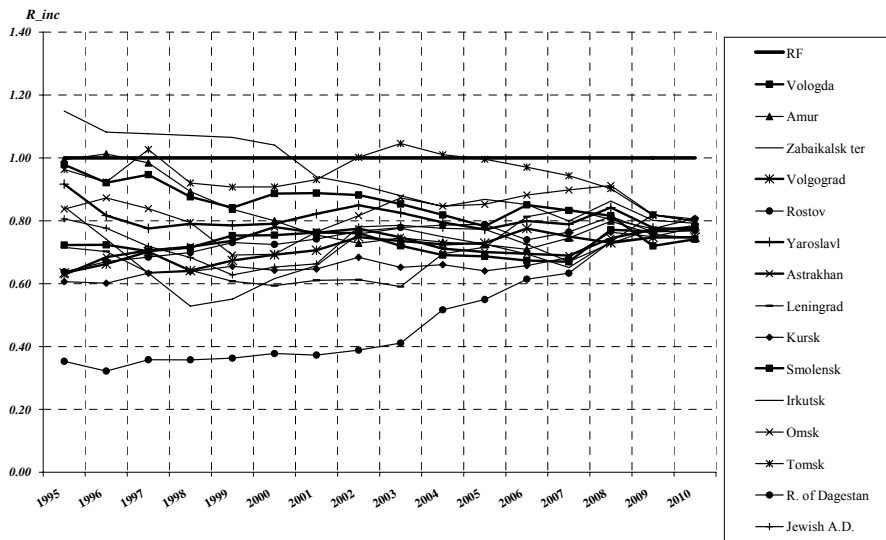


Fig. 7-3. Dynamics of R_{inc} in the subjects of the first 20% group, 1995 - 2010.

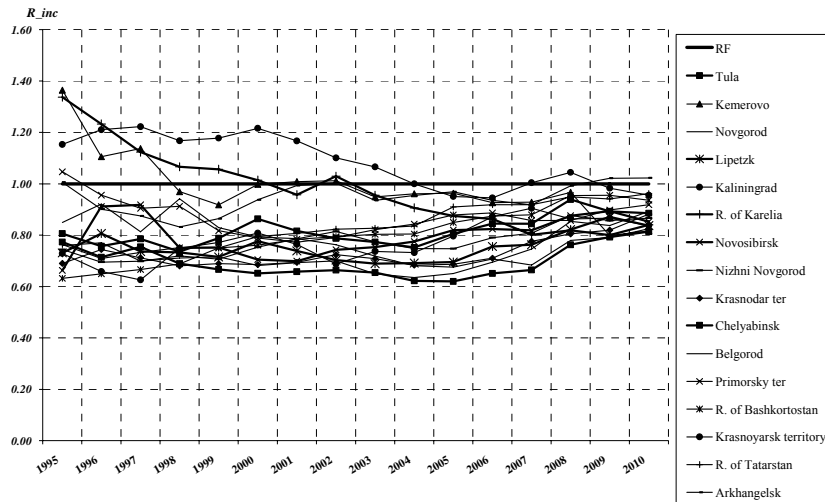


Fig. 7-4. Dynamics of R(inc) in the subjects of the fourth 20% group, 1995 - 2010.

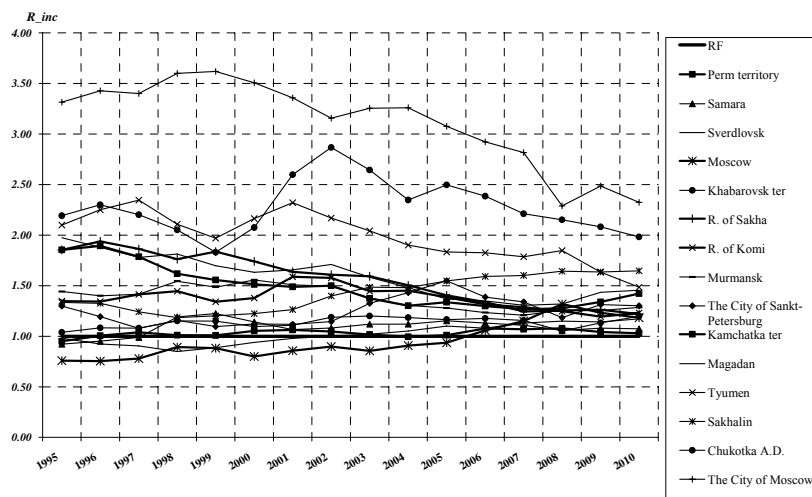


Fig. 7-5. Dynamics of R(inc) in the subjects of the fifth 20% group, 1995 - 2010.

To eliminate the stochastic changes in $R(t)$ during the time, IAP – “index of accumulated potential” is constructed.

The IAP is based on the proposition that if $R(T)$ in a region is far higher than 1 during long time, the region (or the population in this region) accumulates some financial potential. In this case, a short time decreasing of income does not lead to fundamental changes in well-being of population and position of the region in row of others. Other wise, if $income\ pc$ in a region is much lower than in The Russia (as a whole) during a long time, a short term increasing of $income\ pc$ do not change significantly well-being of population in this region. It could say that it needs an ontological approach to study the formation of social – economic potential the regions.

To address IAP index $R(t)$ is used. In general

$$R(x_{ji}(t)) = \frac{x_{ji}(t)}{x_{\bullet i}(t)}$$

For calculation IAP – “index of accumulated potential” has named LAR and presented by formulas (3) and (3a).

$$LAR(x_{ji}(t)) = \log_2 \left[\prod_{\tau=1}^t R(x_{ji}(\tau)) \right] = \sum_{\tau=1}^t \log_2 (R(x_{ji}(\tau))) \quad (3)$$

$$\text{or } LAR(x_{ji}(t)) = LAR(x_{ji}(t-1)) + \log_2 [R(x_{ji}(t))] \quad (3a)$$

Graphics for visualization IAP – “index of accumulated potential” created by per capita income (inc) and its comparison with $R(inc)$ presented by Fig 8-1 – Fig 8-5.

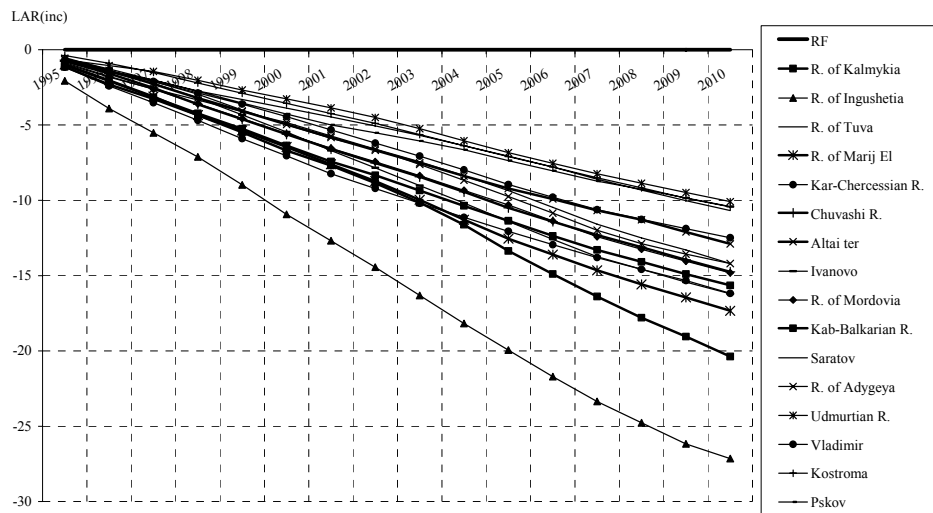


Fig 8-1. LAR(inc) - "Index of accumulated potential", 1995 -2010. The first 20% group

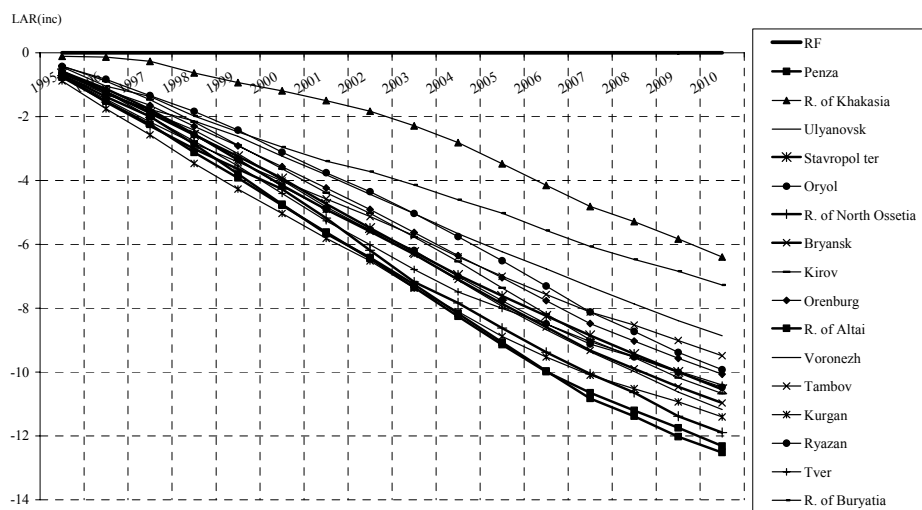
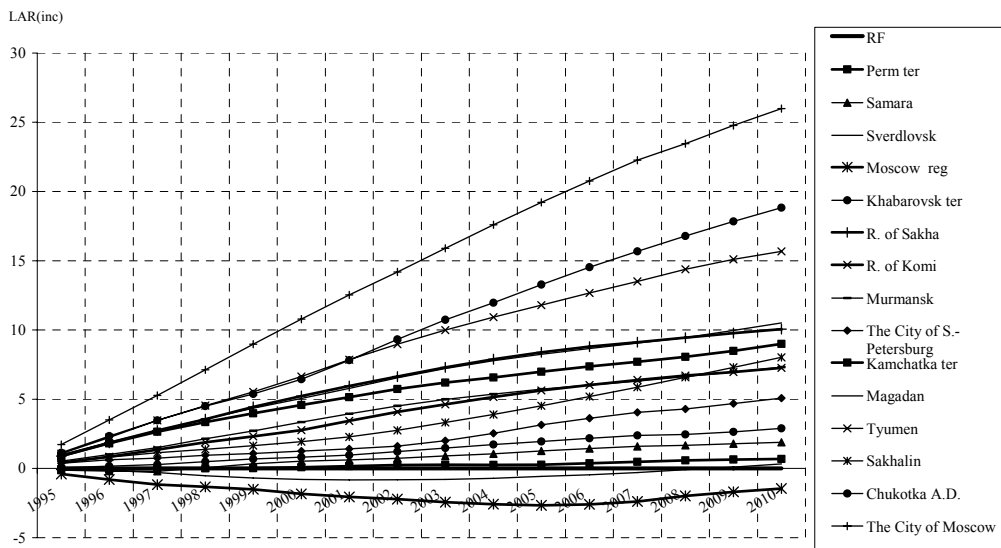
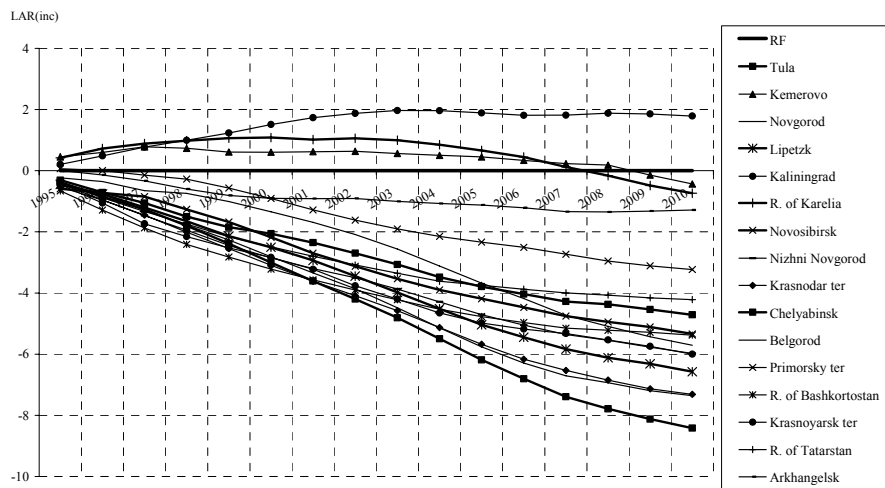
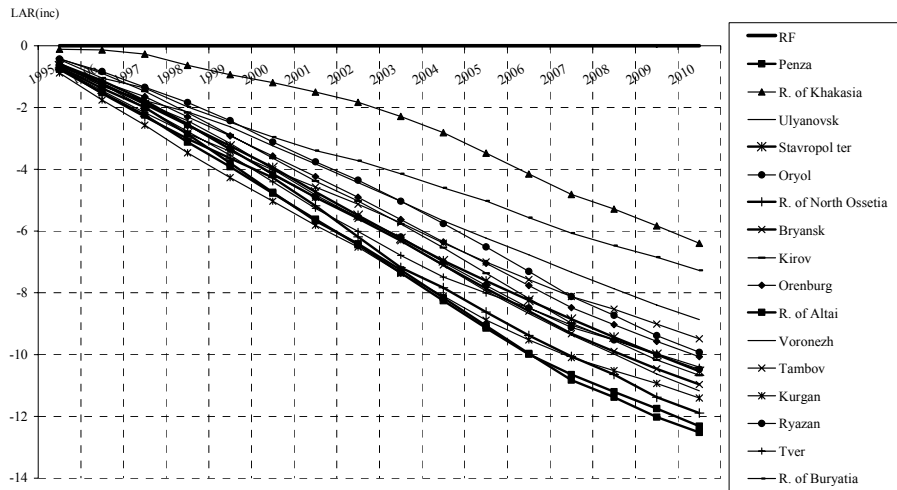


Fig 8-2. LAR(inc) - "Index of accumulated potential", 1995 -2010. The Second 20% group



As for R , trajectories for LAR are created for all the structural components of income. They display a wide variety of trends. To find and estimate the factors of the observed trend is the focus of further investigation. There are two other very important lines of research.

It is the estimation of correlation between the trends of different indicators of social – economic development such as GDP and Income. The other one is to analyze social – economic development at the municipal level to understand more clear the possibilities of population to obtain the income from different sources to and to propose the decisions how to ameliorate the habitat. These studies require a multidisciplinary approach and more detailed statistical information.

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