Inequality and Convergence after Transition – Evidence from Russia

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Research aim

- Analyse the distribution of per capita GRP in Russia in the period 1995-2013
  - Identify the presence of geographical patterns
  - Disentagle the contribution of sectoral GRP components

Data and method

- Exploratory spatial analysis
- Transient evolution of GRP distribution
- Regional and sectoral decomposition of GRP

- Robustness checks
  - Regression approaches to estimate convergence
    - Static specifications with both cross-sectional and panel data
    - Dynamic specifications i.e. Anderson-Hsiao and Arellano-Bond

Related literature

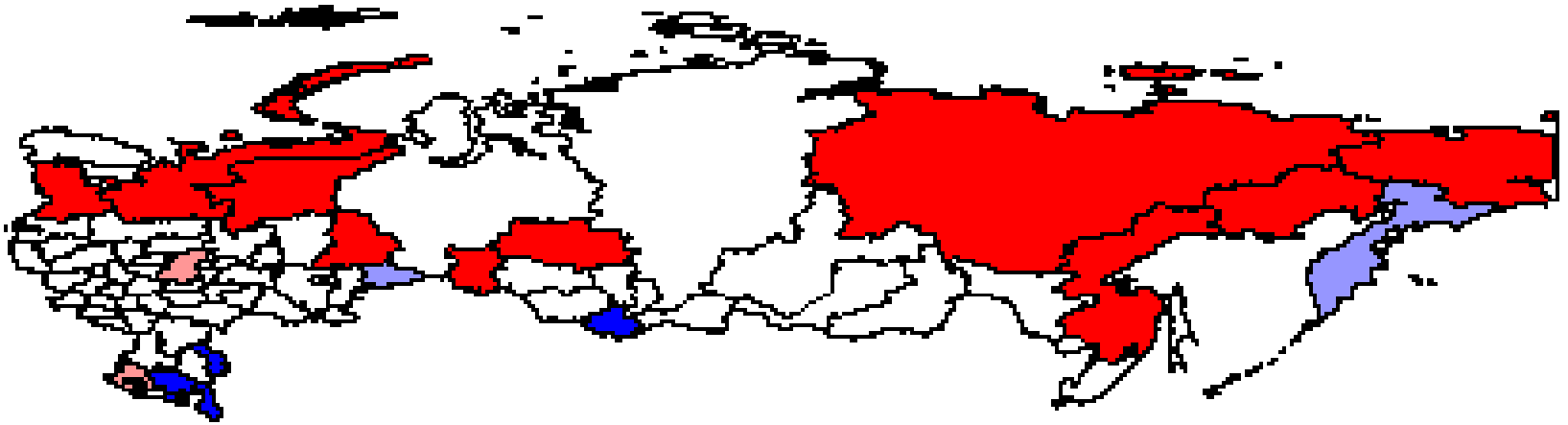
- Dolinskaya (2002) – transition matrix approach
- Galbraith et al (2004), Mahler (2001) – generalized entropy indices
- Berkowitz and DeJong (2003-05), Ahrend (2005-06-08) – regression approach

Exploratory spatial analysis

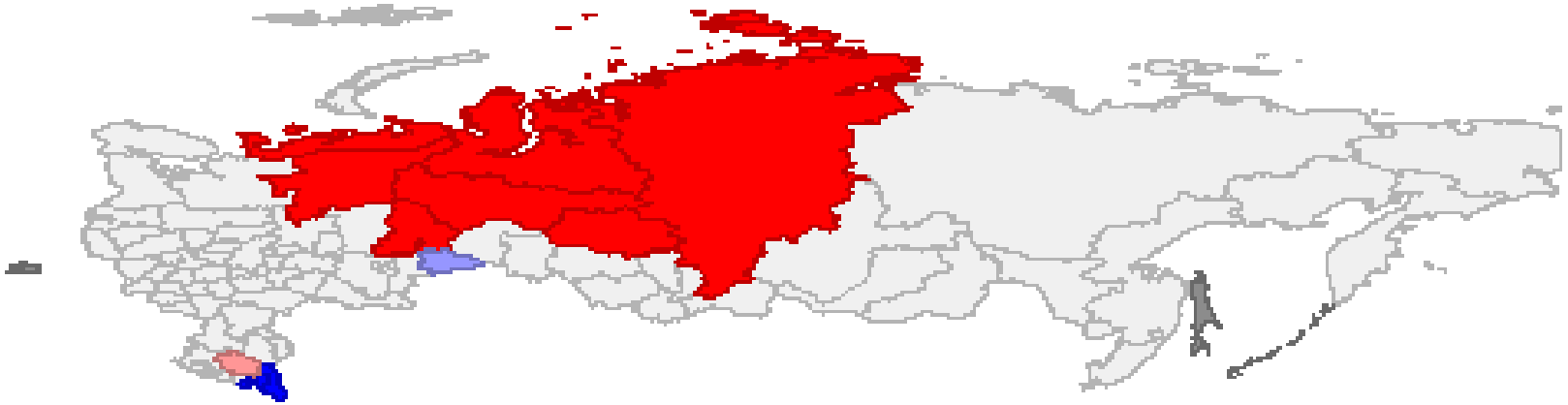
- Cluster maps allow to identify
  - which regions contribute to local spatial autocorrelation
  - what is the trajection of the correlation
    - High-high *red*
    - High-low *pink*
    - Low-high *purple*
    - Low-low *blue*

Clusters of p.c. GRP in 1995

..in 2008



..in 2013



Distribution dynamics (Quah 1993)

- Given the distribution of per capita GRP F_t and the law of motion $F_{t+1} = M \cdot F_t$,

  by iteration the process gives a predictor for future distributions $F_{t+s} = M^s \cdot F_t$
- There is evidence of convergence if F_{t+s} tends toward a mass point
- M maps the current distribution at time *t* into a future distribution at *t+1*

Transition probability matrix 1995-2013

Origin quintile	**Destination quintile**				
Regions	1st	2nd	3rd	4th	5th
12	9	2	2	-	-
14	5	5	4	-	-
19	1	7	7	3	1
15	-	2	1	6	6
17	-	-	6	2	9

Generalized Entropy Indices (Shorrocks 1982)

- Generalized Entropy measures of inequality are determined using the following general formula

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \qquad \alpha \neq 0,1$$

- For a = 2, we have half the squared CV
- General Entropy varies between 0 and 1, with increasing inequality as the index approaches 1

- Decomposition by population subgroups allows to identify the role of *within-group* and *between-group* inequality
  - The hierarchical structure is *federal district–region*

- Decomposition by GRP components or income sources shows the contribution of each factor to inequality
  - Rosstat data for GVA of industrial sectors as a percentage of the total are available starting from 1998

Decomposition by groups

Decomposition of the population-weighted half the squared coefficient of variation by federal districts										
District	*Central*	*North-W*	*Southern*	*Volga*	*Urals*	*Siberian*	*Far East*	*WD*	*BD*	*Tot*
1995	.10	.04	.04	.04	.21	.04	.06	.10	.03	.14
1998	.20	.03	.04	.04	.35	.05	.06	.18	.05	.24
2002	.24	.02	.03	.05	.35	.04	.07	.21	.05	.26
2007	.26	.03	.02	.04	.30	.03	.07	.21	.06	.27
2010	.22	.03	.01	.04	.32	.03	.06	.19	.05	.25
2013	.19	.04	.02	.05	.28	.04	.08	.18	.05	.23

- Although inequality in GRP has been increasing over time, most of the increase refers to the first phase of transition 1995-1998
- The districts with the lowest inequality *between-regions* are those with diversified economic activities
- The Moscow area and the oil-extractive sector in the Urals persist as the two diverging factors of the Russian economy

Decomposition by GRP factors

- Decomposition by GVA at the industrial level

- Reported results are
  - the proportional contribution of each factor to total inequality s_k
  - the share of each component in total GRP *share_k*
  - the coefficient of variation for each factor *WCV_k*

Decomposition by GRP factors 1998 - 2005

GRP Factors	s_k	share_k	WCV_k
	1998		
Agriculture	.36	8.4	.69
Manufacturing	.76	32.56	.32
Construction	-.085	7.45	.28
Transport	.12	9.84	.46
Communications	-.022	1.97	.41
Trade and catering	-.33	13.81	.43
Other services	.19	25.9	.18
Total	1	100	-

GRP Factors	s_k	share_k	WCV_k
	2005		
Agriculture and fishing	3	9.08	.64
Mining	2.70	7.39	1.72
Manufacturing	1.06	22.09	.46
Electricity, gas, water	.51	4.67	.46
Construction	.64	6.46	.43
Wholesale retail trade	-6.26	17.28	.48
Hotels	-.13	.98	.50
Transport & communications	1.19	11.89	.39
Real estate	-2.46	7.40	.44
Public administration	.28	3.84	.38
Education	.51	3.54	.36
Health	.46	3.95	.34
Other services	-.51	1.40	.54
Total	1	100	-

Decomposition by GRP factors 2010 - 2013

GRP Factors	s_k	share_k	WCV_k	s_k	share_k	WCV_k
	2010			2013		
Agriculture and fishing	9.38	6.71	.73	8.47	6.42	.75
Mining	15.91	7.05	1.70	14.28	7.11	1.73
Manufacturing	2.92	19.83	.45	2.29	19.16	.44
Electricity, gas, water	.95	4.95	.45	-.03	4.13	.41
Construction	6.10	7.73	.55	4.73	7.42	.49
Wholesale retail trade	-23	17.23	.44	-17.5	16.78	.37
Hotels	.12	1.14	.54	.05	1.27	.78
Transport & communications	1.27	11.1	.32	-1.05	10.17	.34
Real estate	-15.8	9.10	.53	-13.2	10.59	.46
Public administration	2.99	5.98	.40	1.47	6.66	.40
Education	1.11	3.56	.31	1.51	3.92	.30
Health	.73	4.30	.27	1.07	4.83	.27
Other services	-1.74	1.25	.42	-1.54	1.53	.34
Total	1	100	-	1	100	-

Summary of results

- Inequality decompositions point to two diverging factors
  - geographical concentration of returns from extractive activities
  - concentration of business activities and public administration in Western Russia
- The social service sector, education and health still does not have the expected equalizing effect
- Regions are still diverging (*not converging*) in terms of per capita GRP, although this is happening at a slower pace as time passes

Robustness checks - regression results

- Regression results provide evidence of *divergence*
  - for the whole time period 1995-2013 and sub-periods until 1998 and the economic crisis in 2008
  - valid for both unconditional and conditional convergence
  - divergence is decreasing over time

Regression results, cross-sectional data

Dependent variable: average growth rate of per capita GRP					
	(1) 1995-2013	(2) 1995-2000	(3) 2001-2013	(4) 2000-2007	(5) 2005-2013
Initial GRP per capita	-.15 (.09)	-.04 (.05)	-.004 (.009)	-.04 (.05)	-.02 (.02)
Observations	77	77	77	77	77
R^2	.06	.02	.001	.01	.01

$$lny_{i,t} - ln\, y_{i,0} = \alpha + \beta ln\, yi_{,0} + \varepsilon_{i,t}$$

Static panel data models

Dependent variable: growth rate of per capita GRP						
	Annual data			Interval averages		
	(1) 1995-2013	(2) 1995-2000	(3) 2001-2013	(4) 1995-2012	(5) 1995-2000	(6) 2002-2013
GRP per capita	.10 (.02)***	.65 (.17)***	.07 (.03)**	.23 (.06)***	.62 (.06)**	.28 (.11)**
Observations	1386	385	1001	385	154	154
R^2	.47	.63	.39	.69	.64	.38

$$ln\, y_{i,t} - lnyi_{,t-1} = \beta ln\, y_{i,t-1} + \delta W_{i,t-1} + \mu_i + \eta_t + \varepsilon_{it}$$

- Notes: all variables are in natural logarithm. All specifications control for regional and time effects. Clustered S.E. robust to heteroskedasticity in parenthesis. Column (4) is averaged over 3-year intervals (T=6), column (5) is averaged over 3-year intervals (T=2), column (6) is averaged over 4-year intervals (T=3). In columns (1-3) GRP per capita is the GRP in the year prior to the one for which the growth rate is measured. In columns (4-6) GRP per capita is the GRP at the initial year of each interval.

Dynamic panel data models

Dependent variable: annual growth rate of per capita GRP						
	Anderson-Hsiao			System-GMM		
	(1) 1995-2013	(2) 1995-2000	(3) 2001-2013	(4) 1995-2013	(5) 1995-2000	(6) 2001-2013
Lagged dep. variable	-.007 (.003) **	-.015 (.009)*	-.005 (.003)	.08 (.03)***	-.01 (.04)	.14 (.05)***
AR(1)				.00	.00	.00
AR(2)				.63	.40	.05
Hansen test				.12	.21	.36
Diff-in-Hansen				.17	.16	.03
N. instruments				52	13	35
Observations	1309	308	847	1386	385	1001

- Notes: all variables are in natural logarithm. All specifications include time effects. Robust S.E. in parenthesis. The lagged dependent variable in the Anderson-Hsiao estimators columns (1-3) is instrumented with *yi,t-2*. In system GMM we use robust Windmeijer S.E. to reduce finite sample bias. AR(1) and AR(2) report p-values for the Arellano and Bond's tests for first and second order residual serial correlation. The null hypothesis is no autocorrelation. Hansen and difference-in-Hansen report p-values for the tests for overidentifying restrictions. Difference-in-Hansen tests for the additional orthogonality conditions required by system-GMM i.e. that the instruments for the level equation are uncorrelated with the fixed effects. The null hypothesis is instrument exogeneity. In the baseline specification (4-6), instruments for the equation in differences are log per capita GRP lagged twice, instruments for the levels equation are log per capita GRP lagged and differenced once

Earlier version available online

Lehmann, H. and M. G. Silvagni (2013), “Is There Convergence of Russia's Regions?: Exploring the Empirical Evidence: 1995–2010”

Technical Background Paper for OECD Economic Surveys – Russian Federation (January 2014)