NATIONAL RESEARCH UNIVERSITY

Unemployment Clubs in Russian Regions: spatial econometric approach

Danilenko Tatiana (NRU HSE, Moscow, Russia),
Demidova Olga (NRU HSE, Moscow, Russia),
Signorelli Marcello (University of Perugia, Italy)

56 th ERSA Congress, Vienna, August 23-26 , 2016

Motivation

The concept of socio-economic development of the Russian Federation till 2020 states that the priorities of the state regional policy are

(i) balanced socio-economic regional development and

(ii) the reduction of interregional disparities.

Literature review (1)

Regional real convergence and regional labour market dynamics

- Barro and Sala-i-Martin, 1991; Blanchard and Katz, 1992; Armstrong, 1995; Obstfeld et al., 1998; Boldrin and Canova, 2001; Magrini, 2004; Albu et al., 2010; Fischer, 2015
- Elhorst, 2003; Huber, 2007; Ferragina and Pastore, 2008; Decressin and Fatás, 1995; Francis, 2009; Caroleo and Pastore, 2010; Falk and Leoni, 2010; Marelli and Signorelli, 2010; Beyer and Smets, 2014; Marelli et al., 2014; Beyer and Stemmer, 2015; Mussida and Pastore, 2015a and 2015b); Gray, 2004; Marelli et al., 2012; Bruno et al., 2014; Scarpetta and Worgotter, 1995; Scarpetta and Huber, 1995; Lopez-Bazo et al., 2005; Tyrowicz and Wojcik, 2010

Literature review (2)

Russian regional development and unemployment

- Solanko (2008); Ledyaeva et al. (2008); Kholodilin et al. (2012); Akhmedjonov et al., (2013); Lehmann and Silvagni (2013); Mikheeva (1999); Dolinskaya (2002); Galbraith et al., (2014); Popov (1999); Ahrend (2005); Desai et al. (2005); Oshchepkov (2015); Demidova and Signorelli (2012); Demidova, Marelli and Signorelli (2013); Demidova, Marelli and Signorelli (2015).

Focus on some studies for Russia

Lugovoy O., Dashkeyev, I. Mazayev, D. Fomchenko, E. Polyakov. (2007). Analysis of Economic Growth in Regions: Geographical and Institutional Aspect. Consortium for Economic Policy Research and Advice. Moscow: IET.:

"Even during a relatively short period under consideration (1998–2004) one can talk about significant spatial heterogeneity in economic development of Russian regions, which obviously should be taken into account in empirical studies of regional growth".

Kolomak, E. (2011). Spatial Externalities as a Source of Economic Growth. Regional Research of Russia, 1, 2, pp. 114–119. Moscow: Springer.

For the western regions of Russia spatial effects for economic growth positive and statistically significant for both the neighborhood matrix and the distance matrix. For the eastern regions of Russia spatial externalities on their economic growth are limited to the neighboring territories and negative.

Kholodilin, K. A., Oshchepkov, A., & Siliverstovs, B. (2012). The Russian regional convergence process: Where is it leading?. Eastern European Economics, 50(3), 5-26:

"Our results show that the overall speed of regional convergence in Russia, being low by international standards, becomes even lower after controlling for spatial effects. However, when accounting for the spatial regimes, we find a strong regional convergence among high-income regions located near other high-income regions".

Focus on some studies adopting a club/cluster approach

- Many studies on real regional growth follow a club approach (Quah, 1997; Baumont et al., 2003; Canova, 2004, Alexiadis (2013), Fischer & LeSage, 2014). As for a survey, see Alexiadis (2013).
- However, in the literature on unemployment a cluster approach (Overman and Puga, 2002) is more widespread.
- More recently, some chapters in Mussida C. and F. Pastore (Eds.), (2015) follow a cluster approach for investigating geographical labour market imbalances.

Club vs cluster

The main technical difference between a club and cluster approach:

- **Using a cluster approach, researchers try to unify regions with close values of independent variables (this requires the using of special multi-dimensional distance between objects, for example, the Euclidean or Mahalonobis).**
- **Under the club approach researchers unify regions with close values of the dependent variable.**

Data and weights matrices

- 80 Russian regions; period 2005 – 2012;
- The dependent variable is regional unemployment rate.

$$W_{len} = \begin{pmatrix} 0 & w_{12}^{len} & \cdots & w_{1n}^{len} \\ w_{21}^{len} & 0 & \cdots & w_{2n}^{len} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^{len} & w_{n2}^{len} & \cdots & 0 \end{pmatrix}$$

$$w_{ij}^{len} = \frac{length\,in\,km\,of\ \ joint\,boundaries\,between\,regions\,i\ and\ \ j}{total\,length\,in\,km\,of\ \ all\,boundaries\,of\ \ region\,i}$$

Data and weights matrices

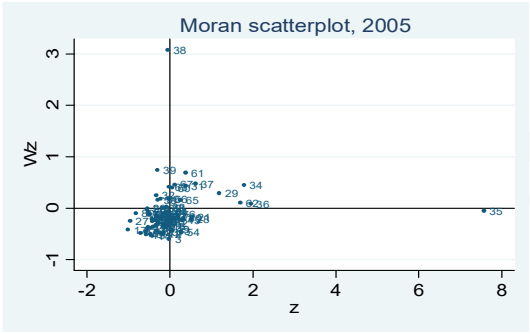
$$W_b = \begin{pmatrix} 0 & w_{12}^b & \cdots & w_{1n}^b \\ w_{21}^b & 0 & \cdots & w_{2n}^b \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^b & w_{n2}^b & \cdots & 0 \end{pmatrix}$$

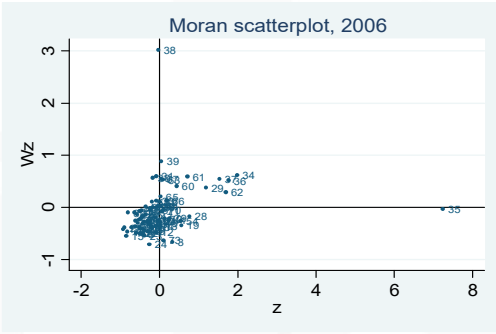
$w_{ij}^b = 1 \quad if \quad regions \quad i \quad and \quad j$
$have \quad joint \quad boundary$

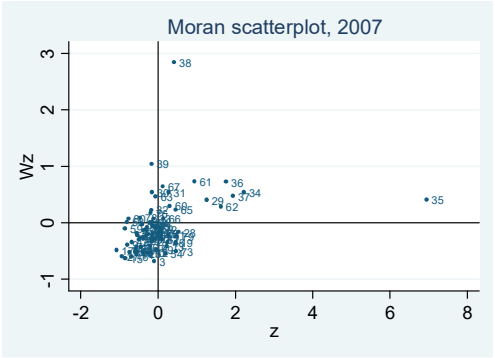
$$W_{id} = \begin{pmatrix} 0 & w_{12}^{id} & \cdots & w_{1n}^{id} \\ w_{21}^{id} & 0 & \cdots & w_{2n}^{id} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^{id} & w_{n2}^{id} & \cdots & 0 \end{pmatrix}$$

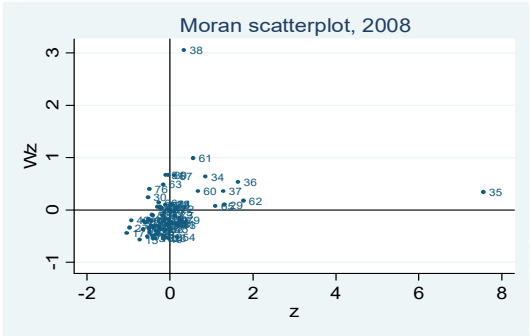
$w_{ij}^{id} = \quad inverse \quad distance \quad between$
$regions \quad i \quad and \quad j$
$by \quad auto \quad road$

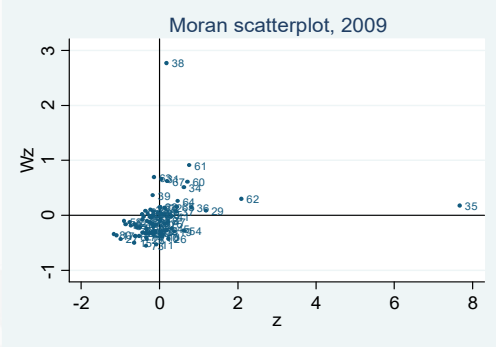
The Moran plots

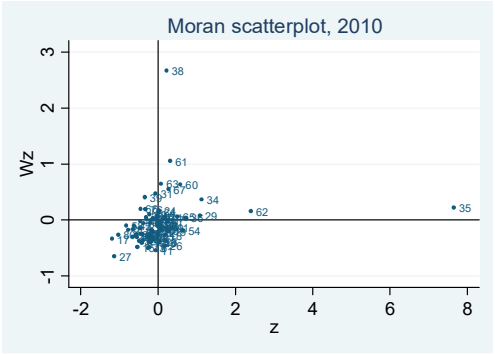


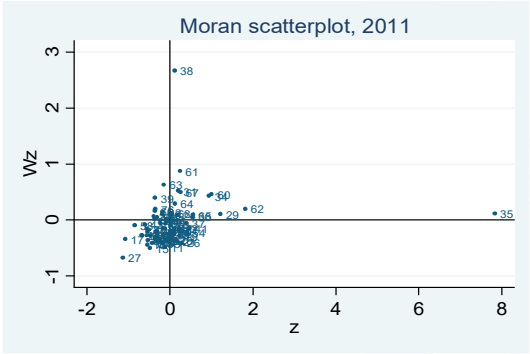


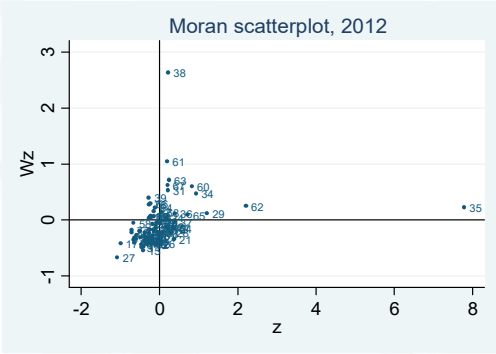








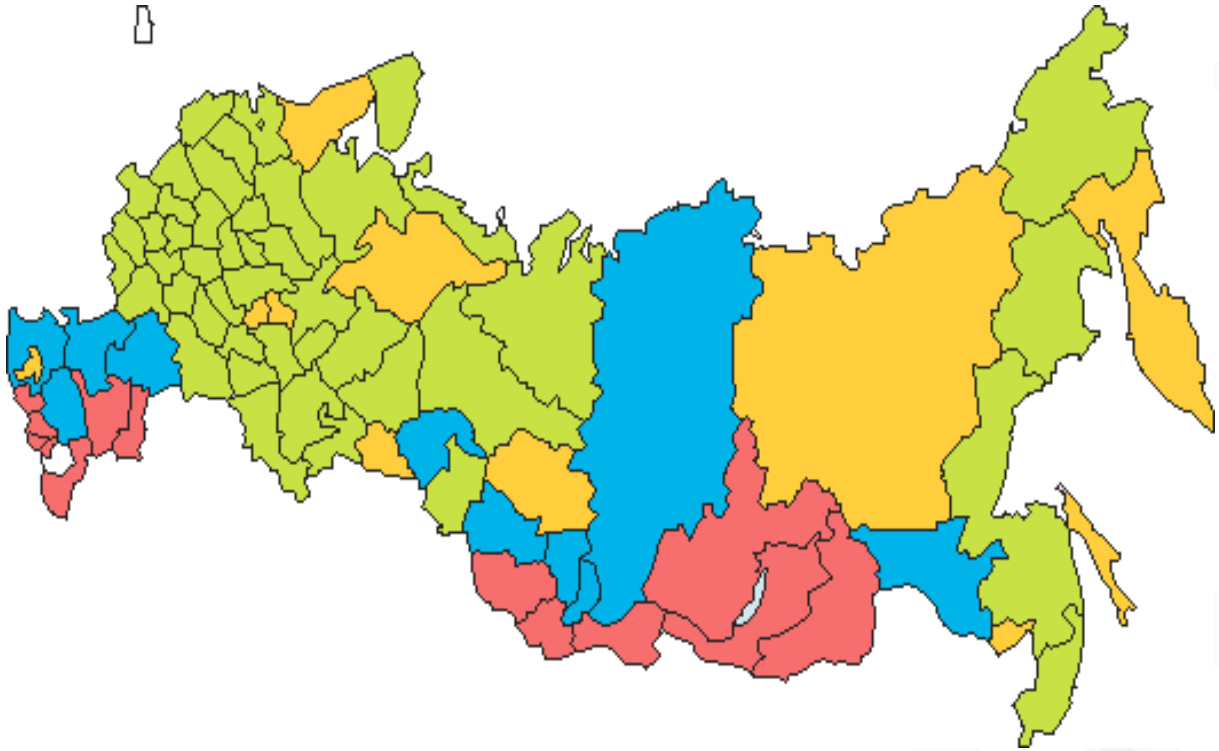




Clubs

High-High Club	Low-Low Club		
Republic of Kalmykia	Belgorod region	Yaroslavl region	Kirov region
Astrakhan region	Bryansk region	Moscow	Nizhny Novgorod region
Republic of Dagestan	Vladimir region	Arkhangelsk region	Orenburg region
Republic of Ingushetia	Voronezh region	Nenets Autonomous Okrug	Penza region
Republic of Kabardino-Balkaria	Ivanovo region	Vologda region	Samara region
Republic of Karachaevo-Cherkessia	Kaluga region	Leningrad region	Saratov region
Republic of Northen Osetia – Alania	Kostroma region	Murmansk region	Ulyanovsk region
Republic of Altay	Kursk region	Novgorod region	Sverdlovsk region
Republic of Buryatia	Lipetsk region	Pskov region	Khanty-Mansi Autonomous Area - Yugra
Republic of Tyva	Orel region	Saint-Petersburg	Yamal-Nenets autonomous region
Altay Territory	Ryazan region	Republic of Bashkortostan	Chelyabinsk region
Zabaykalsky Territory	Smolensk region	Republic of Mordovia	Omsk region
Irkutsk region	Tambov region	Republic of Tatarstan	Primorsky Territory
	Tver region	Republic of Udmurtia	Khabarovsk Territory
	Tula region	Perm territory	Magadan region
			Chukotka Autonomous Okrug

Map of Russia



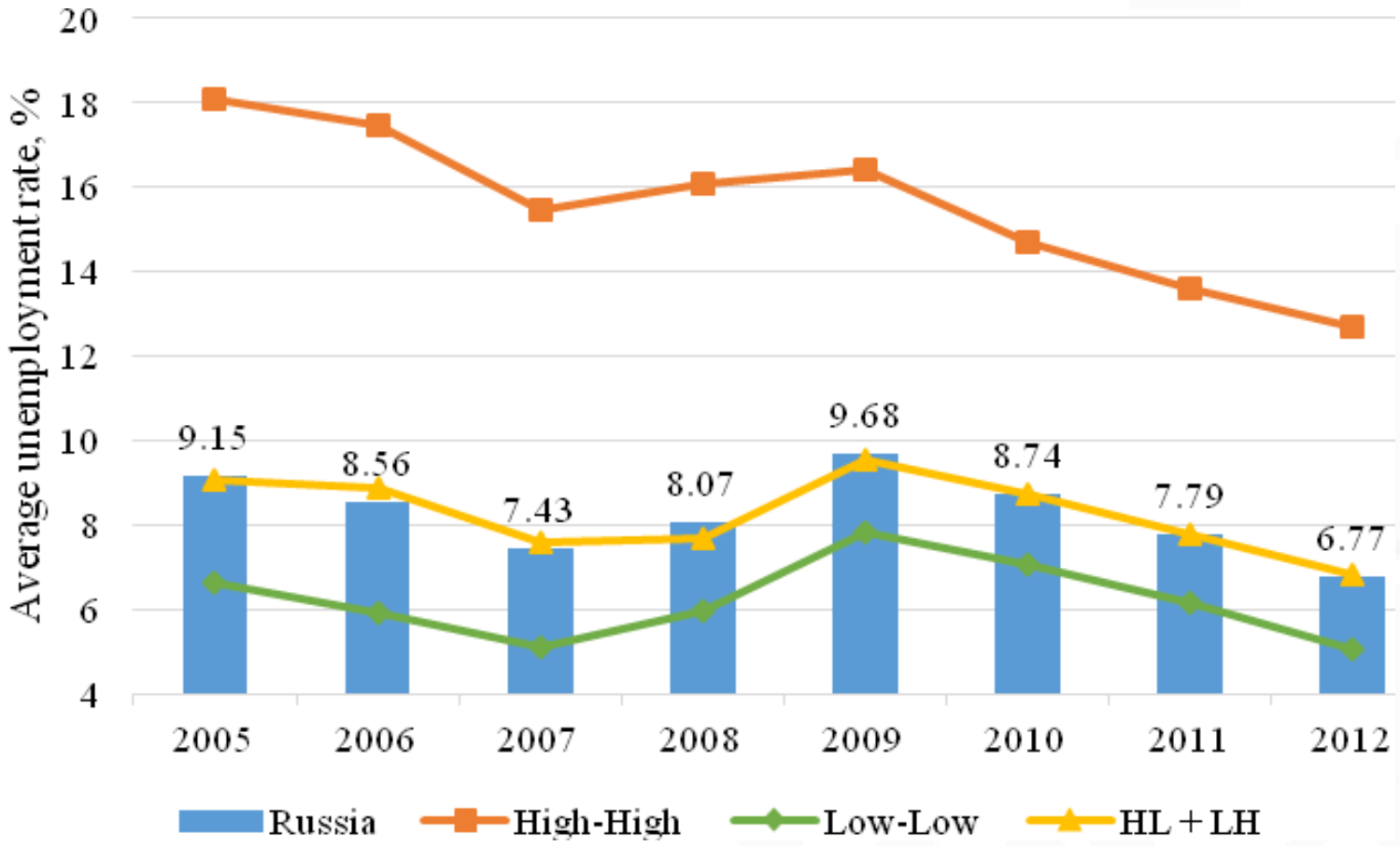
High-high club

Low-Low club

High-low club

Low-high club

The dynamic of average unemployment rate in Russia for 2005-2012, %



The dynamic of Moran's I

Weights matrix	Boundaries lengths matrix	Binary contiguity matrix	Inverse distance matrix
2005	0.059	0.072	0.055*
2006	0.088	0.120**	0.112*
2007	0.163***	0.191***	0.158***
2008	0.134**	0.145***	0.121***
2009	0.098*	0.101**	0.088*
2010	0.09	0.098**	0.069
2011	0.081	0.085*	0.063
2012	0.110**	0.118**	0.071

Main Hypotheses

- **H1: spatial effects for the High-High and Low-Low clubs differ from spatial effects for other regions;**

- **H2: the determinants of unemployment for the High-High and Low-Low clubs differ from other regions.**

Explanatory Variables

Three groups of variables:

1) variables about the attractiveness of the region

2) socio-demographic variables

3) variables of the industrial structure of the employed population.

Explanatory Variables

1) variables about the attractiveness of the region:

- GRP per capita (variable grp, thousand rubles), productivity per worker (variable product, thousand rubles)
- the share of urban population (variable urban_share, %)
- population density (variable dens, %)

2) socio-demographic variables:

- the age structure of the population (variables below and above of working age, %)
- the proportion of people with higher education in labour force (variable highed, %).

Explanatory Variables

3) variables of the industrial structure of the employed population:

- **the share of employment in agriculture (variable agro, %),**
- **the share of employment in mining (variable mining, %),**
- **the share of employment in manufaturing (variable manufaturig, %),**
- **the share of employment in construction (variable build, %),**
- **the share of employment in wholesale and retail trade (variable trade, %),**
- **the share of employment in the public sector (variable public, %).**

Average values of explanatory variables

Variable	All Russia	High-High Club	Low-Low Club	Variable	All Russia	High-High Club	Low-Low Club
productivity	254.7	166.9	283.5	agriculture	12.2	17	10.9
grp	129.5	65.3	152.1	construction	7.2	6.4	7.5
density	71.4	33	105.6	trade	15.6	13.7	15.9
urban_share	69.1	53.4	74	public	17	21.1	15.7
below_working	17.2	22.1	15.7	mining	2.4	1.7	2.5
above_working	20.5	16	22	manufacturig	14.8	10.2	17.1
high_education	23.6	26.2	23.4				

Several minor hypotheses

3) The higher the GRP per capita or productivity per worker, the lower the unemployment rate;

4) The higher the share of urban population, the lower the unemployment rate;

5) The higher the share of the young, the higher the level of unemployment;

6) The higher the share of the elderly, the higher the level of unemployment;

7) The higher the share of educated population in labour force, the lower the unemployment rate.

Choice of basic model

$$Y_{it} = \tau Y_{it-1} + \rho W_Y Y_{it} + X\beta_{it} + \theta W_X X_{it} + \alpha_i + c_t + \varepsilon_{it}, \quad \varepsilon_{it} = \lambda W_\varepsilon \varepsilon_{it} + u_{it}$$

Type of model	Restrictions in model (1)	Type of weights matrix					
		Wleng		Wbound		Winvdist	
		AIC	BIC	AIC	BIC	AIC	BIC
SAR dynamic model with FE	Θ = λ = 0	1801	1892.17	1794.42	1885.313	1791.205	1882.09
SAR static model with FE	Θ = λ = τ =0	2237.94	2327.16	2234.98	2324.21	2225.78	2315.01
SDM dynamic model with FE	λ = 0	1799.21	1942.04	1783.07	1925.89	1785.94	1928.769
SDM static model with FE	λ = τ =0 αi are FE	2221.62	2364.38	2206.93	2349.70	2188.42	2331.19
SDM static model with RE	λ = τ =0 αi are RE	2668	2819.82	2657.01	2808.7	2667.06	2818.75
SAC static model with FE	Θ = τ = 0	2182.17	2275.86	2184.48	2278.177	2206.70	2300.4
SEM static model with RE	ρ = Θ = τ = 0	2678.6	2776.75	2674.60	2772.754	2664.47	2762.62

Modification of SDM model

$$Y_{it} = \tau Y_{it-1} + \rho_H (W \cdot H) Y_{it} + \rho_L (W \cdot L) Y_{it} + \rho_{HL} (W \cdot (I - H - L)) Y_{it} + X\beta_{it} +$$
$$+ ((L \cdot X)\theta_L)_{it} + ((H \cdot X)\theta_H)_{it} + \alpha_i + c_t + u_{it}$$

$$H_{ii} = \begin{cases} 1, & if \quad i \in \{29,\ 31,\ 34 - 38,\ 60 - 62,\ 64,\ 65,\ 67\} - \\ numbers & of \quad regions \quad from \quad High - High \quad C\,\text{lub} \\ 0, & otherwise \end{cases}$$

$$L_{ii} = \begin{cases} 1, & if \quad i \in \{1-17,\ 20-27, 40, 42-44, 46-53, 55, 57-59, 70, 74-75, 77, 80\} - \\ numbers & of\ regions from Low - Low C\,\text{lub}, \\ 0, & otherwise \end{cases}$$

Estimated econometric model

$$\begin{pmatrix} Y_{ih} \\ Y_{il} \\ Y_{ilh} \end{pmatrix}_t = \tau \begin{pmatrix} Y_{ih} \\ Y_{il} \\ Y_{ilh} \end{pmatrix}_{t-1} + \rho_H \begin{pmatrix} WY_{ih} \\ 0 \\ 0 \end{pmatrix}_t + \rho_L \begin{pmatrix} 0 \\ WY_{il} \\ 0 \end{pmatrix}_t + \rho_{HL} \begin{pmatrix} 0 \\ 0 \\ WY_{ihl} \end{pmatrix}_t +$$

$$+ \begin{pmatrix} X_{ih} \\ X_{il} \\ X_{il} \end{pmatrix}_t \beta + \begin{pmatrix} X_{ih} \\ 0 \\ 0 \end{pmatrix}_t \theta_H + \begin{pmatrix} 0 \\ X_{il} \\ 0 \end{pmatrix}_t \theta_L + \begin{pmatrix} \alpha_{ih} \\ \alpha_{il} \\ \alpha_{ihl} \end{pmatrix} + c_t + \begin{pmatrix} u_{ih} \\ u_{il} \\ u_{ihl} \end{pmatrix}_t$$

Formalization of two main research hypotheses

Hypothesis 1. There are no differences of spatial effects in regional clubs.

Alternative hypothesis 1. There are differences of spatial effects in regional clubs.

Formal main and alternative hypotheses 1:

$$H_0 : \rho_h = \rho_l = \rho_{hl}$$

$$H_1 : \rho_h \neq \rho_l \; or \; \rho_h \neq \rho_{hl}$$

Formalization of two main research hypotheses

Hypothesis 2. There are no differences in the influence of the factors on unemployment rates in the regions belonging to different regional clubs.

Alternative hypothesis 2. There are differences in the influence of the factors on unemployment rates in the regions belonging to different regional clubs.

Formal main and alternative hypotheses 2:

$$H_0 : \theta_H = \theta_L = 0$$

$$H_1 : \theta_H \neq 0 \; or \; \theta_L \neq 0$$

The results of estimation - 1

Variable	Model1	Model2	Model3	Model4	Model5	Model6
Time lag	0.350***	0.349***	0.361***	0.380***	0.393***	0.402***
Spatial lags						
WlenHY	-0.068			-0.123		
WlenLY	0.392***			0.385***		
Wlen(I-H-L)Y	0.501***			0.506***		
WbHY		-0.016			-0.073	
WbLY		0.524***			0.520***	
Wb(I-H-L)Y		0.721***			0.723***	
WidHY			0.290**			0.278**
WidLY			0.641***			0.620***
Wid(I-H-L)Y			0.707***			0.677***

The results of estimation - 2

productivity_hh	-0.038***	-0.039***	-0.028***			
productivity	0.002	0.002	-0.001			
productivity+ productivity_hh	-0.036***	-0.037***	-0.029***			
grp_hh				-0.102***	-0.103***	-0.071***
grp				0.005**	0.004**	0
grp+grp_hh				-0.097***	-0.099***	-0.071***
density_hh	-0.534**	-0.636**	-0.600**	-0.492*	-0.596**	-0.568*
density_ll	-0.494*	-0.592**	-0.577**	-0.492*	-0.590**	-0.567*
density	0.497*	0.595**	0.579**	0.494*	0.592**	0.569*
density+density_hh	-0.037**	-0.041**	-0.021	0.002	-0.004	0.001
density+density_ll	0.003*	0.003**	0.002	0.002**	0.002**	0.002
urban_share	0.061	0.078	0.064	0.08	0.088	0.06
below_working	0.460*	0.544**	0.963***	0.460*	0.584**	0.978***
above_working	0.072	-0.018	-0.237	0.091	-0.004	-0.262

The results of estimation - 3

high_education	0.006	0.007	0.020*	0.004	0.006	0.021*
agriculture_hh	-0.491**	-0.416*	-0.204	-0.487**	-0.357	-0.135
agriculture	0.099	0.081	0.068	0.095	0.076	0.065
agriculture+agriculture_hh	-0.392*	-0.335	-0.136	-0.392	-0.281	-0.07
construction_hh	0.878***	0.816***	0.763***	1.002***	0.962***	0.894***
construction	-0.053	0.007	0.133	-0.068	-0.008	0.106
construction+ construction_hh	0.825***	0.823***	0.896***	0.934***	0.954***	1***
trade	0.156**	0.112	0.134*	0.151**	0.11	0.142*
public_hh	1.372***	1.173***	1.453***	1.398***	1.206***	1.404***
public_ll	0.790**	0.513	0.266	0.797**	0.511	0.277
public	-0.153	-0.014	0.177	-0.171	-0.008	0.187
public+public_hh	1.219***	1.159***	1.63***	1.227***	1.198***	1.591***
public+public_ll	0.637***	0.499**	0.443*	0.626***	0.503**	0.464*
mining	-0.092	-0.127*	-0.182**	-0.086	-0.127	-0.189**
manufacturig	-0.095**	-0.101**	-0.133***	-0.094**	-0.102**	-0.134***

The results of estimation - 4

d2007	-0.412*	-0.163	-0.054	-0.420*	-0.161	-0.096
d2008	0.254	0.414	1.671***	0.263	0.461*	1.647***
d2009	0.964***	0.883**	2.656***	0.974***	0.891**	2.668***
d2010	-0.349	-0.279	-0.083	-0.429	-0.39	-0.126
d2011	-0.661	-0.441	-0.068	-0.739	-0.535	-0.146
d2012	-1.084	-0.696	0.407	-1.136	-0.766	0.314
_cons	-23.04**	-23.77***	-28.63***	-24.56***	-25.95***	-28.59***
Number of instruments	50	50	50	50	50	50
p-v AB(1) test	0	0	0	0	0	0
p-v AB(2) test	0.91	0.688	0.747	0.914	0.863	0.582
p-v AB(3) test	0.991	0.957	0.623	0.634	0.615	0.347
p-v Sargan test	0.38	0.417	0.132	0.356	0.383	0.153

Main Results - 1

- The first hypothesis about differences in spatial effects for regions from different unemployment clubs received partial empirical confirmation. A positive spatial effect for the Low-Low and High-Low clubs was found for all spatial matrices. A spatial effect for the High-High club was significant only for the inverted distance matrix.
- The second hypothesis also received partial empirical confirmation. We revealed club effect for the variables productivity, grp, density, agriculture, construction, public.
- We have received empirical confirmation of our third hypothesis (the higher the GRP per capita or productivity per worker, the lower the unemployment rate) only for the High-High club.
- Hypothesis 4 did not receive empirical confirmation, the coefficients of variable urban_share (the share of urban population) was insignificant .

Main Results - 2

- We did not get stable results concerning the influence of population density on the unemployment rate. The coefficient of density was positive for High-Low group (in all models), positive (but less in absolute value) for Low-Low club and insignificant for High-High club (in most of models).
- Hypothesis 5 received partial empirical confirmation. The increasing share of young people raises unemployment in the regions, as expected, this factor did not demonstrate a club effect. At the same time the share of the elderly does not affect the level of unemployment (contradicting our hypothesis 6 .
- Hypothesis 7 (the higher the share of educated population, the lower the unemployment rate) also did not receive empirical confirmation, the coefficient of corresponding variable was insignificant, we also did not receive club effect for this factor.

Main Results - 3

- We found negative coefficients for share of employed people in agriculture for High-High club and insignificant coefficient of this variable for other clubs.
- The increased share of employed people in the construction industry raises unemployment only in the High-High club. .
- The coefficient of variable trade was positive in most part of models and did not demonstrate club effect.
- The increased share of employed people in the public sector, which is presented with education and health sectors, increases unemployment rates in both the High-High and Low-Low clubs, but more in the first one.
- The coefficient of variable mining was negative (but insignificant in a half of models) and did not demonstrate club effect. At the same time coefficients of variable manufacturing are highly significant and negative in all models (but this factor also did not demonstrate club effect).

Conclusions - 1

- There are four regional groups in Russia, but only two of them are stable over time – High-High and Low-Low. For this reason, they were included in the model as clubs, while the remaining regions were grouped as High-Low.
- Model evaluation partially confirmed the first hypothesis. So far, a positive spatial effect was detected for regions in the Low-Low and High- Low clubs for all weights matrices. A spatial effect for the High-High club was significant only for the inverse distance matrix (reflected the links between all regions).
- The second hypothesis was also partially confirmed. We found the determinants of unemployment for the High-High and Low-Low clubs significantly differ from those for the other regions.

Conclusions – 2

•Among all factors which influence unemployment, a group of factors which increase unemployment may be defined. This group consists of the share of young population (in the whole country), the share of people employed in the construction industry (in the High-High club), and in the public sector (in both High-High and Low-Low clubs but with different degrees of influence).

•We can also distinguish a group of factors, which helps to reduce unemployment. It consists of growth of productivity per worker, GRP per capita (in the High-High club) and increase in share of people employed in the manufacturing (in whole Russia).

•The results obtained may be taken into account to formulate a state regional policy aimed at reducing unemployment levels in regions. It should be noted that the impact on the unemployment rate in regions that belong to different clubs may have different effects, and regions included in the High-High club (mostly from North Caucasus Federal and south of the Siberia) differ significantly from other regions of Russia.

Thank you!

danilenko-tanya@yandex.ru

demidova@hse.ru
http://www.hse.ru/org/persons/demidova_olga

marcello.signorelli@tin.it , marcello.signorelli@unipg.it
http://www.ec.unipg.it/DEFS/signorelli.html?lang=it

NATIONAL RESEARCH UNIVERSITY

Unemployment Clubs in Russian Regions: spatial econometric approach

Danilenko Tatiana (NRU HSE, Moscow, Russia),

Demidova Olga (NRU HSE, Moscow, Russia),

Signorelli Marcello (University of Perugia, Italy)

56 th ERSA Congress, Vienna, August 23-26 , 2016

Motivation

The concept of socio-economic development of the Russian Federation till 2020 states that the priorities of the state regional policy are

(i) balanced socio-economic regional development and

(ii) the reduction of interregional disparities.

Literature review (1)

Regional real convergence and regional labour market dynamics

- Barro and Sala-i-Martin, 1991; Blanchard and Katz, 1992; Armstrong, 1995; Obstfeld et al., 1998; Boldrin and Canova, 2001; Magrini, 2004; Albu et al., 2010; Fischer, 2015
- Elhorst, 2003; Huber, 2007; Ferragina and Pastore, 2008; Decressin and Fatás, 1995; Francis, 2009; Caroleo and Pastore, 2010; Falk and Leoni, 2010; Marelli and Signorelli, 2010; Beyer and Smets, 2014; Marelli et al., 2014; Beyer and Stemmer, 2015; Mussida and Pastore, 2015a and 2015b); Gray, 2004; Marelli et al., 2012; Bruno et al., 2014; Scarpetta and Worgotter, 1995; Scarpetta and Huber, 1995; Lopez-Bazo et al., 2005; Tyrowicz and Wojcik, 2010

Literature review (2)

Russian regional development and unemployment

- Solanko (2008); Ledyaeva et al. (2008); Kholodilin et al. (2012); Akhmedjonov et al., (2013); Lehmann and Silvagni (2013); Mikheeva (1999); Dolinskaya (2002); Galbraith et al., (2014); Popov (1999); Ahrend (2005); Desai et al. (2005); Oshchepkov (2015); Demidova and Signorelli (2012); Demidova, Marelli and Signorelli (2013); Demidova, Marelli and Signorelli (2015).

Focus on some studies for Russia

Lugovoy O., Dashkeyev, I. Mazayev, D. Fomchenko, E. Polyakov. (2007). Analysis of Economic Growth in Regions: Geographical and Institutional Aspect. Consortium for Economic Policy Research and Advice. Moscow: IET.:

"Even during a relatively short period under consideration (1998–2004) one can talk about significant spatial heterogeneity in economic development of Russian regions, which obviously should be taken into account in empirical studies of regional growth".

Kolomak, E. (2011). Spatial Externalities as a Source of Economic Growth. Regional Research of Russia, 1, 2, pp. 114–119. Moscow: Springer.

For the western regions of Russia spatial effects for economic growth positive and statistically significant for both the neighborhood matrix and the distance matrix. For the eastern regions of Russia spatial externalities on their economic growth are limited to the neighboring territories and negative.

Kholodilin, K. A., Oshchepkov, A., & Siliverstovs, B. (2012). The Russian regional convergence process: Where is it leading?. Eastern European Economics, 50(3), 5-26:

"Our results show that the overall speed of regional convergence in Russia, being low by international standards, becomes even lower after controlling for spatial effects. However, when accounting for the spatial regimes, we find a strong regional convergence among high-income regions located near other high-income regions".

Focus on some studies adopting a club/cluster approach

- Many studies on real regional growth follow a club approach (Quah, 1997; Baumont et al., 2003; Canova, 2004, Alexiadis (2013), Fischer & LeSage, 2014). As for a survey, see Alexiadis (2013).
- However, in the literature on unemployment a cluster approach (Overman and Puga, 2002) is more widespread.
- More recently, some chapters in Mussida C. and F. Pastore (Eds.), (2015) follow a cluster approach for investigating geographical labour market imbalances.

Club vs cluster

The main technical difference between a club and cluster approach:

- **Using a cluster approach, researchers try to unify regions with close values of independent variables (this requires the using of special multi-dimensional distance between objects, for example, the Euclidean or Mahalonobis).**
- **Under the club approach researchers unify regions with close values of the dependent variable.**

Data and weights matrices

- 80 Russian regions; period 2005 – 2012;
- The dependent variable is regional unemployment rate.

$$W_{len} = \begin{pmatrix} 0 & w_{12}^{len} & \cdots & w_{1n}^{len} \\ w_{21}^{len} & 0 & \cdots & w_{2n}^{len} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^{len} & w_{n2}^{len} & \cdots & 0 \end{pmatrix}$$

$$w_{ij}^{len} = \frac{length\,in\,km\,of\ \ joint\,boundaries\,between\,regions\,i\ and\ \ j}{total\,length\,in\,km\,of\ \ all\,boundaries\,of\ \ region\,i}$$

Data and weights matrices

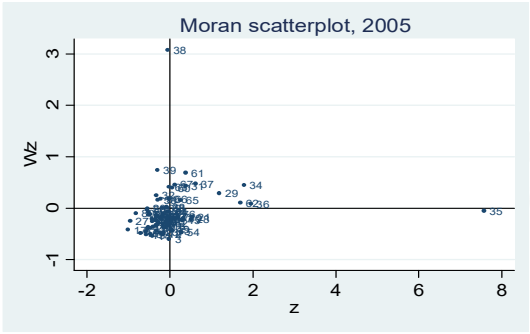
$$W_b = \begin{pmatrix} 0 & w_{12}^b & \cdots & w_{1n}^b \\ w_{21}^b & 0 & \cdots & w_{2n}^b \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^b & w_{n2}^b & \cdots & 0 \end{pmatrix}$$

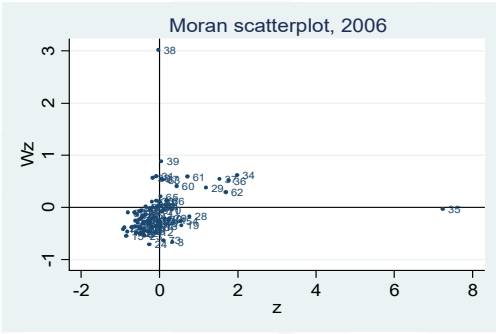
$w_{ij}^b = 1 \quad if \quad regions \quad i \quad and \quad j \quad have \quad joint \quad boundary$

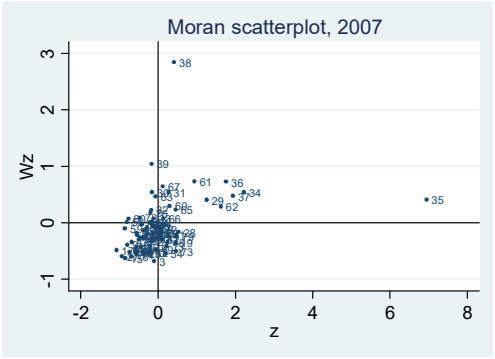
$$W_{id} = \begin{pmatrix} 0 & w_{12}^{id} & \cdots & w_{1n}^{id} \\ w_{21}^{id} & 0 & \cdots & w_{2n}^{id} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1}^{id} & w_{n2}^{id} & \cdots & 0 \end{pmatrix}$$

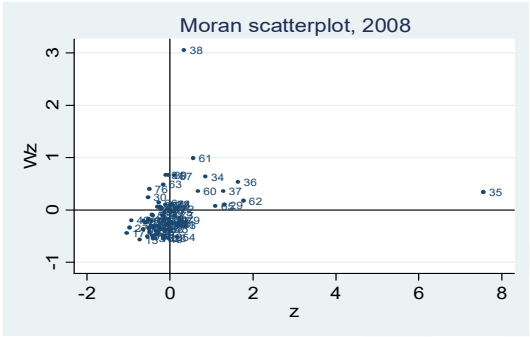
$w_{ij}^{id} = \quad inverse \quad distance \quad between \quad regions \quad i \quad and \quad j \quad by \quad auto \quad road$

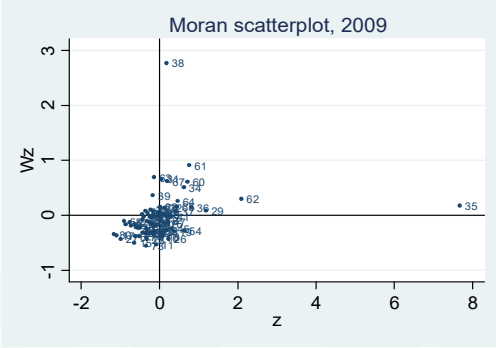
The Moran plots

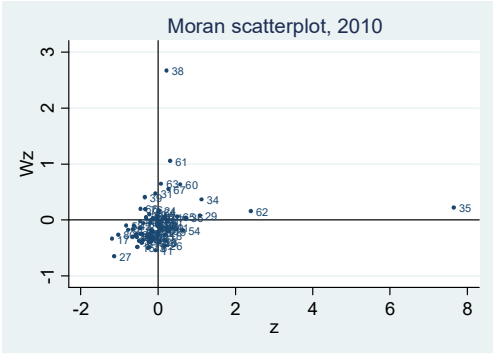


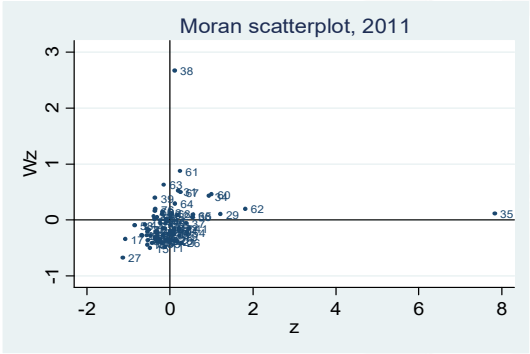


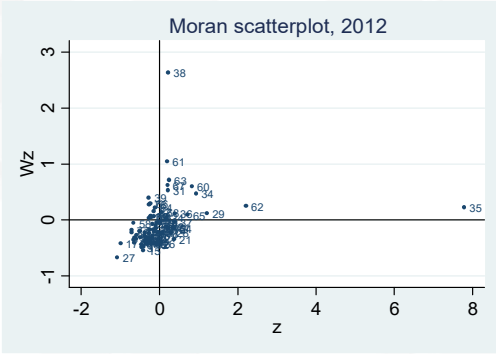








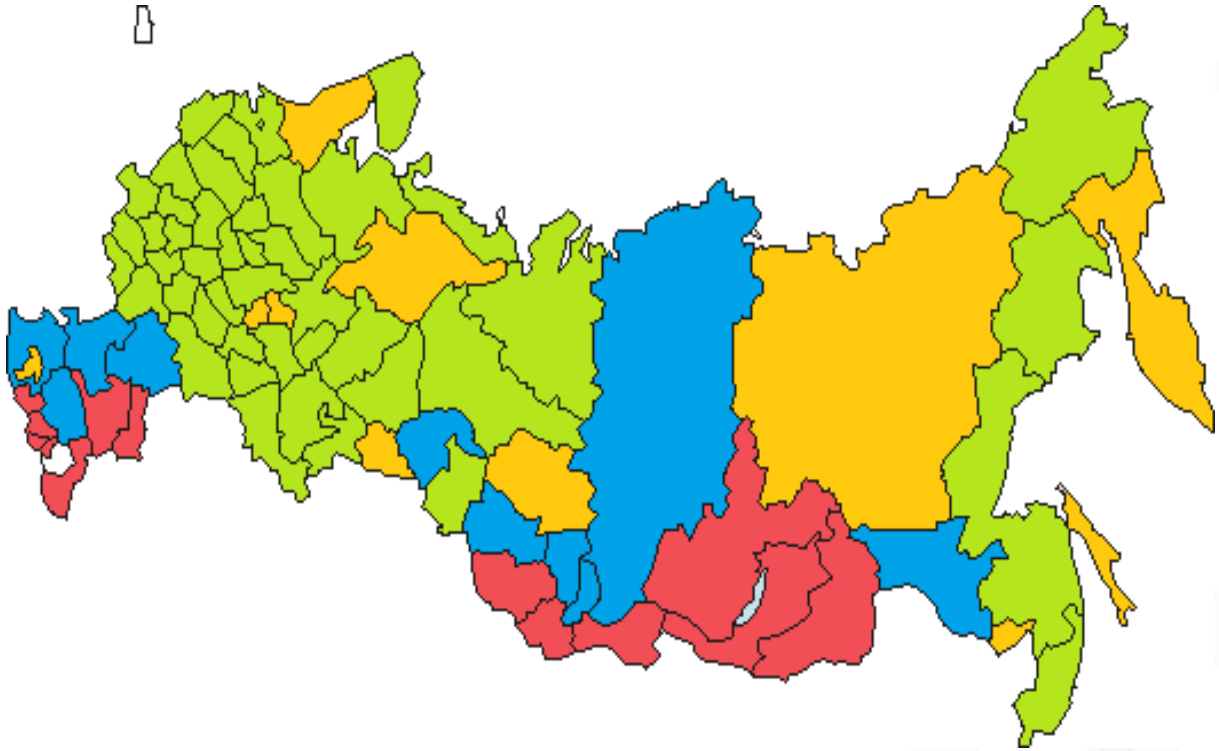




Clubs

High-High Club	Low-Low Club		
Republic of Kalmykia	Belgorod region	Yaroslavl region	Kirov region
Astrakhan region	Bryansk region	Moscow	Nizhny Novgorod region
Republic of Dagestan	Vladimir region	Arkhangelsk region	Orenburg region
Republic of Ingushetia	Voronezh region	Nenets Autonomous Okrug	Penza region
Republic of Kabardino-Balkaria	Ivanovo region	Vologda region	Samara region
Republic of Karachaevo-Cherkessia	Kaluga region	Leningrad region	Saratov region
Republic of Northen Osetia – Alania	Kostroma region	Murmansk region	Ulyanovsk region
Republic of Altay	Kursk region	Novgorod region	Sverdlovsk region
Republic of Buryatia	Lipetsk region	Pskov region	Khanty-Mansi Autonomous Area - Yugra
Republic of Tyva	Orel region	Saint-Petersburg	Yamal-Nenets autonomous region
Altay Territory	Ryazan region	Republic of Bashkortostan	Chelyabinsk region
Zabaykalsky Territory	Smolensk region	Republic of Mordovia	Omsk region
Irkutsk region	Tambov region	Republic of Tatarstan	Primorsky Territory
	Tver region	Republic of Udmurtia	Khabarovsk Territory
	Tula region	Perm territory	Magadan region
			Chukotka Autonomous Okrug

Map of Russia



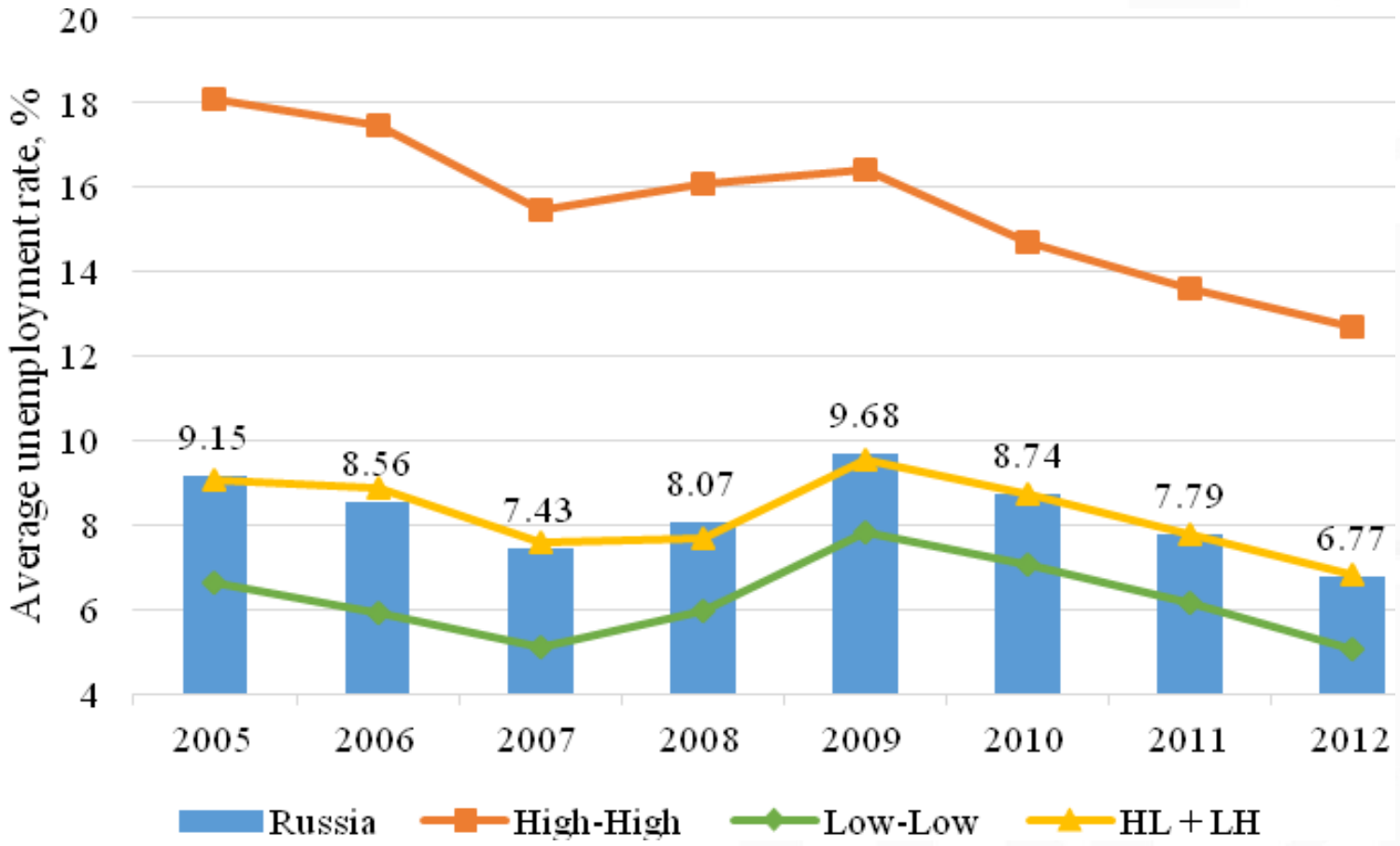
High-high club

Low-Low club

High-low club

Low-high club

The dynamic of average unemployment rate in Russia for 2005-2012, %



The dynamic of Moran's I

Weights matrix	Boundaries lengths matrix	Binary contiguity matrix	Inverse distance matrix
2005	0.059	0.072	0.055*
2006	0.088	0.120**	0.112*
2007	0.163***	0.191***	0.158***
2008	0.134**	0.145***	0.121***
2009	0.098*	0.101**	0.088*
2010	0.09	0.098**	0.069
2011	0.081	0.085*	0.063
2012	0.110**	0.118**	0.071

Main Hypotheses

- **H1: spatial effects for the High-High and Low-Low clubs differ from spatial effects for other regions;**

- **H2: the determinants of unemployment for the High-High and Low-Low clubs differ from other regions.**

Explanatory Variables

Three groups of variables:

1) **variables about the attractiveness of the region**

2) **socio-demographic variables**

3) **variables of the industrial structure of the employed population.**

Explanatory Variables

1) variables about the attractiveness of the region:

- GRP per capita (variable grp, thousand rubles), productivity per worker (variable product, thousand rubles)
- the share of urban population (variable urban_share, %)
- population density (variable dens, people per km2)

2) socio-demographic variables:

- the age structure of the population (variables below and above of working age, %)
- the proportion of people with higher education in labour force (variable highed, %).

Explanatory Variables

3) variables of the industrial structure of the employed population:

- **the share of employment in agriculture (variable agro, %),**
- **the share of employment in mining (variable mining, %),**
- **the share of employment in manufaturing (variable manufaturig, %),**
- **the share of employment in construction (variable build, %),**
- **the share of employment in wholesale and retail trade (variable trade, %),**
- **the share of employment in the public sector (variable public, %).**

Average values of explanatory variables

Variable	All Russia	High-High Club	Low-Low Club	Variable	All Russia	High-High Club	Low-Low Club
productivity	254.7	166.9	283.5	agriculture	12.2	17	10.9
grp	129.5	65.3	152.1	construction	7.2	6.4	7.5
density	71.4	33	105.6	trade	15.6	13.7	15.9
urban_share	69.1	53.4	74	public	17	21.1	15.7
below_working	17.2	22.1	15.7	mining	2.4	1.7	2.5
above_working	20.5	16	22	manufacturig	14.8	10.2	17.1
high_education	23.6	26.2	23.4				

Several minor hypotheses

3) The higher the GRP per capita or productivity per worker, the lower the unemployment rate;

4) The higher the share of urban population, the lower the unemployment rate;

5) The higher the share of the young, the higher the level of unemployment;

6) The higher the share of the elderly, the higher the level of unemployment;

7) The higher the share of educated population in labour force, the lower the unemployment rate.

Choice of basic model

$$Y_{it} = \tau Y_{it-1} + \rho W_Y Y_{it} + X\beta_{it} + \theta W_X X_{it} + \alpha_i + c_t + \varepsilon_{it}, \quad \varepsilon_{it} = \lambda W_\varepsilon \varepsilon_{it} + u_{it}$$

Type of model	Restrictions in model (1)	Type of weights matrix					
		Wleng		Wbound		Winvdist	
		AIC	BIC	AIC	BIC	AIC	BIC
SAR dynamic model with FE	Θ = λ = 0	1801	1892.17	1794.42	1885.313	1791.205	1882.09
SAR static model with FE	Θ = λ = τ =0	2237.94	2327.16	2234.98	2324.21	2225.78	2315.01
SDM dynamic model with FE	λ = 0	1799.21	1942.04	1783.07	1925.89	1785.94	1928.769
SDM static model with FE	λ = τ =0 αi are FE	2221.62	2364.38	2206.93	2349.70	2188.42	2331.19
SDM static model with RE	λ = τ =0 αi are RE	2668	2819.82	2657.01	2808.7	2667.06	2818.75
SAC static model with FE	Θ = τ = 0	2182.17	2275.86	2184.48	2278.177	2206.70	2300.4
SEM static model with RE	ρ = Θ = τ = 0	2678.6	2776.75	2674.60	2772.754	2664.47	2762.62

Modification of SDM model

$$Y_{it} = \tau Y_{it-1} + \rho_H (W \cdot H) Y_{it} + \rho_L (W \cdot L) Y_{it} + \rho_{HL} (W \cdot (I - H - L)) Y_{it} + X\beta_{it} +$$
$$+ ((L \cdot X)\theta_L)_{it} + ((H \cdot X)\theta_H)_{it} + \alpha_i + c_t + u_{it}$$

$$H_{ii} = \begin{cases} 1, & if \quad i \in \{29,\ 31,\ 34 - 38,\ 60 - 62,\ 64,\ 65,\ 67\} - \\ numbers & of \quad regions \quad from \quad High - High \quad C\,\text{lub} \\ 0, & otherwise \end{cases}$$

$$L_{ii} = \begin{cases} 1, & if \quad i \in \{1-17,\ 20-27, 40, 42-44, 46-53, 55, 57-59, 70, 74-75, 77, 80\} - \\ numbers & of\ regions from Low - Low C\,\text{lub}, \\ 0, & otherwise \end{cases}$$

Estimated econometric model

$$\begin{pmatrix} Y_{ih} \\ Y_{il} \\ Y_{ilh} \end{pmatrix}_t = \tau \begin{pmatrix} Y_{ih} \\ Y_{il} \\ Y_{ilh} \end{pmatrix}_{t-1} + \rho_H \begin{pmatrix} WY_{ih} \\ 0 \\ 0 \end{pmatrix}_t + \rho_L \begin{pmatrix} 0 \\ WY_{il} \\ 0 \end{pmatrix}_t + \rho_{HL} \begin{pmatrix} 0 \\ 0 \\ WY_{ihl} \end{pmatrix}_t +$$

$$+ \begin{pmatrix} X_{ih} \\ X_{il} \\ X_{il} \end{pmatrix}_t \beta + \begin{pmatrix} X_{ih} \\ 0 \\ 0 \end{pmatrix}_t \theta_H + \begin{pmatrix} 0 \\ X_{il} \\ 0 \end{pmatrix}_t \theta_L + \begin{pmatrix} \alpha_{ih} \\ \alpha_{il} \\ \alpha_{ihl} \end{pmatrix} + c_t + \begin{pmatrix} u_{ih} \\ u_{il} \\ u_{ihl} \end{pmatrix}_t$$

Formalization of two main research hypotheses

Hypothesis 1. There are no differences of spatial effects in regional clubs.

Alternative hypothesis 1. There are differences of spatial effects in regional clubs.

Formal main and alternative hypotheses 1:

$$H_0 : \rho_h = \rho_l = \rho_{hl}$$

$$H_1 : \rho_h \neq \rho_l \; or \; \rho_h \neq \rho_{hl}$$

Formalization of two main research hypotheses

Hypothesis 2. There are no differences in the influence of the factors on unemployment rates in the regions belonging to different regional clubs.

Alternative hypothesis 2. There are differences in the influence of the factors on unemployment rates in the regions belonging to different regional clubs.

Formal main and alternative hypotheses 2:

$$H_0 : \theta_H = \theta_L = 0$$

$$H_1 : \theta_H \neq 0 \; or \; \theta_L \neq 0$$

The results of estimation - 1

Variable	Model1	Model2	Model3	Model4	Model5	Model6
Time lag	0.350***	0.349***	0.361***	0.380***	0.393***	0.402***
Spatial lags						
WlenHY	-0.068			-0.123		
WlenLY	0.392***			0.385***		
Wlen(I-H-L)Y	0.501***			0.506***		
WbHY		-0.016			-0.073	
WbLY		0.524***			0.520***	
Wb(I-H-L)Y		0.721***			0.723***	
WidHY			0.290**			0.278**
WidLY			0.641***			0.620***
Wid(I-H-L)Y			0.707***			0.677***

The results of estimation - 2

productivity_hh	-0.038***	-0.039***	-0.028***			
productivity	0.002	0.002	-0.001			
productivity+ productivity_hh	-0.036***	-0.037***	-0.029***			
grp_hh				-0.102***	-0.103***	-0.071***
grp				0.005**	0.004**	0
grp+grp_hh				-0.097***	-0.099***	-0.071***
density_hh	-0.534**	-0.636**	-0.600**	-0.492*	-0.596**	-0.568*
density_ll	-0.494*	-0.592**	-0.577**	-0.492*	-0.590**	-0.567*
density	0.497*	0.595**	0.579**	0.494*	0.592**	0.569*
density+density_hh	-0.037**	-0.041**	-0.021	0.002	-0.004	0.001
density+density_ll	0.003*	0.003**	0.002	0.002**	0.002**	0.002
urban_share	0.061	0.078	0.064	0.08	0.088	0.06
below_working	0.460*	0.544**	0.963***	0.460*	0.584**	0.978***
above_working	0.072	-0.018	-0.237	0.091	-0.004	-0.262

The results of estimation - 3

high_education	0.006	0.007	0.020*	0.004	0.006	0.021*
agriculture_hh	-0.491**	-0.416*	-0.204	-0.487**	-0.357	-0.135
agriculture	0.099	0.081	0.068	0.095	0.076	0.065
agriculture+agriculture_hh	-0.392*	-0.335	-0.136	-0.392	-0.281	-0.07
construction_hh	0.878***	0.816***	0.763***	1.002***	0.962***	0.894***
construction	-0.053	0.007	0.133	-0.068	-0.008	0.106
construction+ construction_hh	0.825***	0.823***	0.896***	0.934***	0.954***	1***
trade	0.156**	0.112	0.134*	0.151**	0.11	0.142*
public_hh	1.372***	1.173***	1.453***	1.398***	1.206***	1.404***
public_ll	0.790**	0.513	0.266	0.797**	0.511	0.277
public	-0.153	-0.014	0.177	-0.171	-0.008	0.187
public+public_hh	1.219***	1.159***	1.63***	1.227***	1.198***	1.591***
public+public_ll	0.637***	0.499**	0.443*	0.626***	0.503**	0.464*
mining	-0.092	-0.127*	-0.182**	-0.086	-0.127	-0.189**
manufacturig	-0.095**	-0.101**	-0.133***	-0.094**	-0.102**	-0.134***

The results of estimation - 4

d2007	-0.412*	-0.163	-0.054	-0.420*	-0.161	-0.096
d2008	0.254	0.414	1.671***	0.263	0.461*	1.647***
d2009	0.964***	0.883**	2.656***	0.974***	0.891**	2.668***
d2010	-0.349	-0.279	-0.083	-0.429	-0.39	-0.126
d2011	-0.661	-0.441	-0.068	-0.739	-0.535	-0.146
d2012	-1.084	-0.696	0.407	-1.136	-0.766	0.314
_cons	-23.04**	-23.77***	-28.63***	-24.56***	-25.95***	-28.59***
Number of instruments	50	50	50	50	50	50
p-v AB(1) test	0	0	0	0	0	0
p-v AB(2) test	0.91	0.688	0.747	0.914	0.863	0.582
p-v AB(3) test	0.991	0.957	0.623	0.634	0.615	0.347
p-v Sargan test	0.38	0.417	0.132	0.356	0.383	0.153

Main Results - 1

- The first hypothesis about differences in spatial effects for regions from different unemployment clubs received partial empirical confirmation. A positive spatial effect for the Low-Low and High-Low clubs was found for all spatial matrices. A spatial effect for the High-High club was significant only for the inverted distance matrix.
- The second hypothesis also received partial empirical confirmation. We revealed club effect for the variables productivity, grp, density, agriculture, construction, public.
- We have received empirical confirmation of our third hypothesis (the higher the GRP per capita or productivity per worker, the lower the unemployment rate) only for the High-High club.
- Hypothesis 4 did not receive empirical confirmation, the coefficients of variable urban_share (the share of urban population) was insignificant .

Main Results - 2

- We did not get stable results concerning the influence of population density on the unemployment rate. The coefficient of density was positive for High-Low group (in all models), positive (but less in absolute value) for Low-Low club and insignificant for High-High club (in most of models).
- Hypothesis 5 received partial empirical confirmation. The increasing share of young people raises unemployment in the regions, as expected, this factor did not demonstrate a club effect. At the same time the share of the elderly does not affect the level of unemployment (contradicting our hypothesis 6 .
- Hypothesis 7 (the higher the share of educated population, the lower the unemployment rate) also did not receive empirical confirmation, the coefficient of corresponding variable was insignificant, we also did not receive club effect for this factor.

Main Results - 3

- We found negative coefficients for share of employed people in agriculture for High-High club and insignificant coefficient of this variable for other clubs.
- The increased share of employed people in the construction industry raises unemployment only in the High-High club. .
- The coefficient of variable trade was positive in most part of models and did not demonstrate club effect.
- The increased share of employed people in the public sector, which is presented with education and health sectors, increases unemployment rates in both the High-High and Low-Low clubs, but more in the first one.
- The coefficient of variable mining was negative (but insignificant in a half of models) and did not demonstrate club effect. At the same time coefficients of variable manufacturing are highly significant and negative in all models (but this factor also did not demonstrate club effect).

Conclusions - 1

- There are four regional groups in Russia, but only two of them are stable over time – High-High and Low-Low. For this reason, they were included in the model as clubs, while the remaining regions were grouped as High-Low.
- Model evaluation partially confirmed the first hypothesis. So far, a positive spatial effect was detected for regions in the Low-Low and High- Low clubs for all weights matrices. A spatial effect for the High-High club was significant only for the inverse distance matrix (reflected the links between all regions).
- The second hypothesis was also partially confirmed. We found the determinants of unemployment for the High-High and Low-Low clubs significantly differ from those for the other regions.

Conclusions – 2

•Among all factors which influence unemployment, a group of factors which increase unemployment may be defined. This group consists of the share of young population (in the whole country), the share of people employed in the construction industry (in the High-High club), and in the public sector (in both High-High and Low-Low clubs but with different degrees of influence).

•We can also distinguish a group of factors, which helps to reduce unemployment. It consists of growth of productivity per worker, GRP per capita (in the High-High club) and increase in share of people employed in the manufacturing (in whole Russia).

•The results obtained may be taken into account to formulate a state regional policy aimed at reducing unemployment levels in regions. It should be noted that the impact on the unemployment rate in regions that belong to different clubs may have different effects, and regions included in the High-High club (mostly from North Caucasus Federal and south of the Siberia) differ significantly from other regions of Russia.

Thank you!

danilenko-tanya@yandex.ru

demidova@hse.ru
http://www.hse.ru/org/persons/demidova_olga

marcello.signorelli@tin.it , marcello.signorelli@unipg.it
http://www.ec.unipg.it/DEFS/signorelli.html?lang=it