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IZA DP No. 12901

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ABSTRACT

It's the Way People Move! Labour Migration as an Adjustment Device in Russia*

This paper aims to assess the role of migration as an adjustment mechanism device to favor convergence across states and regions of Russia. In contrast to previous studies, we use variations in the population of a region as a proxy of its net migration rate and apply spatial econometric methodology in order to distinguish the effect from the neighbouring regions. We provide descriptive statistical evidence showing that Russia has more/less/the same intense migration flows than the USA and EU. The econometric analysis shows that migration flows are sensitive to both regional income and regional unemployment differentials. Nonetheless, we find that internal migration is sensitive to regional unemployment and income differentials of neighbouring regions. Dependent on the welfare, pre- or after-crisis period, income in neighbouring regions can create out- or in-migration flows. The relatively high degree of internal mobility coupled with the low sensitivity of migration flows to the local unemployment rate of distant regions might explain why migration flows tends not to generate convergence, but rather divergence across Russian regions.

JEL Classification: F15, F22, J61, R23

Keywords: internal and international migration, adjustment mechanism, spatial econometrics, Russia

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1. Introduction

Mobility among labor market statuses as well as internal and international migration are key drivers of a potentially important and strong adjustment mechanism for economic shocks, if working properly. This is especially true for market economies that rely also on market forces to correct their internal imbalances. Therefore, it is critical to investigate to what extent migration can become an equilibrating tool in the labour market of all countries, but especially in emerging market economies. Unfortunately, studies addressing these aspects are rare when not missing at all, also due to the lack of suitable statistical data. This is especially the case of Russia, where data on internal and international migration flows have been rarely collected, if not at all.

In this paper, we study the migration response to regional labour market shocks, by investigating whether migration contributes substantially to the adjustment to the region-specific labour demand shocks. Similar to what Jauer, Liebig et al. (2019) do for the EU, we investigate the statistical relationship between migration in a region and the relative unemployment rate along with the relative income in another region in the case of Russia, a country for which there are only very few studies on migration flows (Andrienko and Guriev 2004, Andrienko and Guriev 2005, Guriev and Vakulenko 2012, Vakulenko 2014, Guriev and Vakulenko 2015). We focus explicitly on population changes as proxies for migration flows what allows us to analyze both internal and external migration flows. To our knowledge, this approach has never been used before for Russian data until now.

Many previous studies that analyze regional convergence, also in the case of Russia, follow convergence models where observations relative to individual regions are considered independent of each other (see e.g. Østbye and Westerlund 2007, Lehmann and Silvagni 2013). However, as noted in a growing strand of the regional literature (Elhorst 1995, Möller and Soltwedel 2007, Niebuhr, Granato et al. 2012, LeSage 2014), the use of regional data requires an appropriate econometric treatment to avoid specific sources of bias: regions cannot be seen as independent of each other. They are often interrelated especially with neighbouring regions. This spatial interrelation arises in a spatial lag, which if not taken into account creates biased estimates in the regression model (Franzese and Hays 2007). To take this adequately into account, we also apply spatial econometrics methodology (Anselin 1988, LeSage and Pace 2010, Elhorst 2014), which allows us to distinguish the effect of changes in incomes and unemployment rates in the neighbouring regions from the rest. This represents an important innovation in the relevant literature, since it allows us to separate the effect of migration relative to distant regions from those relative to neighbouring ones. To our knowledge, only few previous studies on labour mobility as an adjustment device have ever controlled for spatial effects of neighbouring regions (see Gordon 2003, Niebuhr, Granato et al. 2012, Vakulenko 2014).

Migration in Russia does not only include foreign migrants, especially from other former Soviet Union republics.[1] Interregional migration flows also play an important role in the effective spatial allocation of the population and serves as an adjustment mechanism or regional inequality. It is usually considered as an instrument to overcome regional imbalances and to reallocate workers from regions with low wage and high unemployment to regions with better labour market conditions (Andrienko and Guriev 2005). However, only few attempts have been made until now to study the interstate and interregional migration mutually. Using population changes as proxies for migration flows allows us to do that, since other statistical sources available dramatically underreport the real magnitude of migration flows[2].

Previous studies (see e.g. Buccellato 2007, Solanko 2008, Guriev and Vakulenko 2012, Kholodilin, Oshchepkov et al. 2012, Vakulenko 2014) have mostly focused on the estimation of convergence in gross regional per capita product and find almost no or little evidence of regional convergence in per capita gross regional product, incomes and wages. In the 1990s and the 2000s, Russia has experienced a great increase in regional differences. Differences in income levels and wages surged by liberalization of free trade have increased substantially (see Table 1 in Appendix).

In our paper, we study the rare case of migration response to local labor market shocks. Our empirical analysis suggests why and in what circumstances a change in regional income or unemployment might cause an outflow or inflow of migrants to the region. Moreover, the relatively high degree of internal mobility coupled with the low sensitivity of migration flows to the local shocks of distant regions might explain why

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[1] According to the Federal State Statistics Service 89,6% of international immigrants in 2014 come from other former Soviet Union republics.

[2] For example, in 2008 the total number of people arrived to the region minus the number of people departed from the region was only 36% of total population change

migration flows tend not to generate convergence, but rather divergence across Russian regions.

This study innovates on the existing literature on several aspects. First, this is the first study in the literature on the adjustment mechanism which differentiates the effect of a local labour market shock from the shock in the neighbouring regions. In other words, we take into account spatial spillover effects of the labour market shocks in neighbouring regions and distinguish them from the effects relative to remote regions. Second, this is one of the few studies looking at the impact of internal and international migration on Russian regions and the only one using data on population as a proxy for migration. Assuming that the change in regional population is mostly driven by migration flows allows to additionally account for illegal migration, which is often the case in Russia. Finally, we link the literature on international and internal migration with that on convergence in incomes and unemployment differentials in Russia. Last but not least, we make some effort to predict the length and extent of convergence after a shock in local labor market conditions as based on migration flows as an adjustment device.

The outline of the paper is as follows. Section 2 provides a short survey of the literature, both that relative to other continents and that relative to Russia. Section 3 illustrates the methodology and data. Section 4 presents the main results. Some concluding remarks follow.

2. Literature

2.1. International literature

Geographical labour market heterogeneity not only *between*, but also *within* countries is an increasingly important concern for policy makers at all levels. In fact, it generates new and persistent forms of social and income inequality which might generate social instability and turmoil in peripheral areas, leading in the extreme cases to a fragmentation of nations if not adequately addressed. In fact, persistent geographical imbalances undermine social cohesion and the basic principles of formal and substantial inequality, which are at the basis of modern states. Migration might be, at least in principle, and has, in fact, been spelled out as the first factor to reduce regional unemployment differentials and favor convergence and spatial equality.

Differences in unemployment rates, wages and other labour market characteristics are crucial to consider also in terms of reactions to labour market shocks. According to neoclassical economic theory (see, for instance, Marston, 1985), regional labour market shocks have a significant direct effect on migration. More than that, disparities between regions caused by local shocks might be mitigated substantially by internal labour and capital mobility. Hence, the literature focuses on the migration effect as an adjustment mechanism for regional convergence and studies the response of migration to changing labour market conditions across regions and over time.

Blanchard and Katz (1992) developed a seminal model of regional labour market adjustment as driven by geographical labor mobility by looking at the evolution of the regional unemployment rate among US states over a period of 40 years (1950-1990). They suggested to analyze their joint behavior. In their model, an adverse shock of the labour demand, which caused increase in unemployment rates and decrease in wages in one state, induces workers to emigrate from that state. In turn, as explained in Marston (1985), that migration reduces unemployment in the region where the shock took place equalizing its level to that of the booming regions.

Since Blanchard and Katz (1992) showed that mobility might play a major role in the process of adjustment in the first year after a shock, a large part of literature has applied their approach. Covering the period 1975-1987, Decressin and Fatas (1995) investigate regions of Western Europe in comparison to the US and find participation rates to play a more important role in the adjustment in Europe than in the US: in other words, they show that the labour market adjustment in the EU leads to a response in terms of changes in the activity rates, whereas in US the first factor to adjust is labor mobility. In regions with high unemployment rates in Europe, there is a process of discouragement that reduces the unemployment rate. Hence, the reaction in terms of labor mobility within the EU is slower than in the US. In turn, cultural and language differences among European countries as compared to the more homogeneous US states explained this.

Dao, Furceri et al. (2014) reassess the adjustment of the US states and find that since 1980 the contribution of migration to asymmetric shocks across US states has decreased due to the declined disparities in unemployment rates. Beyer and Smets (2015) claim that labour mobility accounts for about 50% of long-run adjustments to region-specific labour demand shocks in US and Europe. They find that the mobility response to region-specific shocks plays a minor role comparing the mobility reaction to common asymmetric shocks. Arpaia, Kiss et al. (2016) confirm the importance of labour mobility as an adjustment mechanism in Europe. They find that labour market mobility reacts to labour demand shocks increasingly and absorbs about 25% of asymmetric shocks in one year and 50% in 5 years.

Overall, the literature shows that mobility is absorbing labour market shocks to varying extent. Studies using aggregate data show there is a small positive effect of employment on migration. However, individual data show no effect of unemployment on out-migration. So, it is essential to assess from an empirical point of view whether migration acts as an equilibration force for labour market shocks, to what extent and how it does so. It is also important to monitor these effects over time.

As already noted, traditional neoclassical models state that migration reduces regional disparities in unemployment rates (Marston 1985). However, this might not hold true in many cases. Studying the pre-war period in Sweden, Enflo, Lundh et al. (2014) find that migration fostered regional convergence in wages, and agglomeration effects were not enough to offset the labour supply effects. The most recent models of New Economic Geography suggest possible reasons for it: for example, regions with higher returns to capital, which attract more labour, perform better than other regions. This in turn leads to further divergence.

Newly born models and hypothesis of New Economic Geography state that in the long-run agglomeration forces generate even more jobs due to incoming migrants, which in turn creates more labour market divergence. Epifani and Gancia (2005) build a NEG model where they find the factors producing regional agglomeration, differences and growing disparities in unemployment rates. They show that migration rather increases disparities in the long-run.

2.2. Literature on Internal Migration

The analysis of the previous section shows that, even if migration reacts to asymmetric shocks, it is still an issue whether it will lead to regional convergence[1] and whether it does so in Russia, in particular. The literature devoted to Russia finds little evidence of regional convergence in incomes. Using publicly available Rosstat data, Solanko (2008) shows that income dispersion across Russian regions has increased dramatically during the period 1992-2005. Employing panel data analysis, they find evidence of weak sigma-convergence[2] only in the club of poor regions. The evidence based on beta-convergence analysis, however, resulted in support of strong income convergence among the richest regions (Moscow City, Yamalo-Nenets a.o., Khanti-Mansi a.o., Chukotka and Nenets a.o., Tyumen, Taimir a.o., Kamchatka, Koryak a.o., Magadan and Sakha).

Interregional migration might be one of the reasons of convergence across rich neighbouring regions: during the 1990s, a clear tendency of migration to wealthier locations was observed. Kholodilin et al. (2012) showed that the overall speed of regional convergence in Russia is low in comparison to other countries, but there is a distinct tendency towards club convergence in a cluster of rich regions surrounded by other rich regions (Arkhangelsk, Amur, Bashkiria, Iakutia, Kamchatka, Karelia, Kemerovo, Lenoblast, Magadan, Moscow, Mosoblast, Murmansk, Novosibirsk, Omsk, St. Petersburg, Perm, Primorye, Sakhalin, Sverdlovsk, Tomsk). Later he showed that after controlling for spatial effects the rate of convergence is even slower.

Lehmann and Silvagni (2013) study convergence in per capita gross regional product of Russia's regions and find no evidence of beta-convergence, but discover attenuated divergence. Vakulenko (2014) studies the contribution of migration to regional convergence. She looks at the Gini coefficient in order to see the decrease in inequality due to migration. She considers a conditional beta-convergence model with migration on panel data with spatial effects and finds a positive spatial effect for regional wages, income and unemployment. However, the impact of migration on sigma-convergence is very low since they consider only the number of registered migrants (usually not everyone

[1]For surveys of the literature on regional unemployment differentials, see, among others, Elhorst (2003); Ferragina and Pastore (2008); Pastore (2015); and Jauer et al. (2019).

[2]Relative or sigma-convergence represents the case when interregional variance is decreasing, whereas absolute or beta-convergence represents the case when poor regions grow with a higher growth rate than rich regions.

registers when she moves to another place of residence and official migration numbers do not represent true scale of migration).

Buccellato (2007) examines divergence in GDP per capita across Russian regions during the period from 1999 to 2004. Their results, which are robust to spatial correlation between regions, confirm that absolute convergence is absent, whereas the beta-convergence is significant only when controlling for other explanatory variables.

Bakas, Panagiotidis et al. (2016) find a positive and statistically significant effect of labour reallocation on unemployment for 15 European countries. Interestingly, Hogrefe and Sachs (2014) find that sectoral reallocation was a driving factor for unemployment in Spain.

Jauer, Liebig et al. (2019) employ regional panel data to conduct a comparative study of the migration response to asymmetric shocks in Europe and US in 2006 – 2016. Providing the estimates for the periods before and after crisis, they show that migration adopts about a quarter of asymmetric shocks in the labour market. They also find that before the crisis the migration response was greater in the US, than in Europe, whereas after the recession, migration has reacted to labour market shocks more intensively in Europe.

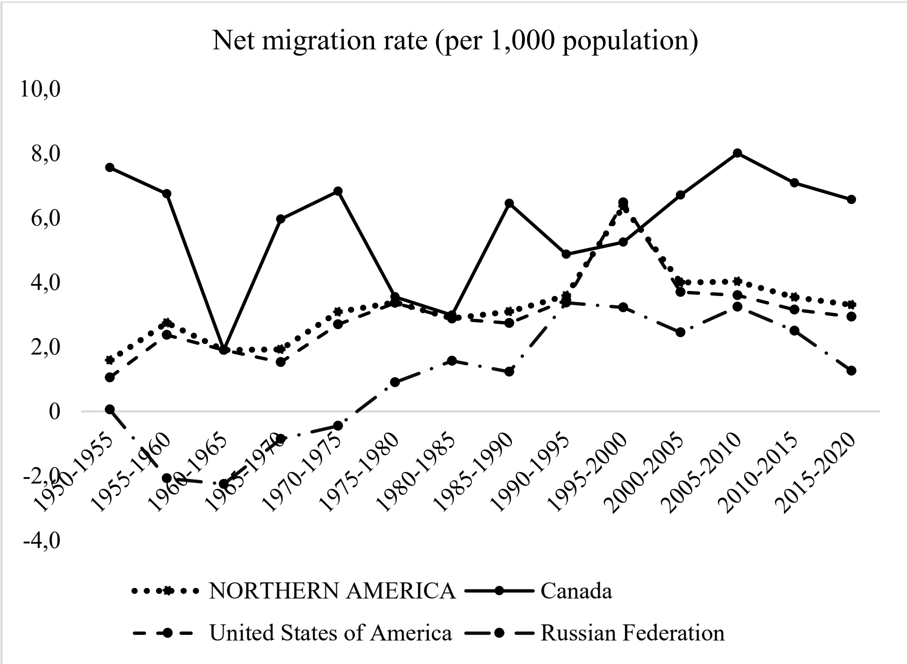
Internal migration is an essential adjustment mechanism for spatial allocation. For example, in the US the adjustment to region-specific shocks occurs mostly via internal migration and takes about 7 year (Blanchard and Katz, 1990). In Russia, an extremely large country with a huge amount of natural resources, migration might possibly play an essential role in generating a more effective geographical allocation of resources.

However, the magnitude of internal migration in Russia during the 1990s was quite low: looking at the official data relative to the year 1992-1999, Andrienko and Guriev (2004) show that internal mobility in Russia was very low. In the 2000's the situation did not change much: in our data we observe high rates of outmigration. Picture 2 represents the size of the migration flows in Russian regions in 2008. Most of the regions experience slightly negative internal migration and the magnitude of migration is quite low. For example, in 2008 the share of people arrived from other regions ranged from 2 to 18 % in different regions. The average percentage of population arrived from other regions is 2%. The most attractive regions in 2008 were Moscow (Federal City), Moscow Oblast and Krasnodar (see pic.1, showing the net interregional migration rate)[1]. Next attractive regions are Saint-Petersburg (Federal City), Leningradskaya Oblast, Sverdlovskaya Oblast, Belgorod Oblast; Novosibirsk Oblast. Regions with the lowest positive level of net internal migration are Yaroslavskaya oblast, Voronezhskaya oblast, Stavropolsly Krai, Nizhny Novgorod Oblast, Republic of Tatarstan, Samarskaya Oblast, Chelyabinskaya Oblast, Tomskaya Oblast. All other regions suffer from low number of people moving out.

The interregional job flows in Russia are much lower than in other transition countries (see, for comparison, Faggio and Konings, 1999, and Konings's calculations cited in Friebel and Guriev (2002). In comparison to the US, we also observe low rates of net migration (see Pic.1). Official statistics report that the rate of interregional mobility was less than 2% in the 2000's, increasing slightly after 2000 (see Pic.2). Low rate of interregional migration is mostly explained by the presence of poverty traps: people who tend to move are not able to do so due to the lack of savings. Friebel and Guriev (2002) explain this by the substantial amount of costs needed for migration, which have to be paid upfront.

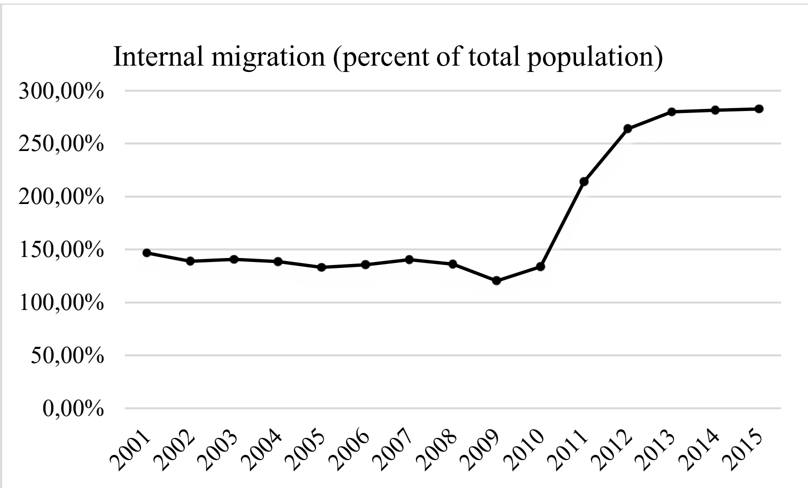
One of the crucial factors for the decision to out-migrate are expectations of higher wages. Using data on Russian regions, Karachurina and Mkrtchyan (2012) find that most of employees are ready to migrate when an expected salary in a new destination area is reasonably high. The survey was conducted among about 2,5 thousand unemployed people in October 2008 and 2,7 thousand unemployed people in December 2009. Expectations are the highest in regional capitals and are the lowest in rural areas. On average employees expect a salary which is 3 times higher than their salary on the last place of work. So, it is clear that people are ready to migrate only in case of sufficient increase in their wages. Another interesting finding of their survey is that people living in regional centers are less likely to find the job outside their region, whereas people from periphery are considering other regions.

[1] Source: Federal State Statistics Service



Pic. 1 Net migration rate

Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, Online Edition. Rev. 1.



Pic. 2 Internal migration (in percent total population)

Source: Data from "Socialnoe Polozhenie i Uroven Zhizni v Rossii (Social Situation and Living Standards in Russia)", Goskomstat (Federal Committee for Statistics), 2001-2015, Moscow (in Russian)

3. Data & Methodology

Russian regional migration data is very limited due to the fact that interregional migration is mostly illegal[1]. Hence the data publicly available represent only registered migrants, whereas most people moving to another region prefer to stay unregistered. At the same time, in the assumption that labor demand is not changing demographical trends, labour mobility is almost completely mirrored in the relative population change. In turn, this suggests that our approach to measuring migration is more effective than any other actual survey type or administrative measure of migration.

Therefore, following Jauer, Liebig et al. (2019), we assume migration basically explains population change, which is certainly true for short periods of time, and proxy the population growth as migration-induced:

$$\frac{mig_{it} + pop_{it-1}}{pop_{it-1}} = \frac{\Delta pop_{it} + pop_{it-1}}{pop_{it-1}} = \frac{pop_{it}}{pop_{it-1}}$$

Migration is mostly determined by real income, unemployment and public good provisions. Harris and Todaro (1970) determine migration as an expected wage, which in turn is a function of wage and unemployment. Hence, as determinants of the migration flow, we include a relative unemployment rate in a region and a relative monthly income per capita. In order to take into account regional heterogeneity and to account for factors that we do not observe, we use panel data estimation with individual fixed effects which are removed after within transformation. Individual fixed effects are likely to catch any regional characteristics constant over time, such as, for example, public good provisions, which are in addition not easy to measure. Any common trends, such as similar for all regions population aging, are captured by time fixed effects and leave no bias on the estimates.

For the aims of our analysis, we employ a panel data of all 80 Russian regions (analogous to NUTS2 level) observed over the period from 2001 until 2015[2]. The data are provided by the Federal State Statistical Office of Russia (RosStat).

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[1] Most migrants prefer not to register due to many reasons including the intention to avoid paper work. Therefore, the number of registered migrants is much lower than the actual number of migrants (see e.g. Vakulenko 2014).

[2] Republic of Dagestan, Ingushetia and Chechenskaya Republic are excluded due to the lack of data. For the spatial analysis we merge regions Khanty-Mansi Autonomous Area – Yugra and Yamal-Nenets autonomous region with Tumen region, Moscow with Moscow region, Saint-Petersburg with Leningradskaya oblast and Nenets Autonomous Okrug with Archangelsk. Hence, the number of regions reduces to 75.

In order to evaluate the response of migration to the labor market shocks, we consider panel data models with individual and time effects:

$$\ln\left(\frac{pop_{it}}{pop_{it-1}}\right) = \alpha_0 + \alpha_1 ln\left(\frac{ur_{it-1}}{ur_{nt-1}}\right) + \alpha_2 ln\left(\frac{y_{it-1}}{y_{nt-1}}\right) + \eta_t + \mu_i + \varepsilon_{it} \qquad (1)$$

where pop_{it} is the number of people who live in the region i, ur_{it-1} - unemployment rate in the region i, ur_{nt-1} - national unemployment rate, y_{it-1} is monthly income per capita, y_{nt-1} is a national monthly income per capita, μ_i are individual effects, η_t are time effects.

Additionally, in contrast to most previous studies (see, for reference, Jauer, Liebig et al. (2019), we assume that regions have not to be treated as independent objects. Taking into account spatial dependence in migration analysis is important as long as the decision to migrate is influenced by the distance between regions, which is very likely to be the case. Many factors, including unobserved ones, like regional and climate amenities, transport infrastructure and other factors common for regions located close to each other, if not taken into account may result in biased or inefficient estimates. Therefore, we extend the models with spatial effects introduced firstly in a textbook by Anselin (1988) and widely developed farther in the 2000's (see among others Arbia 2006, Baltagi and Arbia 2009, LeSage and Pace 2009).

We extend our model by introducing two specifications: the spatial error model and the spatial durbin model (Anselin 1988, LeSage and Pace 2009).

Spatial Error Model:

$$\ln\left(\frac{pop_{it}}{pop_{it-1}}\right) = \alpha_0 + \alpha_1 ln\left(\frac{ur_{it-1}}{ur_{nt-1}}\right) + \alpha_2 ln\left(\frac{y_{it-1}}{y_{nt-1}}\right) + \eta_t + \mu_i + \varepsilon_{it},$$
$$\varepsilon_{it} = \lambda W \varepsilon_{it} + u_i \qquad (2)$$

Spatial Durbin Model:

$$\ln\left(\frac{pop_{it}}{pop_{it-1}}\right) = \alpha_0 + \alpha_1 ln\left(\frac{ur_{it-1}}{ur_{nt-1}}\right) + \alpha_2 ln\left(\frac{y_{it-1}}{y_{nt-1}}\right) + \alpha_3 W ln\left(\frac{ur_{it-1}}{ur_{nt-1}}\right) +$$
$$+ \alpha_4 W ln\left(\frac{y_{it-1}}{y_{nt-1}}\right) + \alpha_5 W \ \ln\left(\frac{pop_{it}}{pop_{it-1}}\right) + \eta_t + \mu_i + \varepsilon_{it} \qquad (3)$$

where W is a $n \times n$ spatial weighting matrix, based on geographical distances between the regional centers (inverse distance matrix) or regional common borders (contiguity matrix).

Non-zero elements of the matrix W indicate that the region j is a neighbour for the region i. Diagonal elements of the matrix are zeros. Matrices are row standardized so that the weights of all neighbouring regions sum up to 1. In order to measure the connectivity between regions we employ two spatial matrices W: a spatial matrix of inverse geographical distances between the regional centers or the continuity matrix. These types of matrices are often used in spatial regional analysis (see e.g. Burgess and Profit 2001, Niebuhr, Granato et al. 2012), since they provide a good approximation for connectivity between regions relevant for labor migrants, who are more likely to move to another region if it is close to the region of origin.

Unobserved spatial connectedness of the neighbouring regions if not taken into account may lead to inefficient estimates. The spatial error model accounts for this spatial dependence in disturbances, causing local spatial spillovers: the specification assumes that a shock in disturbances in one region leads to a change in disturbances in neighboring regions. Spatial structure in disturbances also accounts for the possible spatial correlation in unobserved and omitted factors in the model.

The spatial Durbin model includes spatial lags of explanatory variables what allows us to distinguish the effect of the relative unemployment rate and income in the neighbouring regions. WX represents a linear combination of X values in neighbouring regions. In case of contiguity matrix only regions with common borders are considered as neighbors with equal weights. In case of inverse distance matrix all regions are considered as neighbors, but the weights are proportional to the distance between regions. More than that, SDM specification includes spatial lag of the dependent variable, capturing the spatial correlation in migration.

The SDM specification also allows for a spatial lag of the dependent variable, expanding the local spillovers to global spillovers. In this case a change in any explanatory variable causes a change in Y which in turn affects Y of the neighbouring regions. A change in Y of the neighbouring regions creates a change in their neighbouring regions and so on, leading to a global spatial spillover. Hence, each change in X creates a change in Y of the own region (direct effect) and in the neighbouring region (indirect effect) (LeSage and Pace 2009, LeSage 2014).

4. Results

We evaluate the effect of labour market shocks on migration with the help of panel data regressions. First, we estimate pooled OLS, random effects and fixed effects models with both individual and time effects. The results of the Hausman test[1] indicate that the model with fixed effects should be used. Second, we estimate econometric panel data models which account for spatial spillover effects between regions. Spatial econometric models allow to take into account spatial correlation in disturbances (SEM), spatial lag of the dependent as well as independent variables (SDM). Since the results of the spatial analysis are usually dependent on the design of the spatial weight matrix (Elhorst 2010), we estimate spatial models using alternative spatial weight matrices: contiguity matrix, when only regions with common border are considered as neighbours, and matrix of inverse distances, when the weight of a neighbouring region is proportional to the distance between the regions. Even though we expect spatial model to better explain the data, we leave the classic non-spatial model as a reference model to compare with spatial analysis and other studies that do not take into account spatial effects.

The results for the fixed effects model defined in equation (1) show that only the relative unemployment rate has a significant impact on population growth; instead the income level in the non-spatial model does not show a significant influence. The results confirm the hypothesis that higher unemployment in a region lowers migration to that region (see Table 3). The estimated coefficient can be interpreted as a within effect in the following way: if the number of unemployed people in previous year increases by 1%, the population growth rate in the region decreases by 0.104% ceteris paribus. For example, if the average number of unemployed people in a region was 50 thousand people, a 1% increase, meaning that the number of unemployed people became 50 500, the population would decrease by 0.104%. 0.104% of a population size of the magnitude 1 mln people is about 104 people. Hence, maximum 20,8% of the unemployment increase might be offset by the population change. In fact, an increase in unemployment rates reflects the situation when a region becomes less attractive, what leads to a decrease of immigrants to that region and increase of out-migrants.

Our findings are in line very much with what Blanchard and Katz (1992) report for the US migration. Also the latter is more led by regional unemployment differences and,

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[1] The Hausman Chi-squared statistics for the initial non-spatial model is 28.29 (P-value = 0), showing that random effects assumption fails and there is systematic difference between random effects and fixed effects models, and estimates of a random effects model are not consistent. The results of the FE and RE model and the test are available from the authors on request.

hence, the need to find a job, rather than by income differentials, namely to earn more. The result also corresponds to Jauer et al. (2019) who find a significant effect of relative unemployment rates and no influence of income differentials in the Eurozone and the US in more recent years. The reason is that regional unemployment differentials are much higher than wages differentials: the relative unemployment rate has a larger standard deviation than relative regional income also in the case of Russia (see Table 2).

Small effects of unemployment rate differentials and insignificant influence of income differentials might simply depend on the low size of internal migration (see Picture 1).

Nevertheless, the result described above relate to the non-spatial models, which appear to be not the best ones. Models taking into account spatial spillovers are more informative. According to the information criteria (AIC, BIC) the best one is the spatial durbin model (SDM) employing contiguity matrix.

Spatial models still show a significant negative impact of relative unemployment rates as it was shown in the non-spatial model. The results of spatial analysis (SEM models 2a and 2b) indicate that there is spatial correlation in disturbances (λ=0.145, λ=0.181, Table 3), which means that there exists a group of omitted factors common for regions located close to each other. As it was mentioned above, spatial correlation not taken into account can lead to inefficient estimates, what we obviously observe in non-spatial fixed effects model. Estimates of spatial error models 2a and 2b (as well as spatial durbin models 3a and 3b) increase efficiency of the estimates and in turn reveal the significant effect of the relative income on the population growth: an increase in average regional incomes can reduce population rates. The reason might be that this is the effect for regions in a poverty trap, i.e. regions where people are unable to move to a wealthier region due to low incomes and not enough savings to migrate. About a third of Russian regions are locked in poverty traps which explains lack of convergence between rich and poor regions (Andrienko and Guriev 2004). When average incomes in those regions increase people get the opportunity to leave the region, hence population growth decreases, rather than increasing. Another explanation might be that increasing incomes in a region fall into the increasing commuting flows rather than incoming migrants.

The results of the spatial durbin models (SDM models 3a and 3b) allow for spatial correlation in a more specified way: in SDM model population growth levels are correlated to neighbouring regions levels and regions located in a small distance to each other. Interesting to notice that SDM model with contiguity W matrix result in a significant spatial lag of the dependent variable, which means the presence of a global spatial spillover effect: a change occurring in unemployment or income in a region affects its neighbours, sharing the common border, which in turn affect their neighbours and so on. The SDM model with inverse distance W matrix does not show a significant effect of a dependent variable, and hence a global spillover effect. Instead it has higher estimates of coefficients for the spatial lags of independent variables, which in fact show the weighted effect of all other regions capturing global spillovers.

Both models (3a and 3b) show a negative significant coefficient for the spatial lag of income, i.e. for the weighted average income of the regions, which have a common border with the considered region. This result allows us seeing that when an average income in neighbouring regions increases, it reduces the migration flow to the considered region since people tend to move out, attracted by high incomes in neighbouring regions (in case of contiguity matrix) and all other regions (in case of inverse distance matrix). The negative effect of a spatial lag of unemployment (-0.125*** in 3a and -0.455 in 3b) arises because people in neighbouring regions with increased unemployment are not able to move and create migration flows to the considered region, since they are mostly likely captured by the poverty trap.

Tables 4 and 5 differentiates the results into pre-crisis and after-crisis period. The results of the pre-crisis estimations relax the negative effect of relative income on population growth and gives insignificant coefficients: before crisis regions did not suffer from the poverty traps. At the same time the effect of income in nieghbouring regions becomes even higher, indicating that people may create an out-migration attracted by high incomes of neighbouring regions. SDM model still has the lowest information criteria and remains the best model.

We cannot observe much variation explained by the explanatory variables in estimations after the crisis (Table 5). The after crisis behavior is spontaneous and is explained mostly by individual and time effects. However, spatial models (SEM and SDM models) with inverse distance matrix show that spatial spillover effects still remain, but only if taking into account more neighbours than just nearest ones. This means that in hard circumstances people are considering all possibilities, even being far away from their place of residence. Interestingly, the effect of relative income in neighbouring regions has changed from negative to positive. This illustrates the following case: when income in other regions increases, it allows people to use the opportunity of short-time exit from the poverty trap and finally move to a better place, which increases population in a considered region.

Thus, according to the spatial analysis, we see that the general willingness and ability to move to other regions is dependent on the situation in their region of residence and neighbouring regions simultaneously. Moreover, the direction of influence is determined by the national economic conditions, whether the country is going through the crisis or not.

5. Concluding remarks and policy implications

This paper has aimed at assessing the role of migration as an adjustment mechanism device to favor convergence across regions of Russia. We use variations in the population of a region as a proxy of its net migration rate and analyze whether the relative unemployment rate and relative monthly income in a region fosters migration flows to the regions. In addition, we consider the unemployment and income in the neighbouring regions applying spatial econometric analysis, namely spatial error and spatial durbin models.

The spatial econometric analysis shows that migration flows are sensitive to its own income and unemployment as well as regional income and unemployment of other regions. We find that internal migration is negatively affected by regional income, which is explained by some degree of substitution of commuting to migration. An increase in unemployment rate in turn decreases the attractiveness of the region and lowers the population growth.

Internal migration is also negatively affected by the regional average incomes in the neighouring regions: when neighbouring regions experience an increase in income, it might lead to a decrease of net migration in the considered region, which might be the evidence of the out-migration created by the attractiveness of other regions. The negative effect of unemployment rate in neighbouring regions reflects inability of people to move and create migration inflows to the considered region.

Pre- and after-crisis analysis reveals that the direction and magnitude of the migration flows are highly determined by the current welfare level. We find opposite effect of income in neighbouring regions on the population growth.

Hence, we observe a significant magnitude of spatial spillover effects for interregional migration flows, which being dependent on the welfare can reduce or increase inequality between regions. The relatively low degree of internal mobility coupled with poverty traps might explain why migration flows tends not to generate convergence, but rather divergence across Russian regions.

Policy implications may involve measures which aim to foster migration flows from and to farer regions: reduction of transportation costs, subsidies to housing costs and help in job finding might be important to reduce unemployment in the most depressed and backward regions. However, considering the low degree of migration of the population in regions living in a condition of poverty trap, investing in infrastructural development of those regions might contribute to create jobs locally and revert the tendency to generate brain drain.

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Table 1. Income distribution in Russian Federation

	2012	2013	2014	2015	2016	2017	2018[1)]
Population	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Average income per month, rubles:							
below 7 000,0	12,6	9,8	8,1	6,2	6,0	5,5	5,1
7 000,1 - 9 000,0	7,9	6,8	6,1	5,1	5,0	4,7	4,4
9 000,1 - 12 000,0	12,0	10,8	10,0	8,9	8,8	8,5	8,1
12 000,1 - 15 000,0	10,8	10,3	9,8	9,2	9,1	8,9	8,6
15 000,1 - 20 000,0	14,6	14,5	14,4	14,0	14,0	13,9	13,5
20 000,1 - 25 000,0	10,7	11,2	11,4	11,6	11,6	11,7	11,6
25 000,1 - 30 000,0	7,8	8,4	8,8	9,2	9,2	9,4	9,4
30 000,1 - 35 000,0	5,6	6,3	6,7	7,2	7,3	7,4	7,5
35 000,1 - 40 000,0	4,1	4,7	5,1	5,6	5,7	5,8	6,0
40 000,1 - 50 000,0	5,4	6,3	7,0	7,9	7,9	8,2	8,5
50 000,1 - 60 000,0[2)]	8,5	3,8	4,2	4,9	5,0	5,2	5,4
60 000,1 - 70 000,0[3)]	...	7,1	2,7	3,1	3,2	3,3	3,6
greater than 70 000,0	...	...	5,7	7,1	7,2	7,5	8,3

Source: Federal State Statistics Service

Table 2. Standard deviation of a relative unemployment rate and relative regional income (i.e. regional unemployment and income divided by national unemployment and national income)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Relative unemployment rate															
Standard deviation	0,55	0,91	1,12	1,17	1,02	1,34	1,28	1,11	0,76	0,91	0,94	1,07	0,98	0,78	0,69
Relative income															
Standard deviation	0,48	0,48	0,47	0,44	0,44	0,41	0,39	0,34	0,34	0,32	0,31	0,30	0,30	0,29	0,29

Table 3.

	(1) fe	(2a) SEM W – contiguity matrix	(3a) SDM W – contiguity matrix	(2b) SEM W – inverse distnaces	(3b) SDM W – inverse distnaces
relative unemployment rate$_{t-1}$	-0.104***	-0.0965***	-0.110***	-0.0987***	-0.127***
	(0.031)	(0.0297)	(0.0298)	(0.0308)	(0.0301)
W*relative unemployment rate$_{t-1}$			-0.125**		-0.455***
			(0.0590)		(0.0995)
relative income $_{t-1}$	-0.0547	-0.375***	-0.333***	-0.405***	-0.404***
	(0.088)	(0.0970)	(0.0967)	(0.0960)	(0.0950)
W*relative income $_{t-1}$			-0.613***		-1.350**
			(0.176)		(0.580)
λ		0.145***		0.181*	
		(0.0394)		(0.106)	
W*population growth (ρ)			0.148***		0.116
			(0.0388)		(0.105)
Constant	-0.65				
Time effects	Yes	Yes	Yes	Yes	Yes
AIC	565.1064	559	545.1	569.5	545.4
BIC	651.4811	649.9	646.2	660.4	646.5
Observations	1,189	1,155	1,155	1,155	1,155
Number of regions	80	77	77	77	77

Standard errors in parenthesis. According to the Hausman test we choose fixed effects model. The notation W* means we take the spatial lag of the relative income or unemployment rate. In case of contiguity matrix it is the weighted sum of income or unemployment rate of the bordering regions, in case of the matrix of inverse distances it is the sum of all other regions weighted according to the relative distance.

Table 4. Before crisis 2008

VARIABLES	(1) fe	(2a) SEM W – contiguity matrix	(3a) SDM W – contiguity matrix	(2b) SEM W – inverse distnaces	(3b) SDM W – inverse distnaces
relative unemployment rate$_{t-1}$	-0.238***	-0.213***	-0.259***	-0.171***	-0.247***
	(0.0429)	(0.0394)	(0.0412)	(0.0382)	(0.0403)
W*relative unemployment rate$_{t-1}$			-0.183**		-0.422***
			(0.0840)		(0.126)
relative income $_{t-1}$	-0.110	-0.119	-0.0917	-0.198	-0.253
	(0.197)	(0.198)	(0.183)	(0.185)	(0.181)
W*relative income $_{t-1}$			-2.140***		-3.272**
			(0.356)		(1.511)
λ		0.154***		0.581***	
		(0.0594)		(0.120)	
W*population growth (ρ)			0.128**		0.442***
			(0.0552)		(0.139)
Constant	-0.46				
	(0.175)				
Time effects	Yes	Yes	Yes	Yes	Yes
AIC	155.16	145	103.9	136.1	112.2
BIC	194	187.9	155.4	179	163.7
Observations	553	539	539	539	539
Number of id	79	77	77	77	77

Table 5. After crisis 2008

VARIABLES	(1) fe	(2a) SEM W – contiguity matrix	(3a) SDM W – contiguity matrix	(2b) SEM W – inverse distnaces	(3b) SDM W – inverse distnaces
relative unemployment rate $_{t-1}$	-0.0332	-0.0329	-0.0223	-0.0401	-0.0230
	(0.0448)	(0.0439)	(0.0439)	(0.0417)	(0.0440)
W*relative unemployment rate $_{t-1}$			-0.130		0.0227
			(0.0806)		(0.164)
relative income $_{t-1}$	-0.108	-0.264	-0.298	-0.189	-0.275
	(0.193)	(0.193)	(0.195)	(0.188)	(0.190)
W*relative income $_{t-1}$			0.219		2.511**
			(0.361)		(1.132)
λ		0.0611		0.491***	
		(0.0563)		(0.160)	
W*population growth (ρ)			0.0546		0.561***
			(0.0561)		(0.163)
Constant	-0.128				
	(0.179)				
Time effects	Yes	Yes	Yes	Yes	Yes
AIC	82.97	104	104.3	95.60	94.10
BIC	127.52	152.7	161.8	144.2	151.6
Observations	636	616	616	616	616
Number of id	80	77	77	77	77

Pic. 1. Internal migration (movements within Russia) in 2008
(Net migration, calculated as a number of people arrived to the region minus number of people departed from the region)
Source: Data from the official portal of Russian Federal State Statistics Service (Rosstat, http://www.gks.ru)