Spatial Effects on Youth Unemployment Rate: The Case of Eastern and Western Russian Regions

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Abstract

The purpose of this study is to identify the common and different determinants of youth unemployment in Eastern and Western regions of Russia, especially searching for the existence of spatial effects. We tested two main hypotheses. The first hypothesis consists in the existence of a difference between the processes occurring within the Western and Eastern regions and an asymmetry of the processes of influence of Western and Eastern regions on each other. Our second hypothesis is based on the differences in the determinants of youth unemployment in the Eastern and Western parts of Russia. To test these hypotheses, dynamic panel models were estimated by the Arellano–Bond method. These models included four boundary weighted matrices (west-west, east-east, west-east, east-west) and four types of explanatory variables: (i) variables characterising the demographic situation in a region; (ii) variables on the migration processes in a region; (iii) variables characterising the economic situation in a region; and (iv) variables on the export-import activity of a region. Although we were searching for structural determinants of youth unemployment and for spatial effects in East and West Russia, we also investigated the effect of the 2008-09 financial crisis. The main policy implications of the econometric results have been briefly considered in the final section.

Key words: youth unemployment, Eastern and Western Russian regions, spatial correlation

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1. Introduction

High unemployment is one of the major failures of market economies: not only is it a cost for society but the cost is heavier for specific categories of people, since the unemployment rate is widely differentiated by gender (in many countries it is higher for women), by age, by country or region and also it changes over time. Of course, unemployment generally rises following economic crises and this occurred also after the recent financial crisis and Global Recession.[1]

A worrying feature of unemployment is that it hurts especially young people, that often are unemployed or not looking for jobs or even not at school (the so-called NEET generation).[2] For example, in the European Union, youth unemployment rates are generally more than twice as high as adult unemployment rates, with significant differences across countries (Quintini et al., 2007). A growing literature investigates youth unemployment, but the studies at the sub-national level remain scarce, especially for the Russian case.[3]

Considering this remarkable gap in the existing literature, the main purpose of this paper is to empirically analyse the key determinants of regional youth unemployment by focusing on the differences between the Eastern and Western Russian regions in the 2000-2009 period.

In Section 2, we review the main literature regarding the Russian labour market, the determinants of youth and regional unemployment, and the few published studies on youth regional unemployment in Russia and other transition countries. Section 3 presents our data sources together with some descriptive evidence; then it presents the econometric approaches adopted. In Section 4, we discuss the econometric results for several models; although the main objective is to detect the structural factors determining higher regional youth

[1] In fact, in many countries, unemployment – and especially youth unemployment – rose dramatically after the 2008-09 global economic crisis (ILO, 2010a; Arpaia and Curci, 2010; Choudhry et al., 2012; O'Higgins, 2012).

[2] Thus, the integration of young people into the labour market is an important objective all over the world due to the generally high and persistent youth unemployment rates.

[3] See e.g., Green et al. (2001), Perugini and Signorelli (2010a and 2010b). The studies are lacking especially for Russian regions (e.g. Demidova and Signorelli, 2012).

unemployment rates, the effects of the 2008-09 financial crisis are also investigated. Section 5 concludes with some key policy implications.

2. Literature Review

In this section, we shall review and recall the key research on the following topics: (i) the Russian labour market; (ii) youth unemployment in general, and the determinants of both youth and total unemployment; (iii) the regional differences in the unemployment rates.

A first important feature of the Russian labour market is that employment (and unemployment) has always been relatively stable over time, notwithstanding significant economic shocks.[4] To explain the high stability of aggregate employment and unemployment levels over time, Kapelyushnikov et al. (2012) establish a link between inefficient rule enforcement and the emergence of compensating institutional arrangements, on the one side, and the unusually broad implementation of flexible working time and flexible pay, on the other side.[5] As a consequence of this persistent characteristic, some authors have discussed the "Russian way" (Layard and Richter, 1995) since the early stages of transition. Kapelyushnikov et al. (2012) find a convincing explanation for the prevalence of flexible working time and flexible pay: they make it possible to offset pressures on the labour market during a crisis without a drastic readjustment of employment. Similarly, during phases of economic growth, the ability to increase working hours and pay boosts output and productivity and reduces the need to hire more workers. The authors argue that flexible working hours and pay are not the prerogatives of the Russian labour market; what distinguishes Russia is the persistence, depth and scale of these phenomena and their deep

[4] In other words, the correlation between changes in GDP and employment dynamics has been very weak in the Russian case, differently from several CEECs. As for the peculiarities of the Russian case, see Gimpelson and Kapeliushnikov (2011).

[5] Notice that the authors present a complete review of the relevant literature on the Russian labour market and highlight some key factors influencing labour market practices in a transition economy.

institutional roots. Thus, external shocks are absorbed by means of high "internal flexibility"[6] (shortening working hours) and wage flexibility (Kapelyushnikov et al., 2012). This is a substantially flexible system, notwithstanding the stringency of the formal rules. So, the overall flexibility comes from the willingness and ability of both employers and employees to curtail their exposure to formal rules and rely on informal arrangements. Similar assertions were made by Kapelyushnikov (2011) and Gimpelson et al. (2010). Other studies[7] confirm that law implementation has been extremely flawed in Russia, favouring the creation of a formal regulation vacuum and the diffusion of informal rules. Preliminary evidence concerning the impact of the last crisis seems to confirm the high stability of employment and unemployment levels. Unfortunately, investigations of the role played by the above aspects (e.g., "internal flexibility") are not possible at the regional level due to the lack of sub-national data.

Regarding youth unemployment, it should first be noted that, although official statistics tend to focus – in most countries – on the group aged 15-24,[8] there is debate about the various definitions of "young people" (e.g., Lefresne, 2003; O'Higgins, 1997). In general, employment rate indicators are better than unemployment rates, but this does not hold for young people given the difficulties of accounting for the differences and changes in schooling participation.[9] Additionally, in the case of youth unemployment, specific problems such as underemployment and informal sector employment may be relevant (O'Higgins, 2005). O'Higgins (2012) also highlights the advantage of considering the percentage of youth

[6] The key importance of "internal flexibility" has been stressed by Demidova and Signorelli (2011) for the two Russian crises and by Aricò and Stein (2012) and by Calavrezo and Lodin (2012) for some European countries during the last crisis.

[7] See e.g. ILO (1997), Feige (1997), Vishnevskaya and Kapelyushnikov (2007).

[8] For a more complete definition of "youth unemployment" and some measurement aspects, see ILO (2009). See also the empirical evidences presented in ILO (2010a, 2010b).

[9] In other terms, a lower or/and decreasing youth employment rate is significantly related to high(er) schooling participation. Obviously, in interpreting empirical evidence, it should also be considered that the youth unemployment rate is affected by the problems of definition of "active search for labour" and of the discouragement effect phenomena (e.g. Perugini and Signorelli 2004 and 2007).

not working and not in education or training (NEET). [10] Reviewing now the determinants of – overall and youth – unemployment, many economic and institutional factors are mentioned in the literature. In the first place, both total and youth unemployment depends significantly on macroeconomic cyclical conditions. However, we observe that the literature on the impact of the last financial crises and "Global Recession" on (youth) unemployment remains scarce (e.g.,Demidova and Signorelli, 2012; Marelli et al., 2012; O'Higgins, 2012).[11] Relevant institutions that are found to be significant in determining unemployment and labour market performance comprise tax wedges, unemployment benefits, benefit duration, benefit replacement ratio, union density and union coverage, degree of coordination, degree of centralization, employment protection legislation (EPL), active labour market policies, and many others.[12] As to the specific determinants of youth unemployment, many studies have tried to assess why the youth unemployment rate is persistently higher than the adult (or total) unemployment rate.[13] Many authors found that while a "scarring" effect of unemployment on youth people depends on the overall labour market conditions, it is significantly higher for disadvantaged youth[14]. The main reasons for the (generally worse) youth labour market performance compared to adults are to be found on the supply side, on the demand side or in a bad matching of the two sides of the labour market. Considering the supply side, it is frequently mentioned the lower level and/or different quality of youth's human capital and productivity, compared to adults. It should be noted that the education level is the most immediate variable measuring "human capital", but young people also lack the other two

[10] According to Scarpetta et al. (2010), the size of the group of "youth left behind" can be proxied by the number of young people who are neither employed nor in education or training (NEET). This group represented 11% (on average) of 15-24 year olds in the OECD in 2007.

[11] With reference to previous financial crises, Choudhry et al. (2012) investigate the effect on youth unemployment rates during the 1980-2005 period for approximately 70 countries and find that the crises impact on youth unemployment rates is significant and robust and persists for five years after the crisis.

[12] We just mention the wide review by Bassanini and Duval (2006) as well as the recent paper by Bernal-Verdugo et al. (2012) concerning the impact of labour market flexibility.

[13] See, for example, Clark and Summers (1982), Kolev and Saget (2005), O'Higgins (2005).

[14] See e.g., Bell and Blanchflower (2009). Hence, youth unemployment rates are more sensitive to the business cycle than adult unemployment rates.

components of human capital, namely generic and job-specific work experience.[15] The existence of a "youth experience gap" favours the higher employability of adults with generic and sector specific skills with respect to youngsters. A specific strand of literature focuses on the characteristics of the educational systems and on the processes of human capital formation.[16] On the demand side, besides certain structural characteristics of labour demand, the impact of the institutional framework has been stressed by many authors that have considered the impact of minimum wages legislation and the wide use of temporary contracts[17]. Labour hoarding practices, especially in countries with the highest EPL on "permanent contracts", favour adult segments and can further increase the size and duration of a crisis' impact on youth unemployment. As far as the matching between labour demand and supply, the school-to-work transition (STWT) processes and changes over time seem to play a key role.[18] It is interesting to note that Scarpetta et al. (2010) highlight that crises exacerbate the structural problems that affect the transition from school to work: in fact, during (and after) a crisis, the decline in GDP turns, with a delay of some months, into a reduction of labour demand; in this situation, school-leavers are competing with more jobseekers for fewer vacancies. Meanwhile, the young already in the labour market are generally among the first to lose their jobs, mainly due to the higher diffusion of temporary contracts[19] and have greater difficulties in finding another job. Thus, the high diffusion of temporary contracts is a key explanation of the higher business-cycle sensitivity for youngsters in the labour market.[20] In particolar, Scarpetta et al. (2010) highlight the risk of a

[15] Carmeci and Mauro (2003) have shown that educated young people need to acquire firm-specific knowledge through working activities for "schooling" human capital to become productive.
[16] See e.g. Brunello and Checchi (2005), Brunello et al. (2007), Checchi (2003 and 2006).
[17] For example Abowd at al. (1997), Newmark and Wascher (1999 and 2004). As to the use of temporary contracts, see Booth et al. (2002), Ichino et al. (2005).
[18] See Caroleo and Pastore (2003 and 2007); Quintini and Manfredi (2009), Quintini and Martin (2007), Ryan, (2001), Sciulli and Signorelli (2011).
[19] The higher diffusion of temporary contracts between youngsters leads to the adoption of a sort of "last-in first out" rule.
[20] However, some authors (e.g., Cockx and Picchio, 2009; Scarpetta et al., 2010) note that for many young, some types of temporary contracts, such as apprenticeships, are more often a stepping stone to permanent contracts than a "trap". The trap effect of temporary contracts seems to be higher in countries with a large difference in the stringency of regulations for permanent contracts (i.e., strict EPL) as compared to temporary or other atypical contracts.

"lost generation" and the need to adopt effective active and passive labour policies and STWT institutions to minimise the increase in the number of young people losing effective contact with the labour market and permanently damaging their employment prospects. Verick (2009) further confirms that during and after a severe recession[21], young people find it increasingly difficult both to acquire a job as a new entrant in the labour market, especially in the wake of hiring freezes, and to remain employed, as they are more likely to be laid off than workers with more seniority. According to O'Higgins (2012), the key problem is that young people who are caught by the crisis are more vulnerable to its effects than are adults and that these effects are likely to be more long-lasting for young people.

Lastly, let us discuss the issue of the regional (sub-national) variation in unemployment rates. The regional dimension of total unemployment has only been broadly considered since the work of Blanchard and Katz (1992). As highlighted in Marelli et al. (2012), regional unemployment differentials are wide and persistent; for example, low unemployment regions tend to cluster close to each other. Moreover, such differentials show a clear and persistent core-periphery pattern, as high and persistent unemployment is concentrated in peripheral regions. Elhorst (2003) presents a comprehensive survey on regional unemployment, and several recent studies highlight various aspects and determinants of regional labour market performance. There are studies investigating regional differentiation in Europe, sometimes attempting at identifying groups of regions[22]; some others focus on the role of sectoral specialisation or of specific resources (such as the human capital)[23]; some of them relate to specific institutional features, such as the bargaining

[21] Arpaia and Curci (2010) produce also a broad analysis of labour market adjustments in EU-27 after the 2008-2009 recession in terms of employment, unemployment, hours worked and wages, and they also highlight that workers with weaker work contracts and lower qualifications and experience have borne the brunt of the "Great Recession", with a consequently enormous increase in youth unemployment rates.

[22] Basile and De Benedectis (2008), Garcilazo and Spiezia (2007), Marelli (2006), Overman and Puga (2002). Some of these studies employ advanced econometric techniques (e.g. spatial dynamic models) to investigate how spatial links between regions affect the performance of regional economic systems and labour markets.

[23] For example Longhi et al.(2005), Rodriguez-Pose (2003).

system[24]; a few on the cyclical behaviour[25] Some research is devoted to transition countries[26], but a comprehensive survey of regional labour market developments in transition countries can be found in Huber (2007). To our knowledge, there are only a few studies (e.g., Green et al., 2001; Perugini and Signorelli, 2010a and 2010b) investigating youth labour market performance at the regional level in the European context, and there are very few studies regarding the Russian case, such as Demidova and Signorelli (2011 and 2012) and Kolomak (2011).[27] In fact, with few exceptions, the existing literature generally treats the two subjects – youth unemployment and regional labour markets - separately. Finally, some other strands of literature examine the determinants of (youth or total) unemployment, by considering the effects of demographic composition and changes[28] and the role of migration[29] . A spatial model of commuting is used by Fuchs-Schündeln and Izem (2012) to anlyze the behavior of the unemployment rate across the former East–West border in Germany.[30] In conclusion, regional (sub-national) investigations of labour market performance have rarely considered the youth segment in either the European context or for single countries. This gap in the literature is particularly evident for the Russian case.

3. Data, Descriptive Evidence and Econometric Approaches

To investigate the main determinants of youth unemployment in Russian regions, we select the set of explanatory variables by deriving suggestions from the existing literature,

[24] Vamvakidis (2009), Galbraith and Garcilazo (2010). However, the limited amount of research on the role of "institutions" in regional labour markets is probably due to two causes: (i) the hypothesis that "institutions" are very similar across the regions of a single country and (ii) the lack of institutional indicators at sub-national level (see Perugini and Signorelli, 2007).

[25] See Belke and Hein (2006), Fatàs (1997).

[26] For example, Bornhorst and Commander (2006), Gács and Huber (2005), Jurajda and Terrell (2009), Tyrowicz and Wòjcik (2010). In particular, Marelli and Signorelli (2010b) explain employment growth in a large sample (at the NUTS-3 level of disaggregation) of regions in eight transition countries, considering also an index of "progress in transition" (computed from the EBRD statistics).

[27] This paper compares Eastern and Western regions: the key outcome is that there exist positive externalities generated by regional economic growth in west regions and negative externalities in east regions. Although the paper does not deal with labour market issues, it includes an interesting application of spatial econometrics.

[28] See Flaim (1990), Shimer (1999), Korenman and Neumark (1997).

[29] Harris and Todaro (1970), Pissarides and McMaster (1990).

[30] The authors found that the comparatively low labor productivity in East Germany after reunification is not caused by the depreciation of human capital at reunification, but rather by unfavorable job characteristics.

under the constraint of the availability of regional data. In particular, we use data for the 75 Russian regions (a list of all regions is given in Table A1 in Appendix) over the period 2000-2009.[31] At the present time, Russia is divided into 83 regions, but we have to omit data for 8 regions.[32]. Following the idea of Kolomak (2011) we split all Russian regions into two groups - west and east regions - according to their location.

We begin our analysis by comparing the descriptive statistics for the total unemployment rate (Table 1), the unemployment rate in the 20-29 age group (youth unemployment) (Table 2) and the ratio of youth to total unemployment (Table 3): this is accomplished for Russia as a whole as well as for west and east parts of Russia.

Table 1. Descriptive Statistics for Total Unemployment Rate

All Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	11.77	10.02	8.85	9.29	8.85	8.19	7.75	6.7	7.31	9.16
Median	11.4	9.7	8.3	8.7	8.7	7.6	7.3	6.4	7.1	8.8
Min	3.9	2.1	1.4	1.3	1.6	0.8	1.6	0.8	0.9	2.7
Max	28.5	23.8	20.3	22.6	25.7	23.4	20.7	18.3	19.2	21.5
Coef.Var.	0.34	0.36	0.36	0.4	0.45	0.43	0.48	0.49	0.43	0.31
West part of Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	11.1	9.46	8.39	8.76	8.46	7.8	7.29	6.3	6.82	8.78
Median	10.3	9.1	8.1	8.15	7.4	7.05	6.6	5.7	6.55	8.7
Min	3.9	2.1	1.4	1.3	1.6	0.8	1.6	0.8	0.9	2.7
Max	28.5	18.9	19.1	22.6	25.7	23.4	20.7	18.3	18.3	16.6
Coef.Var.	0.36	0.37	0.38	0.43	0.5	0.46	0.52	0.53	0.46	0.29
East part of Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	13.48	11.45	10.06	10.64	9.83	9.2	8.94	7.71	8.57	10.16
Median	12.3	10	9.3	10.2	9.2	8.9	8.9	7	8	9.5
Min	8.6	8.2	6.5	5.9	5.2	5.4	4.6	2.5	4.4	6.6
Max	23.6	23.8	20.3	20.7	19.7	21.8	20.5	17.1	19.2	21.5
Coef.Var.	0.25	0.32	0.31	0.32	0.3	0.36	0.38	0.39	0.36	0.32

Source: our elaboration on ROSSTAT data

Table 2. Descriptive Statistics for Youth Unemployment Rate

All Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	15.84	13.53	11.68	12.49	10.5	11.1	10.99	9.48	10.06	13.18
Median	14.93	12.67	10.58	12.46	9.61	9.88	10.37	8.66	9.35	12.74
Min	4.9	3.42	2.59	1.68	2.5	1.4	2.44	2.06	1.26	4.2
Max	33.71	31.85	26.48	31.91	26.46	30.29	29.74	27.56	24.91	27.86
Coef.Var.	0.36	0.36	0.38	0.42	0.48	0.44	0.48	0.52	0.43	0.27

[31] Provided by the main Russian statistical agency ROSSTAT (www.gks.ru).

[32] The reasons are: (i) there have been changes in the number of Russian regions over the past 10 years, with some regions being united (for example, the Perm region and Komi-Perm Autonomous District), and (ii) for some regions there are no official data for some years (for example, the Chechen Republic)

West part of Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	14.9	13.08	11.28	11.72	9.34	10.42	10.23	8.69	9.47	12.5
Median	13.96	12.37	10.2	10.6	8.76	9.49	9.54	7.65	8.69	12.12
Min	4.9	3.42	2.59	1.68	2.5	1.4	2.44	2.06	1.26	4.2
Max	32.24	31.85	26.48	31.91	26.46	30.23	29.74	27.5	24.76	23.53
Coef.Var.	0.36	0.38	0.4	0.46	0.52	0.46	0.53	0.56	0.46	0.25
East part of Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	18.26	14.68	12.71	14.48	13.48	12.84	12.95	11.53	11.56	14.94
Median	16.78	14.02	12.35	13.99	12.24	12.18	11.18	10.75	11.07	13.78
Min	9.81	9.51	7.57	8.52	7.42	7.37	7.85	4.26	5.32	10.82
Max	33.71	27.17	24.29	27.92	26.14	30.29	27.05	27.56	24.91	27.86
Coef.Var.	0.33	0.3	0.32	0.29	0.33	0.37	0.35	0.41	0.32	0.25

Source: our elaboration on ROSSTAT data

Table 3. Descriptive Statistics for Ratio of Youth and Total Unemployment Rate

All Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	1.35	1.37	1.34	1.35	1.19	1.38	1.43	1.45	1.41	1.47
Median	1.32	1.36	1.32	1.33	1.17	1.36	1.42	1.41	1.37	1.41
Min	0.91	0.94	0.91	0.85	0.43	0.83	0.97	0.5	0.86	1.13
Max	2.25	1.92	2.26	1.94	1.87	2.35	2.17	3.07	2.49	2.14
Coef.Var.	0.17	0.16	0.17	0.17	0.23	0.17	0.19	0.25	0.21	0.14
West part of Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	1.35	1.4	1.36	1.34	1.12	1.37	1.42	1.43	1.42	1.45
Median	1.33	1.39	1.32	1.33	1.06	1.34	1.43	1.36	1.38	1.4
Min	0.95	0.94	0.91	0.85	0.43	0.83	0.97	0.5	0.86	1.13
Max	2.02	1.92	2.26	1.91	1.87	2.35	2.17	3.07	2.49	2.14
Coef.Var.	0.16	0.15	0.18	0.17	0.25	0.18	0.19	0.28	0.22	0.14
East part of Russia	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	1.35	1.29	1.27	1.39	1.37	1.4	1.46	1.51	1.37	1.51
Median	1.31	1.24	1.27	1.36	1.37	1.39	1.34	1.51	1.33	1.48
Min	0.91	0.99	0.92	1.02	1.12	1.15	1.15	1.18	1.11	1.2
Max	2.25	1.79	1.56	1.94	1.78	1.67	1.9	1.86	2.13	2.09
Coef.Var.	0.19	0.15	0.13	0.17	0.12	0.12	0.17	0.12	0.14	0.15

Source: our elaboration on ROSSTAT data

Tables 1, 2 and 3 show the similar dynamics of youth and total unemployment and the stable higher level of youth unemployment rate in both parts of Russia. The crisis of 2008-2009 affected the growth of total and youth unemployment, the latter to a greater degree. Moreover, Tables 1, 2, 3 clearly demonstrate that both total and youth unemployment rate are higher in east regions compared to west regions. At the same time there are no substantial differences in the ratio of youth and total unemployment rate for east and west parts of Russia. We have tested the hypothesis of means (total unemployment rate, youth unemployment rate, ratio of youth to total unemployment rates) equality for east and west

parts of Russia. Wilcoxon-Mann-Whitney[33] test confirms the equality of means for the ratios and rejects a similar hypothesis for youth and total unemployment rate. That is why in this paper we try to draw attention to possible differences in the determinants of youth unemployment in the western and eastern parts of Russia.

Table 2 indicates the wide range in the regional youth unemployment rates (from a minimum of 4.2 to a maximum of 27.86 in 2009). To understand whether we need to account for spatial heterogeneity of Russian regions, we calculate the Moran's index that permits to reveal the presence of spatial autocorrelation for the whole period 2000-2009. However, our initial results (consistent with those of Kollomak, 2011), exhibiting different spatial effects for east and west parts of Russia, suggesting to calculate Moran's index separately for east and west parts of Russia.

Moran's index for variable X is defined as:

$$I(X) = \frac{N}{\sum_{i,j} w_{ij}} \frac{\sum_{i,j} w_{ij}(X_i - \bar{X})(X_j - \bar{X})}{\sum_i (X_i - \bar{X})^2}$$

where N is the number of spatial units indexed by i and j, $\bar{X}$ is the mean of X, and w_{ij} are elements of the weighted spatial matrix. Moran's index values range from −1 (indicating perfect dispersion) to 1 (indicating perfect correlation). A zero value indicates an absence of spatial correlation. For significance testing, Moran's I values can be transformed to Z-scores in which values greater than 1.96 or smaller than −1.96 indicate spatial autocorrelation that is significant at the 5% level.

We have used three weighted matrices: W - boundary weighted matrix for all Russian regions, W_{ww} - boundary weighted matrix for west Russian regions, W_{ee} - boundary weighted matrix for east Russian regions. W_{ww} and W_{ee} are part of the matrix W, the first one is formed by intersecting the first 54 rows and columns of the matrix W, while the second one is located on the intersection of the last 21 rows and columns. Matrix W_{ww} reflects the influence of youth unemployment in west Russian regions on the youth unemployment in the boundary west regions, W_{ee} reflect the similar influence in east Russian regions. The diagonal elements of all weighted matrices are zero. We use the indicators of joint

[33] See, Hollander and Wolf (1999, p. 106).

boundaries for each pair of regions. After that, all matrices were normalised by rows. The results of Moran's index calculation are shown in Table 4.

Table 4. Dynamics of Moran's Spatial Correlation Index for the variable youthunem

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Moran's I for Russia in total	0.306***	0.306***	0.249***	0.307***	0.41***	0.201**	0.332 ***	0.431***	0.372***	0.318***
Moran's I for west part of Russia	0.372***	0.336***	0.262***	0.278***	0.344***	0.167**	0.315***	0.43***	0.37***	0.233***
Moran's I for east part of Russia	-0.007	0.063	0.105	0.189*	0.21*	0.081	0.114	0.182*	0.096	0.256**

Source: our elaboration on ROSSTAT data
*** - significant at 1%, ** - significant at 5%, * - significant at 10%

The positive and significant meanings of the Moran's index for west weighted matrices for all years suggest a positive and temporally persistent spatial correlation in youth unemployment rates for west bordering regions. This means that each west Russian region is surrounded by regions with a similar youth unemployment rate. At the same time, the unstable results for east regions do not give us the opportunity to make a similar conclusion for east Russian regions.

Based on our initial results, we propose the following four hypotheses: (i) the situation with youth unemployment in Russia is more serious than that of total unemployment; (ii) the 2008-09 crisis had a greater impact on young people than on adults; (iii) in modelling the processes of youth unemployment in Russia, it is necessary to consider the spatial correlation; and (iv) there exists a difference between west and east Russian regions.

These hypotheses can be tested using the following model, which includes both temporal and spatial lags:

$$\begin{pmatrix} YUW_{i_w t} \\ YUE_{i_e t} \end{pmatrix} = \sigma \begin{pmatrix} YUW_{i_w t-1} \\ YUE_{i_e t-1} \end{pmatrix} + \theta \begin{pmatrix} TUW_{it} \\ TUE_{it} \end{pmatrix} + \begin{pmatrix} \rho_{ww} W_{ww} & \rho_{we} W_{we} \\ \rho_{ew} W_{ew} & \rho_{ee} W_{ee} \end{pmatrix} \begin{pmatrix} YUW_{i_w t} \\ YUE_{i_e t} \end{pmatrix} + \begin{pmatrix} X_w \beta_w \\ X_e \beta_e \end{pmatrix} + \\ + \sum_{k=1}^{9} \gamma_k d_{200k} + \alpha_i + \varepsilon_{it}, \quad (1)$$

where *YUW* and *YUE* are unemployment rate in the age group 20-29 in west and east Russian regions; *TUW* and *TUE* are total unemployment rate in the corresponding Russian

regions; $i_w = 1,...,54, i_e = 55,...,75, i = 1,...,75, t = 2000,...,2009$, matrices W_{ww} and W_{ee} were described earlier, matrix W_{we} reflects the influence of east youth unemployment on west one, matrix W_{ew} represents the opposite effect, $d_{2001} - d_{2009}$ are indicators of the corresponding years, matrices X_w and X_e consist of the same variables, but correspondingly for west and east Russian regions; α_i , $i = 1,...,75$ are individual effects for the regions; and $\varepsilon_{it} \sim iid(0, \sigma_\varepsilon^2)$.

If we could estimate the coefficients of model (1), a test of hypothesis (i) would be reduced to the comparison of the coefficient θ estimate in model (1) with 1 (we expect that $\hat{\theta} > 1$). A test of the hypothesis (ii) would be reduced to the comparison between the coefficients $\gamma_1 - \gamma_9$ estimates in model (1) (we expect that $\hat{\gamma}_9 > \max\{\hat{\gamma}_1,...,\hat{\gamma}_8\}$). A test of the hypothesis (iii) would be reduced to the verification of the significance of spatial correlation coefficients $\rho_{ww}, \rho_{we}, \rho_{ew}, \rho_{ee}$. Finally, a test of the hypothesis (iv) would be reduced to the verification of the differences in the coefficients β_w and β_e for the same factors and differences in the spatial lag coefficients $\rho_{ww}, \rho_{we}, \rho_{ew}, \rho_{ee}$.

However, direct estimation of model (1) by OLS would lead to biased and inconsistent estimates of the coefficients, as lagged variables are correlated with individual effects. First differencing of model (1) eliminates the individual effects. However, OLS estimates of coefficients in such models remain biased and inconsistent because regressors and errors are correlated in new models. To obtain unbiased estimates of the coefficients in first difference models, we use the Arellano-Bond two-step general methods of moments (GMM). According to this method for endogenous variables, lags of the dependent and explanatory variables are used as instruments. Estimates of the coefficients obtained by the Arellano-Bond methods are consistent under the following conditions: (i) errors ε_{it} in the initial model (1) must be serially uncorrelated and (ii) the population moment conditions (consisting in the orthogonality of the errors and instruments) must be correct. To test the first condition, the errors of equation in first differences are tested for the presence of

autocorrelation. If the errors in model (1) are uncorrelated, the errors in the difference equation must be identified as first-order autocorrelations and not reveal higher-order autocorrelations. The second condition is verified by the Sargan test, with the null hypothesis that over-identifying restrictions are valid. For all the estimated models we verify these two conditions.

Let us return to the choice of explanatory variables. We include four types of explanatory variables in our models: (i) variables characterising the socio-demographic situation in a region; (ii) variables on the migration processes in a region; (iii) variables characterising the economic situation in a region; and (iv) variables about export-import activity of a region.

For our socio-demographic variables, we choose the share of urban population in a region, the share of individuals aged 20-29 years, the number of students per 10,000 people, and the number of pensioners per 1,000 people. Initially, we propose the following possible relationships: (i) the higher the urban population in a region, the easier it is for young people to find a job because there are more employment opportunities in urban areas; (ii) the higher the proportion of young people in a region, the more difficult it is for individuals to find jobs due to increased competition; and (iii) the more pensioners in a region, the more difficult it is for young people to find a job because more retired people could be in the "irregular labour market" and may compete with young people for jobs.

To characterise the migration process, we use the difference between the number of migrants arriving in and departing from a region per 10,000 people, the percentage of migrants arriving from other regions and from other countries, and the percentage of migrants departing to other regions and to other countries. It should be noted that migration and labour market processes are mutually influential. On the one hand, a large number of migrants arriving in a region may indicate the possibility of finding a job in this region. A large outflow of migrants from a region may indicate the opposite tendency. On the other

hand, numerous migrants can compete with the youth of an area by agreeing to work for lower wages. At the same time, migrants from other regions of Russia, rather than other countries, may be more "dangerous" competitors for youth. Indeed, migrants from economically developed countries usually claim high-paid jobs that are inaccessible to young people. At the same time, migrants from the CIS countries often accept low-skilled and low-wage jobs (e.g., construction) for which young people are not suited.

As for the characteristics of a region's economic situation, we use the following indicators: productivity (GDP per person employed), GDP per capita, and average monthly pension; the latter two indicators were adjusted for diverse regional purchasing power. We assume that the more economically developed a region is, the lower is the youth unemployment therein. As an indicator of regional export-import activity, we choose the openness of the regional economy to export and import. We suggest that the export activity of a region contributes to the creation of new jobs, and thereby reduces youth unemployment, and that regional import activity has the opposite effect. A detailed list of variables is presented in Table A2 in Appendix.

Table A3, in the appendix, contains the Spearman's correlation coefficients for all variables. The significance of the Spearman correlation coefficients for almost all independent variables with the dependent variable *youthunem* suggests that we have successfully selected our explanatory variable. At the same time, as many of the correlation coefficients between the explanatory variables are significant, it is not worthwhile to include all these variables in the model simultaneously, as it could lead to the problem of data multicollinearity. In this regard, we have estimated not just one but six models with the dependent variables youthunem. In each model only a part of the independent variables were included. To test our last hypothesis about differences in the determinants of youth unemployment between east and west regions, we included a double set of explanatory

variables in every model. For example we included variables *shurbanw* and *shurbane* in our first model, where:

$$shurbanw = \begin{cases} shurban, if\ i = 1,\ldots,54\,(west\ regions) \\ 0, if\ i = 55,\ldots,75\,(east\ regions) \end{cases},$$

$$shurbane = \begin{cases} 0, if\ i = 1,\ldots,54\,(west\ regions) \\ shurban, if\ i = 55,\ldots,75\,(east\ regions) \end{cases}.$$

4. Econometric Results

In this section, we present and discuss key econometric results for the different models. Table 5 contains the results of the model (1) estimation using the Arellano-Bond method. First, we verify the two conditions necessary for the consistency of Arellano-Bond estimates, as mentioned above. The results of Arellano-Bond tests (AB test AR(i), $i = 1,2,3$) show that for the errors of the difference equation, first-order autocorrelation is revealed and higher-order autocorrelation is not found, meaning that the first condition of consistency is valid. The validity of the second consistency condition was confirmed by the Sargan test (the p-value for the test statistic in each Sargan test is more than 0.1, so the null hypothesis that moments conditions are valid is not rejected for each model). Thus, the conditions for estimates consistency occurred, and we can start to interpret the obtained results.

Table 5. Determinants of youth unemployment (the results of the estimation of the models with the dependent variable "youthunem")

Model	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**
Time lag	0.02	$-5.75*10^{-3}$	0.01	0.01	$3.23*10^{-3}$	$-1.03*10^{-3}$
w-w spatial lag	0.14***	0.18**	0.14***	0.14**	0.15**	0.17***
w-e spatial lag	0.13**	0.13***	0.15***	0.16***	0.14***	0.15**
e-w spatial lag	0.06	0.03	0.04**	0.07	0.08	0.06
e-e spatial lag	0.18***	0.21***	0.20***	0.21***	0.21***	0.21***
totalunem	1.06***	1.07***	1.08***	1.08***	1.06***	1.07***
d2002	-0.57***	-0.79***	-0.55***	-0.55***	-0.53***	-0.50***
d2003	$-4.89*10^{-4}$	-0.51**	-0.11	-0.11	0.02	-0.23
d2004	-0.85***	-1.36***	-1.1***	-1.08***	-1.1***	-1.19***
d2005	0.4*	-0.48*	0.01	$3.5*10^{-3}$	-0.11	-0.31**
d2006	0.99***	-0.13	0.58***	0.58**	0.42**	0.21
d2007	0.95***	-0.24	0.57*	0.59*	0.37	0.07
d2008	0.97**	-0.48	0.48	0.50	0.15	-0.13
d2009	1.57***	-0.19	0.99***	1.00***	0.59**	0.21
shurbanw	-0.01					
shurbane	0.08					
shareyouthw	-4.26***					
shareyouthsquarew	0.09***					

Model	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**
shareyouthe	3.06					
shareyouthsquaree	-0.07					
numberpensionw	$5.2*10^{-4}$					
numberpensione	$1.01*10^{-3}$**					
migrateposw		$-3.96*10^{-3}$				
migratepose		-0.04*				
migratenegw		$6.57*10^{-3}$				
migratenege		0.02***				
miginotherregw		0.09***				
miginotherrege		$4.11*10^{-3}$				
miginabroadw		0.08***				
miginabroade		-0.02*				
migoutotherregw		-0.02				
migoutotherrege		-0.01				
migoutabroadw		-0.02				
migoutabroade		-0.15				
gdppercapppw			$-3.87*10^{-6}$*			
gdppercapppe			$-2.51*10^{-6}$			
productivityw				$-1.9*10^{-3}$*		
productivitye				$-1.5*10^{-3}$		
openexpcisw					-4.01	
openexpcise					9.06	
openimpcisw					11.2**	
openimpcise					-20.06**	
openexpothw						-1.92**
openexpothe						-1.62**
openimpothw						0.46***
openimpothe						1.52***
Tested hypotheses H_0	$\rho_{ww} = \rho_{we}$, $\rho_{ew} = 0$, $\beta_{shurbanw} = \beta_{shurbane}$, $\beta_{numberpensionw}$ $\beta_{numberpensione}$	$\rho_{ww} = \rho_{we}$, $\rho_{ew} = 0$, $\beta_{mw}^{pos} = \beta_{me}^{p}$ $\beta_{mow}^{out} = \beta_{m}^{o}$ $\beta_{maw}^{out} = \beta_{m}^{o}$	$\rho_{ww} = \rho_{we}$, $\rho_{ew} = 0$, $\beta_{gdpw} = \beta_{g}$	$\rho_{ww} = \rho_{we}$, $\rho_{ew} = 0$, $\beta_{prodw} = \beta$	$\rho_{ww} = \rho_{we}$, $\rho_{ew} = 0$, $\beta_{\exp w}^{cis} = \beta_{e}^{c}$	$\rho_{ww} = \rho_{we}$, $\rho_{ew} = 0$, $\beta_{\exp w}^{oth} = \beta_{e}^{c}$
p-v H_0	0.57	0.36	0.47	0.69	0.52	0.86
p-v AB test AR(1)	0.00	0.00	0.00	0.00	0.00	0.00
p-v AB test AR(2)	0.76	0.83	0.82	0.82	0.88	0.75
p-v AB test AR(3)	0.56	0.59	0.55	0.54	0.52	0.70
p-v Sargan test	0.61	0.57	0.66	0.66	0.59	0.56

From these results we can assume that $\rho_{ww} = \rho_{we}$ and $\rho_{ew} = 0$. We have tested these hypotheses for all models and they were no t rejected in any of the cases. That means that east and west youth unemployment rate equally affect the west youth unemployment ($\rho_{ww} = \rho_{we}$). At the same time west youth unemployment does not influence on east youth unemployment ($\rho_{ew} = 0$). We also tested pairwise equality of the coefficients for west and east variables, like *shurbanw* and *shurbane*. Finally, we tested all accepted hypotheses

together. All our general hypotheses were no rejected. So we incorporated restrictions in our models. It is quite easy, e.g. to incorporate the restriction $\rho_{ew} = 0$ into the model it is necessary don't include the variable $W_{ew}YUW$ into the model; to incorporate the restriction $\beta_{shurbanw} = \beta_{shurbane}$ it is necessary to include one variable *shurban* instead of pair of varibles *shurbanw* and *shurbane*. Then we estimated models with restrictions. The results are presented in table 6.

Table 6. The results of the estimation of the modified models with incorporated restrictions on the coefficients

	MY1	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
Time lag	0.02	-0.01	$4.56*10^{-3}$	$4.6*10^{-3}$	$-1.63*10^{-3}$	$2.32*10^{-4}$
w- (w+e) spatial lag	0.13***	0.17***	0.15***	0.16***	0.15***	0.17***
e-e spatial lag	0.17***	0.21***	0.2***	0.21***	0.20***	0.21***
totalunem	1.07***	1.05***	1.09***	1.08***	1.07***	1.08***
d2002	-0.58***	-0.79***	-0.54***	-0.52***	-0.56***	-0.51***
d2003	0.02	-0.52**	-0.12	-0.1	-0.04	-0.23
d2004	-0.86***	-1.43***	-1.1***	-1.06***	-1.16***	-1.21***
d2005	0.41	-0.65***	-0.03	-0.02	-0.18	-0.33**
d2006	1.0***	-0.27	0.55	0.57*	0.33*	0.19
d2007	0.98**	-0.5	0.56*	0.60*	0.29	0.06
d2008	0.99**	-0.58*	0.46	0.49	0.06	-0.14
d2009	1.62***	-0.35	0.98**	1.01**	0.54**	0.24
shurban	0.03					
shareyouthw	-4.49***					
shareyouthsquarew	0.1***					
shareyouthe	2.83					
shareyouthsquaree	-0.06					
numberpension	$8.33*10^{-4}$					
migratepos		$-7.81*10^{-3}$				
migratenegw		$5.66*10^{-3}$				
migratenege		0.01***				
miginotherregw		0.08***				
miginotherrege		$-3.69*10^{-3}$				
miginabroadw		0.09***				
miginabroade		$-7.96*10^{-3}$				
migoutotherreg		-0.01				
migoutabroad		-0.05				
gdppercappp			$-3.38*10^{-6}$**			
productivity				$-1.72*10^{-3}$*		
openexpcis					-1.95**	
openimpcisw					10.92*	
openimpcise					-16.88*	
openexpother						-1.77***
openimpothw						0.45***
openimpother						1.55***
p-v AB test AR(1)	0.00	0.00	0.00	0.00	0.00	0.00
p-v AB test AR(2)	0.77	0.81	0.84	0.83	0.93	0.75
p-v AB test AR(3)	0.57	0.60	0.56	0.55	0.52	0.70
p-v Sargan test	0.65	0.43	0.66	0.66	0.61	0.57

Source: our results on ROSSTAT data
Note: *** - significant at 1%, ** - significant at 5%, * - significant at 10%

a) After studying the scatter diagram for variables youthunem and shareyouth we assumed that the relationship between these variables might not be linear but quadratic and included in the models a variable square of shareyouth. The results of models estimation confirmed the usefulness of this step.
b) Under including variables related to migration, not simultaneously but one by one, qualitative results remain unchanged.
c) We test the hypothesis $H_0 : d_{2002} = ... = d_{2009}$ for each model and in any case it was rejected for any reasonable level of significance.

Now we can interpret the obtained results. In short, the main results can be summarised and interpreted as follows, commencing with the test of our initial hypotheses: (i) the existence of a stable positive boundary spatial correlation for youth unemployment in Russian regions is clearly detected, because spatial lags coefficients ρ_{w_w+e} and ρ_{ee} are highly significant and positive, which confirms our third hypothesis; (ii) it is necessary to take into account the temporal dynamics of youth unemployment because the group of time dummy variables was highly significant for all models; for instance, in 2004, in the middle of two crises - 1998 and 2008 - the level of youth unemployment rate fell, and has grown in 2008 and especially in 2009, during the second economic crisis, confirming our second hypothesis; (iii) the coefficients of variable "*totalunem*" exceed 1 in all models, highlighting a more serious situation for youth unemployment with respect to the total unemployment rate, confirming our first hypothesis; (iv) the differences between “east and west” estimates of some variables (e.g. $\hat{\beta}_{mw}^{neg}$ and $\hat{\beta}_{me}^{neg}$) are statistically significant, that confirms our fourth hypothesis (below we discuss these differences in more detail). More specific results are the following: (v) our ex-ante idea about a negative relationship between the share of regional urban population and youth unemployment has not garnered empirical evidence (the coefficient of variable shurban is insignificant); (vi) the dependence of the level of youth unemployment on the share of young people in the region is not positive - as we expected theoretically; moreover, it is also different for east and west regions: for east regions the relationship is insignificant, for west regions the relationship is quadratic; in fact, with the increase in the regional youth population, the youth unemployment rate firstly decreases, but after reaching a certain threshold, the unemployment level begins to rise (we allowed the

possibility of such relationship, see note a, below table 5); (vii) as we expected, the relationship between the number of pensioners and the youth unemployment rate in the region is positive (but only for east regions), with two possible explanations of the positive coefficient of the variable "numberpension": as we noted earlier, retired people may compete with young people for jobs, or alternately, the presence of a pensioner in the family may permit young people to remain unemployed for a longer period; (viii) our assumptions about the relationship between youth unemployment and the migration rate were confirmed only partially: we found no relationship between the positive net migration rate in the region and youth unemployment, but the assumption about a positive relationship between the flow of migrants out of the region and youth unemployment in east regions was empirically confirmed; furthermore, our hypothesis about competition of migrants and youth was confirmed only for east regions (it seems that in this case, a system of simultaneous equations should be applied, but it could be an area for a future research). Further results of the models are as follows: (ix) as we expected, the higher the level of economic development in the region, the lower the level of youth unemployment (this is shown by the negative signs of the *gdppercappp* and *productivity* coefficients); (x) the negative sign of variables *openexpcis, openexpothe*r confirm our assumption about the positive influence of regional export activity on youth unemployment, but at the same time a negative influence of regional import activity was confirmed only for import from other (non-CIS) countries and for import activity from CIS countries in west regions, the influence of regional import activity from CIS countries in east regions is positive. [34]

5. Final Remarks

Youth unemployment is in many countries much higher than total unemployment (in many EU countries the youth unemployment rate is two or even three times higher than the

[34] A possible explanation can be the different mix (or labour content) of imports; in east regions imports could be complement rather than substitute for local production.

total one). Also in Russia, it is about 50 per cent higher than the overall rate. The risk to have a “lost generation” should stimulate appropriate public intervention. Thus, the investigation of the differences and dynamics in the regional youth unemployment rate (and its relationship to the total unemployment rate) is extremely important in terms of policy implications, but it is also extremely difficult due to the large number of potentially relevant explanatory variables, the existence of spatial and temporal correlations, and problems of endogeneity.

Our empirical application refers to 75 Russian regions over the 2000-2009 period and, after presenting key descriptive statistics, produces significant econometric results for several models. Youth unemployment rates are persistently higher than total unemployment rates and a clear spatial correlation emerged (as shown by the significance of spatial lags coefficients); moreover the determinants of youth unemployment are statistically different between east and west Russian regions.

The persistency character of (total and youth) unemployment rates suggests that if potential labour market weaknesses are left free to unfold, the effects will be felt for a long period of time and this is particularly awful in case of young people; the other side of the coin is that policy efforts aimed at increasing labour market performance, if successful, may be able to produce durable outcomes, and this time pattern of benefits should be carefully considered when assessing the costs of policy interventions.

The second point (spatial autocorrelation), indicates that supra-regional aspects do matter in shaping labour market performance and that policy design should carefully consider the true spatial extent and interactions that take place at the regional level. This, together with the assessed structural differences between east and west Russian regions, suggests that neither a unique labour policy for the whole Russian Federation nor individual measures at the regional level seem appropriate. A multi-level system of policies is the adequate answer.

Some more specific policy suggestions can be derived from the other significant econometric results discussed in the previous section: for instance, the importance of a higher level of regional economic development together with the complex role played by several demographic, migration and social conditions. The high impact of the 2008-09 crisis on youth unemployment, should be especially noted. In short, there is no single policy intervention able to significantly improve the youth labour market performance in both absolute and relative terms, but there is a complex set of economic, social, institutional, labour and migration policies, well designed by taking into account of the multifaceted regional features and the key factors highlighted in this research.

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Appendix

Table A1. List of Russian regions

Number	Name	Number	Name
	WEST REGIONS	39	Republic of Bashkortostan
1	Belgorod region	40	Republic of Marii El
2	Bryansk region	41	Republic of Mordovia
3	Vladimir region	42	Republic of Tatarstan
4	Voronezh region	43	Republic of Udmurtia
5	Ivanovo region	44	Republic of Chuvashia
6	Kaluga region	45	Perm territory
7	Kostroma region	46	Kirov region
8	Kursk region	47	Nizhny Novgorod region
9	Lipetsk region	48	Orenburg region
10	Moscow region	49	Penza region
11	Orel region	50	Samara region
12	Ryazan region	51	Saratov region
13	Smolensk region	52	Ulyanovsk region
14	Tambov region	53	Kurgan region
15	Tver region	54	Sverdlovsk region
16	Tula region		**EAST REGIONS**
17	Yaroslavl region	55	Tumen region
18	Moscow	56	Chelyabinsk region
19	Republic of Karelia	57	Republic of Altay
20	Republic of Komi	58	Republic of Buryatia
21	Arkhangelsk region	59	Republic of Tyva
22	Vologda region	60	Republic of Khakassia
23	Kaliningrad region	61	Altay Territory
24	Leningrad region	62	Krasnoyarsk Territory
25	Murmansk region	63	Irkutsk region
26	Novgorod region	64	Kemerovo region
27	Pskov region	65	Novosibirsk region

28	Saint-Petersburg	66	Omsk region
29	Republic of Adygea	67	Tomsk region
30	Republic of Kabardino-Balkaria	68	Republic of Sakha (Yakutia)
31	Republic of Kalmykia	69	Kamchatka territory
32	Republic of Karachaevo-Cherkessia	70	Primorsky Territory
33	Republic of Northen Osetia – Alania	71	Khabarovsk Territory
34	Krasnodar Territory	72	Amur region
35	Stavropol Territory	73	Magadan region
36	Astrakhan region	74	Sakhalin region
37	Volgograd region	75	Jewish autonomous area
38	Rostov region		

Table A2. List of variables

Acronym	Definition	Values	Remarks
totalunem	Total Unemployment	Percent	
numunem (NU)	Number of unemployed	Thousands	
shunemp (SU)	Share of unemployed in the age group 20-29	Percent	
numemp (NE)	Number of Employed	Thousands	
shemp (SE)	Share of Employed in the age group 20-29	Percent	
youthunem (YU)	Unemployment in the age group 20-29	Percent	$YU = \frac{NU * SU * 100}{NU * SU + NE * SE}$
ratio	Ratio of youth and total unemployment	Positive numbers	$ratio = \frac{youthunem}{totalunem}$
shurban	Share of urban population in the total population (as of January 1)	Percent	
shareyouth	Share of population aged 20-29 (in total population age 15-72)	Percent	
students	Number of students in public higher education institutions	Per 10000 population	
numberpension	Number of pensioners in the region	Per 1000 population	
migrate	Net migration rate	The difference of immigrants and emigrants per 10000 population	migrate = migratepos + migrateneg
migratepos	Positive net migration rate		Max (Net migration rate, 0)
migrateneg	Negative net migration rate		Min (Net migration rate, 0)
miginotherreg	Migrants who have arrived from another region of Russia	In percentage of total number of migrants arrived to the region	
miginabroad	Migrants who came from outside Russia	In percentage of total number of migrants arrived to the region	
migoutotherreg	Migrants who left for other regions of Russia	As a percentage of the total number of migrants who have left the region	
migoutabroad	Migrants who left for outside of Russia	As a percentage of the total number of migrants who have left the region	

gdp	Gross regional product in the previous year per	Million rubles	The data were available only till 2008
gdppercap	Gross regional product in the previous year per capita	Rubles	The data were available only till 2008
productivity	The Gross regional product in the previous year per person employed	Million rubles	$productivity = \frac{gdp}{labour}$, where labour is average number of employed (thousand people).
purpower	The cost of a fixed basket of consumer goods and services in 2001-2009, The cost of a fixed basket of consumer goods in 2000	Percent	100 percent – Russia in average
gdppercappp	Gross regional product in the previous year per capita corrected for the different "purchasing power"	Rubles	The data were available only till 2008 $gdrpercappp = \frac{gdppercap}{purpower} * 100$
pension	Average monthly pensions	Rubles	
pensionpp	Average monthly pensions corrected for the different "purchasing power"	Rubles	$pensionpp = \frac{pension}{purpower} * 100$
impcis	Import to CIS	Million US dollars	
expcis	Export to CIS	Million US dollars	
expother	Export to other countries	Million US dollars	
impother	Import to CIS	Million US dollars	
openexpcis	Openness of regional economy for export to CIS in the previous year		$open\exp cis = \frac{\exp cis * RUR/USD}{gdp}$
openexpother	Openness of regional economy for export to other countries in the previous year		$open\exp other = \frac{\exp other * RUR/USD}{gdp}$
openimpcis	Openness of regional economy for import to CIS in the previous year		$openimpcis = \frac{impcis * RUR/USD}{gdp}$
openimpother	Openness of regional economy for import to other countries in the previous year		$openimpother = \frac{impother * RUR/USD}{gdp}$

Table A3. Spearman's correlation coefficients

	youthunem	totun	shurban	shareyouth	numberpension	migratepos	migrateneg	miginothereg
youthunem	1							
totun	0.89***	1						
shurban	-0.41***	-0.4***	1					
shareyouth	0.24***	0.21***	0.01	1				
numberpension	-0.33***	-0.35***	0.14***	-0.53***	1			
migratepos	-0.31***	-0.36***	0.16***	-0.1***	0.06	1		
migrateneg	-0.38***	-0.41***	0.14***	-0.19***	0.19***	0.86***	1	
miginothereg	-0.18***	-0.22***	0.32***	-0.14***	0.02	0.38***	0.27***	1
miginabroad	-0.24***	-0.32***	0.2***	-0.16***	0.32***	0.51***	0.48***	0.2***
migoutothereg	-0.05	-0.09**	0.13***	0.01	0.06	0.01	-0.14***	0.52***
migoutabroad	0.05	0.1***	0.29***	-0.21***	-0.05	0.15***	0.09*	0.34***
gdppercappp	-0.39***	-0.46***	0.26***	0.5***	0.03	0.2***	0.18***	-0.01
pensionpp	-0.24***	-0.32***	0	0.46***	0.14***	0.08*	0.14***	-0.17***
productivity	-0.32***	-0.4***	0.29***	0.59***	-0.06	0.18***	0.12***	0.04
openexpcis	-0.31***	-0.29***	0.09***	-0.23***	0.25***	0.31***	0.4***	-0.07*
openimpcis	-0.11***	-0.11***	0.03	-0.38***	0.26***	0.22***	0.31***	0
openexpoth	-0.22***	-0.18***	0.39***	-0.04	-0.05	0.16***	0.15***	0.17***
openimpoth	-0.24***	-0.26***	0.3***	-0.25***	0.2***	0.36***	0.31***	0.4***

	miginabroad	migoutothereg	migoutabroad	gdppercappp	pensionpp	productivity	openexpcis	openimpcis	openexpoth	openimpoth
miginabroad	1									
migoutothereg	0.16***	1								
migoutabroad	0.25***	0.05	1							
gdppercappp	0.25***	0.1***	-0.32***	1						
pensionpp	0.23***	0.05	-0.52***	0.85***	1					
productivity	0.21***	0.15***	-0.3***	0.97***	0.79***	1				
openexpcis	0.34***	-0.19***	0.14***	0.15***	0.12***	0.05	1			
openimpcis	0.32***	-0.16***	0.28***	-0.21***	-0.15***	-0.29***	0.6***	1		
openexpoth	0.03	-0.03	0.34***	0.09**	-0.24***	0.1***	0.13***	0.14***	1	
openimpoth	0.25***	0.16***	0.2***	-0.04	-0.11***	-0.03	0.03	0.22***	0.29***	1

Source: our results on ROSSTAT data Note: *** significant at 1%, ** significant at 5%, * significant at 10%