SIE-EACES session

"*Labour Markets and Crises: Comparative Evidence and Policy Implications*"

Unemployment Clubs in Russian Regions

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Abstract

The paper empirically investigates regional unemployment in Russia by adopting a "clubs approach". The exploration of the Moran scatterplots revealed a significant heterogeneity of Russian regions and suggested the distinction in two clubs: High-High (regions with high unemployment surrounded by regions with high unemployment) and Low-Low (regions with low unemployment surrounded by regions with low unemployment); some regions are not included in these two clubs. We tested the following research hypotheses: (i) spatial effects for the High-High and Low-Low clubs regions differ significantly, (ii) the determinants of unemployment for the High-High and Low-Low clubs significantly differ from the other regions. We adopt a specially designed class of spatial-econometric models and we estimated regional data from 2004 till 2012 using difference GMM and system GMM. For both hypotheses partial empirical confirmation is found; in other terms, we identified both similarities and differences in the spatial effects and in the determinants of unemployment for the selected clubs. Our results can favor a better design of national and regional policies for reducing regional unemployment disparities in Russia.

Keywords: regional unemployment, regional clubs, spatial effects, Russia.
JEL: J64, R23, R19

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1. Introduction

It should be noted that a better knowledge of regional (sub-national) differences can permit to design more appropriate economic and structural (national and regional) policies alleviating the adverse socioeconomic effects associated with spatial concentrations of high unemployment (e.g., Elhorst, 2003). In addition, in order to design more efficient economic policies, it is not only the heterogeneity in the level of unemployment which matters, but also the potential heterogeneity in the factors affecting regional unemployment; so, knowing how regions are distributed into high or low unemployment groups/clusters is a key empirical issue with significant policy implications.[1]

The concept of socio-economic development of the Russian Federation till 2020 states that priorities of the state regional policy are (i) balanced socio-economic regional development and (ii) interregional disparities reduction.

In this paper we examined, by adopting a "clubs approach", the degree of homogeneity of Russian regions according to the level of regional unemployment. First of all, the exploration of the Moran scatterplots revealed a significant heterogeneity of Russian regions. In particular, among all Russian regions we can distinguish the two clubs: High-High (regions with high unemployment, surrounded by regions with high unemployment) and Low-Low (regions with low unemployment, surrounded by regions with low unemployment); however, some regions are not included in these two clubs.

Our main research hypotheses are: 1) spatial effects for the High-High and Low-Low clubs regions differ significantly, 2) the determinants of unemployment for the High-High and Low-Low clubs significantly differ from the other regions. The hypotheses were tested using a specially designed class of spatial-econometric models and estimated by regional data from 2004 till 2012 using difference GMM and system GMM. For both hypotheses partial empirical confirmation is found. In other terms, we identified both similarities and differences in the spatial effects and in the determinants of unemployment for the selected clubs.

Our results can favor a better design of national and regional policies for reducing regional unemployment disparities in Russia.

2. Literature Review

In this section we briefly recall the key literature on (i) regional real convergence and labour market dynamics, (ii) Russian regional development and unemployment.

[1] In a pioneering research, Overman and Puga (2002) cluster 150 NUTS-2 European regions according to several characteristics.

2.1. Regional real convergence, regional labour market dynamics and club approaches

In the past two decades a huge literature investigated the economic growth features and the labour market performance dynamics by adopting the "regions" (sub-national level) as the key geographical dimension.

As for the analyses on regional economic growth, several authors considered the determinants of real convergence or divergence (e.g., 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), especially in the European context.

As for the literature on regional unemployment, three surveys focused on the theoretical and empirical explanations (Elhorst, 2003) and the peculiarities of transition countries (Huber, 2007; Ferragina and Pastore, 2008). Several studies considered the unemployment and labour market dynamics in European regions (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), also investigating the persistent differentials (e.g., Gray, 2004) or considering the impact of the last crisis on NEET and/or youth unemployment (Marelli et al., 2012; Bruno et al., 2014). Some researches focused on transition economies (e.g., Scarpetta and Worgotter, 1995; Scarpetta and Huber, 1995) while others considered the regional unemployment in a specific Western (e.g., Lopez-Bazo et al., 2005) or Eastern (e.g., Tyrowicz and Wojcik, 2010) country.

Many studies on regional real growth follow a club approach (e.g., Quah, 1997; Baumont et al., 2003; Canova, 2004)[2] and also the literature on regional unemployment adopting a cluster approach is growing, especially after Overman and Puga (2002); more recently, several chapters in Mussida and Pastore (2105a) follow a cluster approach for investigating geographical labour market imbalances.

2.2. Russian regional development and unemployment

The studies about Russian regions especially regard the economic growth and development features while just few of them investigate the unemployment differences and dynamics.

In particular, some researches investigate regional real convergence or divergence (e.g., Solanko, 2008; Ledyaeva et al., 2008; Kholodilin et al., 2012; Akhmedjonov et al., 2013; Lehmann and Silvagni, 2013), while others focused on regional inequality (e.g. Mikheeva, 1999; Dolinskaya, 2002; Galbraith et al., 2014). In addition, Popov (1999) focused on the importance of reform strategies, Ahrend (2005) analysed the role of the speed of reform and

[2] On the measurement of polarisation, see Esteban and Ray (1994).

initial conditions for the regional economic performance, Desai et al. (2005) considered the effects of fiscal federalism, Oshchepkov (2015) focused on the role of wage differentials.

The literature on Russian regional labour market differences especially focused on youth unemployment (e.g., Demidova and Signorelli, 2012; Demidova et al., 2013; Demidova et al. 2015). So, according to our knowledge, the existing literature does not give answers about the number and features of regional unemployment clubs in Russia. In addition, questions about possible differences in spatial effects and in the impact of independent variables on regional unemployment level remain open.

3. Regional Unemployment Clubs

The Moran scatter plot is a useful tool for visualization in spatial econometric. It shows the dependence between the observable variable (Y - unemployment rate for the current study) and the weighted sum of the indicator for the rest regions (WY), where W is weighs matrix. Special weighs matrices are used to account for the spatial relationships between regions in econometrics. There are several types of matrices with varying complexity. In this paper, to account for the spatial dependence of the regions a matrix of common borders was formed. It is represented by the following formula of W:

$$W = \begin{pmatrix} 0 & w_{12} & \dots & w_{1n} \\ w_{21} & 0 & \dots & w_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & w_{n2} & \dots & 0 \end{pmatrix},$$

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

It should be noted, that the matrix is line-normalized, so w_{ij} accounts for a weighs of a region; $w_{ij} = 0$, if there is no boundary between regions i and j or if $i = j$. To continue the graph description, its horizontal axis shows the values of Y and the vertical axis – the weighted sum WY. The values of Y usually considered as normalized (Z), which obtains due to centering and normalization procedures: $Z = \dfrac{Y - \mu}{\sigma}$, where μ is mean value of Y and σ is standard deviation of Y. The horizontal and the vertical axis (Z and WZ) divide graph into four parts. Each part corresponds to one regional group: top right – High-High, top left – Low-High, bottom left – Low-Low, bottom right – High-Low. This methodology was used as an underlying principal in regional clubs detection.

It should be noted that such graph may be constructed for each year of the considered period. So, nine Moran scatter plots were built to answer the question about the number of regional groups in Russia (see appendix 1). The first finding of the revealed procedure is that in Russia there are four regional unemployment groups. Than it was necessary to study the membership of each group to find, if it is stable in time or not. This routine showed that only High-High and Low-Low groups are more or less stable in time, so they were called clubs and later were incorporated into the model by the dummy construction. All other regions were united in a group called High-Low. The rule of simple majority was used to define the region belonging to the club; so , if a region was more than five times in High-High or Low-Low group, it was then labeled as High-High or Low-Low, respectively. The results are represented in Figure 1.

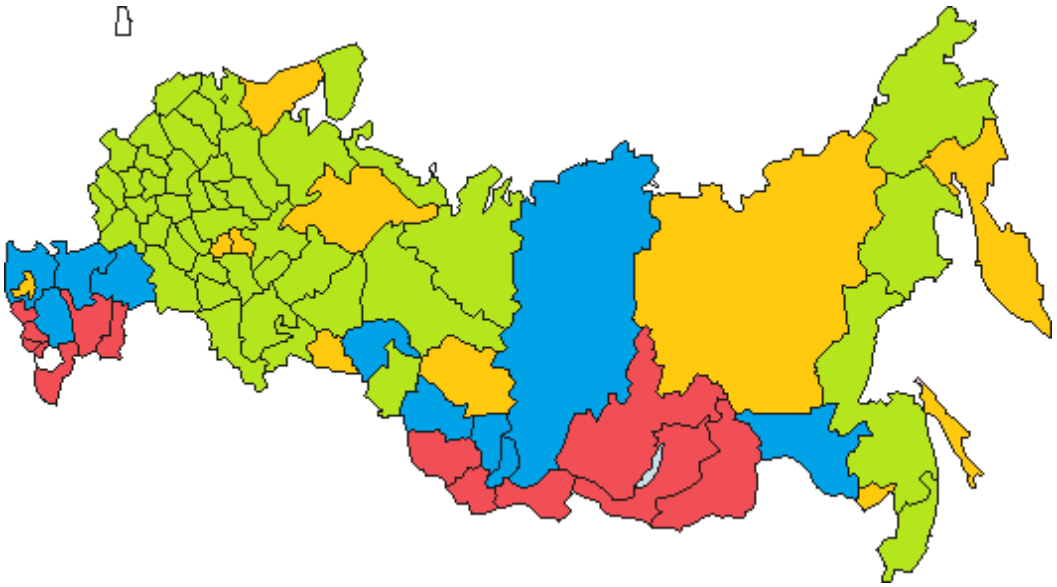

Figure 1. Regional unemployment clubs in Russia in 2004-2012

This map shows the division of Russian regions into four regional unemployment groups according to the Moran scatterplots build for each year of the reporting period 2004-2012. Green color stand for regions from Low-Low club, so these are prosperous regions with low unemployment rates surrounded by the regions with also low unemployment rates. This group is the most numerous (46 subjects) and consists of all regions of the Central Federal district, the majority of the subjects belonging to the North-West, Volga and Ural Federal district. Red color represent regions of the High-High club (13 regions), which consists of two regions from the Southern Federal district (Republic of Kalmykia and Astrakhan Oblast), five regions from the North Caucasus Federal district (Republic of Dagestan, Republic of Ingushetia, Kabardino-Balkar Republic, Karachay-Cherkess Republic, Republic of North Ossetia-Alania) and six regions from the Siberian Federal district (Altai Republic, Republic of Buryatia, Tuva Republic,

Altai Krai, Zabaykalsky Krai, Irkutsk Oblast). Regions from the Southern Federal district and from North Caucasus district are located on the low left part of the colored map, while regions from the Siberian Federal district on the low central part. Regions colored with blue are the regions of the group Low-High, regions colored with yellow – High-Low. Together these two groups form High-Low group.

Moreover, the south of Russia is mostly represented by regions with high unemployment surrounded by regions with high unemployment (High-High club), while the west part of Russia turned out to be prosperous (Low-Low club). So, the result of this procedure is the defining of two stable in time groups, which are Low-Low and High-High regional unemployment clubs.

According to stated questions two main research hypotheses were formed: 1) spatial effects for the High-High and Low-Low clubs differ from spatial effects for other regions; 2) the determinants of unemployment for the High-High and Low-Low clubs differ from other regions.

4. Data, Dependent and Independent Variables

Our sample consists of 80 regions. The majority of the data used in the conducted research is available within the public access via the website of Federal State Statistics Service (FSSS) of Russian Federation. The information covers the period of nine years from 2004 to 2012. It was impossible to include in the research earlier years due to the different classification of industries before the year 2004. Moreover, data on some regions is not included in the study because of its absence (the Republic of Chechnya, the Republic of Crimea and Sevastopol). In addition, Kaliningrad region was not included in the study, because it has no common borders with other regions of Russia what is necessary for matrix construction. Moreover, during the reporting period some regions were exposed to the changes of administrative-territorial character. This altering of boundaries was taken into consideration, mitigated by aggregating procedure (see appendix 2).

The dependent variable considered in this study is regional unemployment rate. Its dynamic for the reporting period is shown below (see figure 2). As can be seen from the graph, until the year 2007 the average unemployment level in Russia was reducing. Then, during crisis years, it moderately went up. By the end of the period, the examined indicator decreased by about one third compared with the initial value and reached the level of 6.77 per cent.

Additionally, the given graph present the average unemployment rate in regional clubs. It can be noted that the dynamics of the average unemployment rate in regional clubs (High-High and Low-Low) and regional group High-Low is similar in comparison with the country indicator. The gap in the average unemployment level between the two regional clubs is quite stable around 10-11 percentage points. The existence of such persisting imbalance is an incentive

to the current study; in addition, it is important to mention that resembling dynamic trends of average unemployment rates permit not to include separate dummy variables for each year in our econometric estimations.

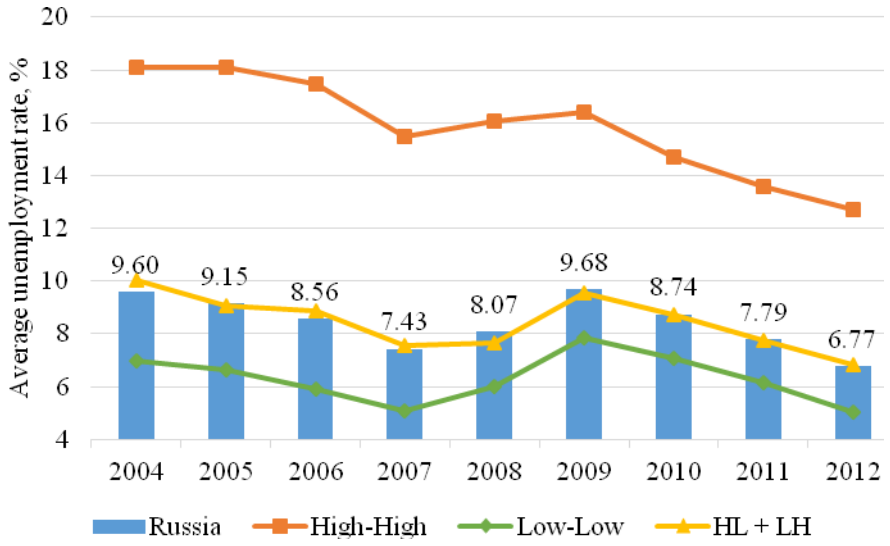

Figure 2. The dynamic of average unemployment rate in Russia for 2004-2012, %

To explain existing levels of unemployment rate and to test two main research hypotheses three groups of variables were chosen: 1) variables about the attractiveness of the region; 2) socio-demographic variables and 3) variables of the industrial structure of employed population.

The first group of variables consists of three indicators: (i) GRP per capita (variable *grp*, million rubles/ thousand people), (ii) the share of city population (variable *city*, %) and (iii) population density (variable *dens*, %). GRP per capita in the region for each year was converted to basic prices (2004). Firstly, GRP per capita was divided by the calculated chain CPI for the appropriate year and then divided by the cost of a fixed set of goods and services in 2004 in percent of the average value of the whole country. According to numerous studies, GRP per capita is expected to lower unemployment rate, while there are no certain net effect of density on unemployment. The socio-demographic features of the population consists of two variables: the age structure of the population (variables below and above, %) and the proportion of people with higher education (variable highed, %). To illustrate the age structure shares of people below and above working age were taken as variables. Working age in Russia is above 16 and below retirement age, which is 60 years for men and 55 for women. So, children and adolescents under the age of 16 years represent the young, while people above working age were considered as the elderly (or retired people). The quality of human capital (variable highed) measured as the share of employed population with higher education, where higher education means that people gained

at least higher professional education according to FSSS classification of educational levels.[3] The age structure of the population is expected to affect the unemployment rate in the following way: a high proportion of young people (variable *below*) leads to an increase in unemployment, as well as a high proportion of older people (variable *above*). According to (Partridge and Rickman, 1995) the effect of the elderly is lower than from the young. In contrast to the age structure, a high proportion of people with higher education is expected to lower unemployment rates. Two possible explanations for this trend are presented in (Semerikova, 2015): educated people have more job offers and they are better informed about the situation in the labor market. Both speeds up the job search process, which decreases unemployment.

Industrial structure of employed population consists of five separate variables, which are the share of employment in agriculture (variable agro, %), the share of employment in industry (variable indust, %), 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, %). For 2004, in the original data source there was no partitioning of industry into mining and manufacturing, while for the remaining period it was separated. Therefore, for 2005-2012 these two sectors were summed and represented as a single variable called indust. In addition, public sector consists of education and health services.

Based on expected direction of factors' influence on regional unemployment rates there were put forward several minor hypotheses to test:

3) *The higher the GRP per capita, the lower the unemployment rate*;

4) *The higher the share of city 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, the lower the unemployment rate*.

As population density may influence unemployment rate in two directions, there is no minor hypothesis for this factor. Moreover, there are no expectations about the influence of industrial structure, so there are no minor hypotheses for this factor as well.

Table 1 above shows average values of discussed independent variables. As can be seen from this table there are disparities between High-High and Low-Low clubs. For example, all variables that characterize the attractiveness of the region are higher in Low-Low club. Moreover, the share of agricultural sector is notably higher in regions belonging to High-High club, while the share of industrial sector is considerably higher in regions of Low-Low club. The table illustrates the inequality among Russian regions, which is consistent with the earlier observation based on the data on the unemployment rate (see figure 2).

[3] A person usually completes the higher professional education at age 22-23.

Table 1 - **Average values of independent variables in regional clubs**

Var	grp	dens	city	below	above	highed	agro	indust	build	trade	public
High-High	60.1	14.9	53.7	20.7	16.3	25.9	**15.9**	12.7	6.0	13.3	19.3
Low-Low	**105.5**	**28.8**	**73.1**	15.2	23.2	23.4	10.4	**20.1**	6.8	15.8	15.9
HL + LH	100.4	8.7	67.4	17.0	19.9	23.1	12.4	14.9	7.2	16.1	16.9
Russia	97.1	20.4	69.0	16.4	21.2	23.6	11.9	17.2	6.9	15.5	16.5

5. Econometric Model

To test two main research hypotheses and five minor hypotheses the modification of spatial autoregressive model (SAR) was built, which is as follows:

$$\begin{pmatrix} Y_{ih} \\ Y_{il} \\ Y_{ilh} \end{pmatrix}_t = \theta \begin{pmatrix} Y_{ih} \\ Y_{il} \\ Y_{ilh} \end{pmatrix}_{t-1} + \rho_h \begin{pmatrix} WY_{ih} \\ 0 \\ 0 \end{pmatrix}_t + \rho_l \begin{pmatrix} 0 \\ WY_{il} \\ 0 \end{pmatrix}_t + \rho_{hl} \begin{pmatrix} 0 \\ 0 \\ WY_{ihl} \end{pmatrix}_t +$$

$$+ \begin{pmatrix} X_{ih}\beta_h \\ 0 \\ 0 \end{pmatrix}_t + \begin{pmatrix} 0 \\ X_{il}\beta_l \\ 0 \end{pmatrix}_t + \begin{pmatrix} 0 \\ 0 \\ X_{ihl}\beta_{hl} \end{pmatrix}_t + \begin{pmatrix} \alpha_{ih} \\ \alpha_{il} \\ \alpha_{ihl} \end{pmatrix} + c_t + \begin{pmatrix} \varepsilon_{ih} \\ \varepsilon_{il} \\ \varepsilon_{ihl} \end{pmatrix}_t$$

where $i_h \in \{29, 31, 34\text{-}38, 60\text{-}62, 64\text{-}65, 67\}$; $i_l \in \{1\text{-}17, 20\text{-}27, 40, 42\text{-}44, 46\text{-}53, 55, 57\text{-}59, 70, 74\text{-}75, 77, 80\}$; $i_{hl} \in \{18\text{-}19, 28, 30\text{-}31, 33, 39, 41, 45, 54, 56, 63, 66, 68\text{-}69, 71\text{-}73, 76, 78\text{-}79\}$ – numbers of the regions from High-High, Low-Low, High-Low clubs (the list of all regions with numbers is given in the appendix 3); $t = 2004,...,2012$; Y is the unemployment rate, W – weights matrix; X – matrix of explanatory variables; α - fixed effects, c – time effects; ε - disturbances (we propose $\varepsilon \sim iid(0, \sigma_\varepsilon^2 I)$); $\rho_h, \rho_l, \rho_{hl}$ are the coefficients for the spatial lags for High-High and Low-Low clubs and for group High-Low, respectively; β_h, β_l, β_{hl} are the vectors of coefficients for High-High and Low-Low clubs and for group High-Low, respectively.

Previously mentioned two main research hypotheses may be formally tested (see the details below).

The main hypothesis 1. There are no differences of spatial effects in regional clubs.

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

Formal main and alternative hypotheses 1:

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

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

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

The 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:

$$H_0 : \beta_h = \beta_l = \beta_{hl}$$

$$H_1 : \beta_h \neq \beta_l \; or \; \beta_h \neq \beta_{hl}$$

6. The Results of Estimation

The splitted spatial lags in our model are endogenous. To solve the problem of endogeneity difference-GMM (Arellano, Bond, 1991) and system GMM (Blundel, Bond, 1998; Kukenova, Monteiro, 2009) are usually use as methods of estimation.

However, the application of this method to the initial specification (with all explanatory variables, divided into three parts) requires a huge number of instruments (more than number of regions). According (Roodman, 2009) this lead to the bias in the parameters' estimation. To avoid this problem we have to use Arellano-Bond approach for estimation and strictly restrict number of instruments. To test the robustness of the final model (with all incorporated restrictions on the coefficients) we also estimate it with system GMM (and the main results were the similar).

The final obtained results are presented below in table 2. The results of each step are presented in appendix 4, for each model we also demonstrate the results of post estimation procedures: test on autocorrelation of observations, test of validity of instruments and hypotheses about equality of some coefficients (step by step we incorporated all accepted restrictions into the model). Here we discuss only final estimates.

In spatial econometric models it is necessary to distinguish direct and indirect effects. Direct effects indicate the effect of the independent variable from regions of some particular club on the unemployment rates in regions of the same club. The indirect effects show the influence of the independent variable from regions of one club on the unemployment rates in regions from the other club. The calculation of these effects is quite complicated work and usually provided for the interpretation of the results in the long-term period. In this research, we investigated the short-term interpretation, so the explanation of signs behind explanatory variables (β) is enough, as the direction of influence (sign) comply with signs of direct effects. According the results of autocorrelation AB and Sargan tests the conditions for estimates consistency are satisfied.

The first research hypothesis about differences in spatial effects for regions from different unemployment clubs gained partial empirical confirmation. There was found a negative spatial effect for High-High club. Saying that, if in some region from High-High club the economic situation improves and, as a result, the unemployment rate lowers, the situations in neighboring

regions deteriorates because of increased unemployment rates. Such logic chain demonstrates the existence of competitive environment, so regions compete for labor sources.

The second research hypothesis also gained partial empirical confirmation. Therefore, the same factor may decrease unemployment rate in regions from one club and have the opposite effect or no effect at all in other club. These results are discussed further in terms of minor hypotheses (numbers 3 to 7) and with relation to factors which expected influence was not defined (population density and industrial structure).

Table 2 - The results of estimation for the modified SAR model

Variable	ab_final	sys_final	Variable	ab_final	sys_final
L1.	0.320***	0.308***	indust_hh	1.089***	-0.03
wlen_hh	-0.284***	-0.246***	indust_ll	-0.422***	-0.424***
wlen_ll	0.135	-0.002	indust_hl	-0.085	0
wlen_hl			build_hh	1.634***	0.524*
grp_hh	-0.004	-0.001	build_ll	0.116	0.079
grp_ll			build_hl		
grp_hl			trade_hh	0.866***	0.546***
city_ll	0.132	0.001	trade_ll	0.101	0.199**
city_hh			trade_hl		
city_hl			public_hh	1.741***	0.359***
dens_hh	0.036	0.087***	public_ll	0.382*	0.519***
dens_ll	0.001	-0.002	public_hl	-0.506	-0.019
dens_hl	0.385*	0.022	d2006	0.115	-0.386*
below_hh	1.134***	0.727***	d2007	-0.333	-1.213***
below_ll			d2008	0.529	-0.434
below_hl			d2009	1.704***	0.677*
above_hh	-1.284*	-0.652***	d2010	0.343	-1.161**
above_ll	-0.451	0.235*	d2011	-0.166	-1.997***
above_hl			d2012	-0.972	-3.155***
highed_ll	0.039**	0.039**	_cons	-22.594*	-15.210*
highed_hh	-0.023	-0.016	Number of instruments	52	73
highed_hl			p-v AB(1) test	0.000	0.000
agro_hh	0.829***	0.169	p-v AB(2) test	0.106	0.111
agro_ll	-0.019	0.006	p-v AB(3) test	0.571	0.305
agro_hl			p-v Sargan	0.626	0.598

legend: * p<0.05; ** p<0.01; *** p<0.001

Two minor hypotheses about the direction of influence of the GRP per capita (hypothesis 3) and the share of city population (hypothesis 4) did not get the empirical confirmation, as the obtained coefficients turned out to be insignificant.

Hypotheses 5 and 6 both got partial empirical confirmation. The increasing share of young raises unemployment in the regions (hypothesis 5), as it was expected, but this factor not demonstrated club effect,[4] that is why it is possible to conclude that the share of the young has the same influence across the whole country. The increase in the share of the elderly unexpectedly decreases unemployment in the regions (hypothesis 6) of High-High club. Hypothesis 7 about the negative influence of high education on unemployment rate was not empirically confirmed. The higher the share of educated people in regions of Low-Low club, the higher there unemployment. Such influence may be explained by the following logic: educated people are better informed about the economic situation as a whole and about labor market, have a higher reservation wage, they have more job offers, so all these may slower the process of equilibrium establishment, as more time required to make the decision and attendants may migrate to other region with better offers.

Density of population is the only independent variable from the group of regressors that explain unemployment through the attractiveness of the region. The higher the population density in regions of High-High club, the higher the unemployment. This can depends on the higher (active) participation and search for a job in regions with a higher density and a possible higher reservation wage with respect to more rural regions.

Four factors from the group of industrial structure raise unemployment and one factor has a club effect (different influence across clubs). The increasing share of employed people in agricultural sector, industrial sector, construction industry and trade sector raise unemployment in High-High club, while in Low-Low club the increase of the share of employed people in industry lowers unemployment. The coefficients obtained for agriculture and industry sectors (in High-High club) are significant for only difference GMM. The increasing share of employed people in public sector, which is presented with education and health, increases unemployment rates both in Low-Low and in High-High clubs, illustrating, that there is no difference in influence of this factor among detected clubs.

7. Conclusions

In this paper, we investigate the spatial effects for the regional unemployment clubs in Russia and the differences in the impact factors that explain regional unemployment. The panel data was collected covering the period 2004-2012. To account for potential spatial effects the spatial lag of the dependent variable (WY) was included in the model. All regions were divided into three groups – two clubs, High-High and Low-Low, and the group of other regions. In addition, in order to separate regions into clubs the Moran scatter plots were constructed for each

[4] This variable is not separated into clubs in the finite specification of the model.

year of the chosen period. Clubs are groups of regions with low (high) unemployment, surrounded by regions with low (high) unemployment, called Low-Low (High-High) club. Built modification of the spatial autoregressive model (SAR) were estimated using difference and system GMM.

The main conclusions obtained are the following:

1. There are four regional groups in Russia, but only two of them are stable in 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.

2. Model evaluation has partially confirmed the first research hypothesis. So far, negative spatial effect was detected for regions of High-High club. The improving economic situation and the decline of unemployment in a region of the High-High club leads to the deterioration of the economic situation and rising unemployment in neighboring regions of this club.

3. The second research hypothesis was also partially confirmed. There was found no difference in influence of the employment share in public sector. In respect to other variables there were explored directions of their influence with no comparison, because effects were caught for one of two clubs only.

4. Among all factors, that influence unemployment, there may be defined a group of factors, which increase unemployment. This group consists of population density (in High-High club), the share of young population (in the whole country), the share of people with high education (in Low-Low club), the share of employed people in agricultural sector (in High-High club), in construction industry (in High-High club), in trade industry (in High-High club) and in public sector (in both clubs but with different degrees of influence). The share of retired population (in High-High club) is the factor which decrease unemployment. The share of people employed in industry has a twofold effect: it lowers unemployment in the Low-Low club and raises it in the High-High club.

The results obtained may be taken into account for formulating a state regional policy that is aimed at reducing unemployment level in regions. It should be noted that the impact on the unemployment rate in regions that belong to different clubs, may give different effects (see, for example, the impact of the industrial sector that was discussed above).

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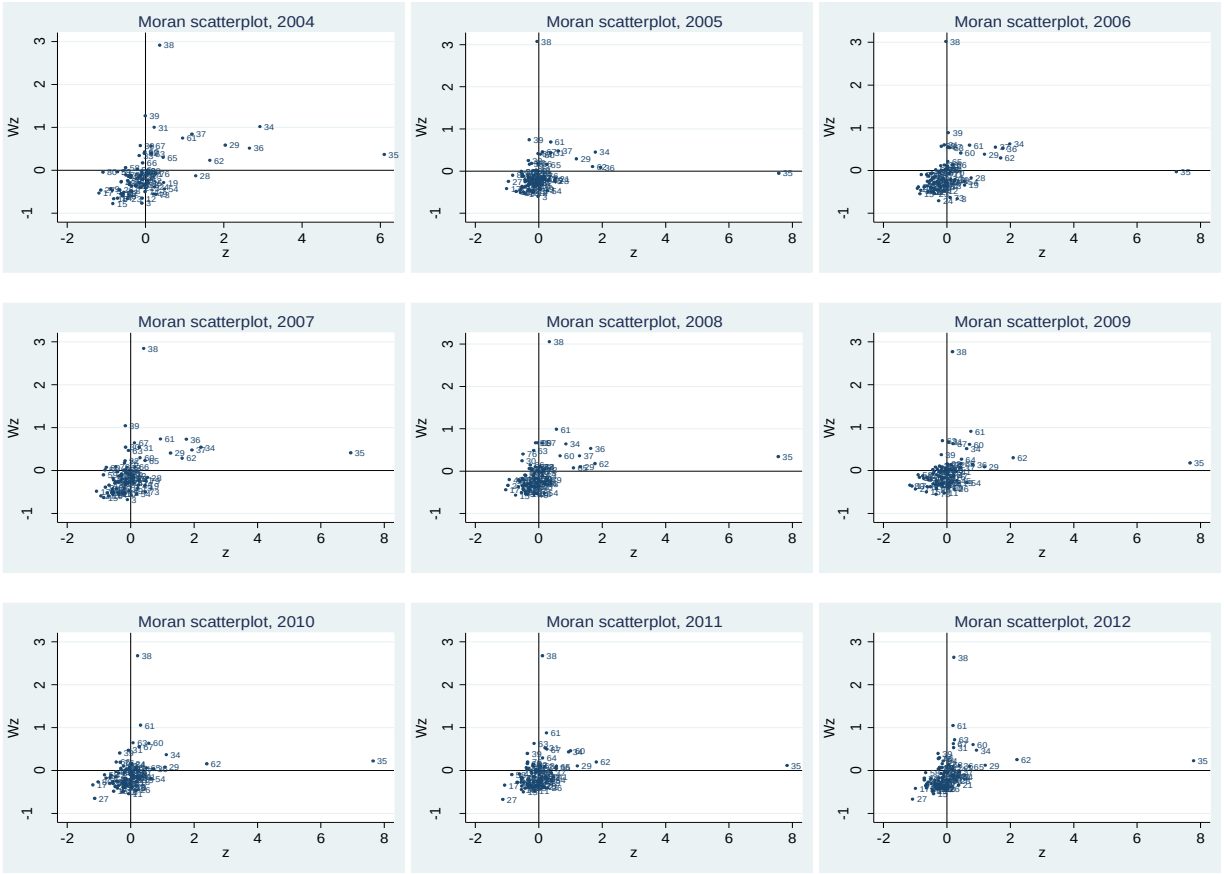
Appendix 1. The Moran scatter plots for unemployment rates



Appendix 2. United subjects of the Russian Federation

Data	Merging regions	Incorported as
01.01.2007	Taymyr Autonomous Okrug	Krasnoyarsk Territory
	Evenk Autonomous Okrug	
	Krasnoyarsk territory	
01.07.2007	Kamchatka oblast	Kamchatka territory
	Koryak Autonomous Okrug	
01.01.2008	Ust-Orda Buryat Autonomous Okrug	Irkutsk region
	Irkutsk region	
01.03.2008	Chita region	Zabaykalsky Territory
	Aginsky Buryatsky Autonomous Okrug	
01.07.2012	Moscow	Moscow
	Moscow region	

Appendix 3. Regional unemployment clubs in Russia in 2004-2012

id	Region	59	Chelyabinsk region
Low-Low Club, n_l = 46		70	Omsk region
1	Belgorod region	74	Primorsky Territory
2	Bryansk region	75	Khabarovsk Territory
3	Vladimir region	77	Magadan region
4	Voronezh region	80	Chukotka Autonomous Okrug
5	Ivanovo region	**High-High Club, n_l = 13**	
6	Kaluga region	29	Republic of Kalmykia
7	Kostroma region	31	Astrakhan region
8	Kursk region	34	Republic of Dagestan
9	Lipetsk region	35	Republic of Ingushetia
10	Orel region	36	Republic of Kabardino-Balkaria
11	Ryazan region	37	Republic of Karachaevo-Cherkessia
12	Smolensk region	38	Republic of Northen Osetia – Alania
13	Tambov region	60	Republic of Altay
14	Tver region	61	Republic of Buryatia
15	Tula region	62	Republic of Tyva
16	Yaroslavl region	64	Altay Territory
17	Moscow	65	Zabaykalsky Territory
20	Arkhangelsk region	67	Irkutsk region
21	Nenets Autonomous Okrug	**High-Low group, n_{hl} = 21**	
22	Vologda region	18	Republic of Karelia
23	Leningrad region	19	Republic of Komi
24	Murmansk region	28	Republic of Adygea
25	Novgorod region	30	Krasnodar Territory
26	Pskov region	32	Volgograd region
27	Saint-Petersburg	33	Rostov region
40	Republic of Bashkortostan	39	Stavropol Territory
42	Republic of Mordovia	41	Republic of Marii El
43	Republic of Tatarstan	45	Republic of Chuvashia
44	Republic of Udmurtia	54	Kurgan region
46	Perm territory	56	Tumen region
47	Kirov region	63	Republic of Khakassia
48	Nizhny Novgorod region	66	Krasnoyarsk Territory
49	Orenburg region	68	Kemerovo region
50	Penza region	69	Novosibirsk region
51	Samara region	71	Tomsk region
52	Saratov region	72	Republic of Sakha (Yakutia)
53	Ulyanovsk region	73	Kamchatka territory
55	Sverdlovsk region	76	Amur region
57	Khanty-Mansi Autonomous Area - Yugra	78	Sakhalin region
58	Yamal-Nenets autonomous region	79	Jewish autonomous area

Appendix 4. The results of the model evaluation

Variable	ab_1	ab_2	ab_3	ab_4	ab_5	ab_6	ab_7	ab_8	ab_9	ab_10	ab_final	sys_final
L1.	0.129	0.106	0.159**	0.219***	0.231***	0.230***	0.220***	0.216***	0.223***	0.227***	0.320***	0.308***
wlen_hh	-0.282***	-0.264***	-0.263***	-0.244***	-0.253***	-0.238***	-0.242***	-0.237***	-0.237***	-0.231***	-0.284***	-0.246***
wlen_ll	0.061	0.103	0.109	0.092	0.086	0.062	0.054	0.045	0.058	0.042	0.135	-0.002
wlen_hl	0.231	0.207	0.215	0.147	0.144	0.087	0.072	0.044	0.033	0.005		
grp_hh	0.019	-0.004	-0.003	-0.003	-0.003	-0.004	-0.004*	-0.004*	-0.004*	-0.004*	-0.004	-0.001
grp_ll	-0.004*											
grp_hl	0.007											
city_ll	0.055	0.064	0.047	0.082	0.165*	0.163*	0.153	0.151	0.148	0.141	0.132	0.001
city_hh	0.546*	0.391**	0.247**	0.195*								
city_hl	0.201	0.181										
dens_hh	0.066	0.096*	0.086*	0.057	0.054	0.052	0.05	0.052	0.05	0.048	0.036	0.087***
dens_ll	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	-0.002
dens_hl	0.450***	0.439***	0.424***	0.503***	0.499***	0.530**	0.546***	0.552***	0.566***	0.577**	0.385*	0.022
below_hh	0.854***	0.804***	0.882***	1.096***	1.105***	1.158***	1.212***	1.229***	1.248***	1.277***	1.134***	0.727***
below_ll	0.648	0.670*	0.668*									
below_hl	0.994**	0.951**	1.027**									
above_hh	-1.913**	-1.471**	-1.499**	-0.932*	-0.907*	-0.77	-0.799*	-0.767	-0.767	-0.715	-1.284*	-0.652***
above_ll	-0.204	-0.197	-0.264	-0.156	-0.198	-0.128	-0.104	-0.111	-0.112	-0.12	-0.451	0.235*
above_hl	-0.399	-0.247	-0.338	-0.102	-0.088							
highed_ll	0.025	0.027*	0.028*	0.028*	0.028*	0.027*	0.028*	0.028*	0.030*	0.030*	0.039**	0.039**
highed_hh	-0.039*	-0.048**	-0.039*	-0.037*	-0.036*	-0.035*	-0.01	-0.01	-0.01	-0.009	-0.023	-0.016
highed_hl	0	0.001	0.003	-0.002	-0.001	-0.003						
agro_hh	0.859**	0.887***	0.875***	0.887***	0.892***	0.880***	0.943***	0.950***	0.957***	0.959***	0.829***	0.169
agro_ll	0.074	0.116	0.12	0.039	0.028	0.022	0.026	-0.023	-0.031	-0.035	-0.019	0.006
agro_hl	-0.014	0.019	0.017	-0.022	-0.018	-0.074	-0.063					
indust_hh	1.029*	1.202***	1.124***	1.155***	1.148***	1.150***	1.188***	1.202***	1.202***	1.208***	1.089***	-0.03
indust_ll	-0.371***	-0.361***	-0.357***	-0.397***	-0.405***	-0.409***	-0.409***	-0.422***	-0.404***	-0.416***	-0.422***	-0.424***
indust_hl	0.016	0.037	0.035	0.013	0.015	-0.04	-0.031	-0.007	-0.027	-0.029	-0.085	0
build_hh	1.686***	1.703***	1.605***	1.703***	1.703***	1.723***	1.770***	1.785***	1.788***	1.804***	1.634***	0.524*
build_ll	0.102	0.086	0.075	0.06	0.074	0.083	0.067	0.045	0.084	0.059	0.116	0.079
build_hl	0.104	0.134	0.151	0.135	0.13	0.133	0.16	0.185				
trade_hh	1.022***	1.167***	1.144***	0.937***	0.911***	0.909***	0.964***	0.981***	0.977***	0.973***	0.866***	0.546***
trade_ll	0.158	0.185*	0.185	0.168	0.161	0.148	0.148	0.112	0.104	0.135	0.101	0.199**
trade_hl	0.146	0.159	0.155	0.141	0.154	0.13	0.095	0.121	0.132			
public_hh	1.557*	1.835**	1.817***	1.789***	1.762***	1.829***	1.862***	1.899***	1.899***	1.927***	1.741***	0.359***
public_ll	0.550**	0.536**	0.501*	0.488*	0.496*	0.507**	0.490**	0.482*	0.479**	0.477**	0.382*	0.519***
public_hl	-0.037	-0.064	-0.019	0.026	0.031	-0.069	-0.135	-0.127	-0.14	-0.133	-0.506	-0.019
d2006	-0.327	-0.323	-0.264	-0.2	-0.211	-0.207	-0.185	-0.188	-0.159	-0.155	0.115	-0.386*
d2007	-0.844**	-0.825**	-0.699*	-0.678**	-0.673*	-0.703**	-0.712**	-0.730**	-0.689**	-0.686**	-0.333	-1.213***
d2008	-0.084	-0.075	0.098	0.022	0.034	-0.019	-0.024	-0.041	0	0.02	0.529	-0.434
d2009	1.289**	1.232**	1.428***	1.183**	1.207**	1.170***	1.181***	1.204***	1.254***	1.275***	1.704***	0.677*
d2010	0.279	0.24	0.36	-0.175	-0.198	-0.29	-0.308	-0.288	-0.266	-0.267	0.343	-1.161**
d2011	-0.439	-0.453	-0.278	-0.946	-0.951	-1.099	-1.159*	-1.156*	-1.126*	-1.146*	-0.166	-1.997***
d2012	-1.371	-1.368	-1.118	-1.921*	-1.917*	-2.148**	-2.253**	-2.275**	-2.241**	-2.287**	-0.972	-3.155***
_cons	-22.403*	-24.171*	-22.871*	-31.464**	-34.721***	-35.120***	-35.687***	-35.066***	-35.348***	-35.039***	-22.594*	-15.210*
Instruments	72	68	67	65	64	63	62	61	60	59	52	73
p-v AB(1) test	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-v AB(2) test	0.021	0.050	0.069	0.086	0.102	0.090	0.060	0.054	0.053	0.051	0.106	0.111
p-v AB(3) test	0.709	0.867	0.925	0.823	0.815	0.835	0.865	0.897	0.874	0.857	0.571	0.305
p-v Sargan	0.455	0.309	0.346	0.364	0.364	0.345	0.314	0.319	0.337	0.349	0.626	0.598
Tested hypothesis	grp_hh = grp_ll = grp_hl	city_hh = city_hl	below_hh = below_ll = below_hl	city_ll= city_inc	above_ll = above_hl	highed_hh = highed_hl	agro_ll = agro_hl	build_ll = build_hl	trade_ll = trade_hl	wlen_ll = wlen_hl	legend: * p<0.05; ** p<0.01; *** p<0.001	
P-Value	0.250	0.206	0.551	0.376	0.544	0.142	0.496	0.440	0.879	0.654		