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Does MigrationLead to Regional Convergence in Russia?*

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Abstract

We analyze the impact of migration on wage, income and the unemployment rate. Using the official Russian statistical database from 1995 to 2010, we calculate a dynamic panel data model with spatial effects. There is a positive spatial effect for wage, income and unemployment rate. There is no significant impact of migration on the unemployment rate. We find a negative relationship between net internal migration and both wages and income, which is explained by the positive effect of emigration and negative effect of immigration for income. However, the migration benefits are not big enough to make a difference on the Gini index across regions. We conclude that migration does not affect the regional σ -convergence of economic indicators.

JEL Classification: R23, C23.

Keywords: convergence, migration, wage, income, unemployment rate, spatial dynamic panel data models.

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Introduction

There are significant differences between regions in the Russian Federation. The inter-regional differences in income in Russia are twice as large as in USA or Canada (Kwon & Spilimbergo, 2006)[1]. However, in 2000 we observe a gradual regional convergence, especially in income, wages and the unemployment rate, less so in GDP per capita (Guriev & Vakulenko, 2012). The differentials in income and wages decreased substantially. In this paper we investigate the contribution of migration to convergence. We use Russian regional data for the period 1995-2010 to answer this question. We analyze the impact of migration on wages, income and unemployment rate.

There are many empirical papers on the role of migration in the convergence process reaching different conclusions. Some papers (Persson (1994), Maza (2006), etc.) conclude that there is a positive effect, that is migration leads to convergence. Other researchers (Peeters (2008), Etzo (2008), etc.) find a negative relationship; migration leads to a divergence between regions. Finally, there are papers (Barro & Sala-i Martin (1991, 1992), Soto & Torche (2004), etc.) which claim that there is no significant statistical relationship between migration and convergence[2]. Theoretical papers also present different economic arguments behind the impact of migration on regional convergence. There are two approaches: the neoclassical theoretical model and the New Economic Geography theory. Therefore, the identification of the role of migration in a convergence processes is an empirical question.

Our results show that migration has no significant impact on the unemployment rate. We find a negative relationship between net internal migration, and wages and income, which is explained by the positive effect of emigration and negative effect of immigration for income. However, the migration benefits are not big enough to make a difference on Gini index across regions. We conclude that migration does not affect the regional convergence of

[1] The standard deviation of real regional income in USA was approximately 0.2 during 1995-2000, in Russia it was around 0.4 for the same period.

[2] We discuss this question more detailed in the Section 2.2.

economic indicators. For the unemployment rate, wages and incomes we find a positive spatial effects.

The rest of the paper is organized as follows. Section 2 provides a review of the theoretical and empirical literature. Section 3 presents the empirical models. Section 4 illustrates our data issues. Section 5 discusses the results. Section 6 concludes.

1. Literature review

1.1. Theoretical papers

There are two different concepts of migration and convergence. This is because interregional migration produces both labor supply and labor demand effects. On the labor supply side, workers can reduce regional disparities by moving to more prosperous regions. Labor supply in receiving regions increases and as a result wages decrease. The opposite situation occurs in sending regions. Therefore, interregional disparities in wages and unemployment reduce. On the labor demand side, migrants increase expenditure in a receiving region because of their demand for goods and services. Neoclassical theory suggests that the labor supply effect dominates the labor demand effect. The main assumptions of the neoclassical paradigm are homogenous labor, constant return to scale and diminishing marginal returns, and perfect competition. On the other hand, the New Economic Geography model argues that the labor demand effect dominates the labor supply effect if we consider imperfect competition. In this case 'core' regions gain from immigration in terms of higher real wages and a lower unemployment rate and 'periphery' regions lose from emigration (Krugman, 1991). Therefore, the disparities between regions increase.

Many papers consider heterogeneous labor migrants. In some cases skill-selective migration can increase interregional disparities in per capita income (Fratessi & Riggi, 2007). Because of the improvement in the capital/labor ratio and savings of returning workers, migration positively affects the sending regions, therefore interregional disparities can be reduced (Larramona & Sanso, 2006). Labor mobility can reduce the speed of income convergence because emigration creates a disincentive for gross capital investment especially in regions with low initial wage levels (Rappaport, 2005). There is a series of papers where the wages of migrants and the native population are compared (Dustman et al., 2008). Different theoretical concepts have led many researchers to argue that the impact of migration on convergence is an empirical question.

The question about the relationship between migration and per capita income is more complex. We know that there are different sources of income: wages, capital income, social benefits, and one of these could explain the convergence of income. Guriev and Vakulenko (2012) show that the main source of income convergence is capital income. We control for difference channels of income convergence and argue that migration leads to income convergence because of wages. In this case we can explain this relationship through labor market stories mentioned earlier.

1.2. Empirical papers

The first empirical paper on regional convergence and migration was done for the US economy by Barro and Sala-I-Martin (1991). They did not find that migration had a significant effect on convergence. In their following papers the authors estimated the same model for Japanese prefectures and European states, and their conclusions were the same. The authors show that the neoclassical model can be approximated as:

$$(1/T)\ln\left(y_{it}/y_{i,t-T}\right)=\alpha-\left[\ln\left(y_{i,t-T}\right)\right]\left[\left(1-e^{-\beta T}\right)/T\right]+u_{it}$$

where y_{it} is per capita GDP or income for region i at time t. T is the length of the analyzed time period. This model is called the unconditional β -convergence model. The modification of this model by the additional of variables is the conditional β -convergence model. Absolute or β -convergence means that poorer regions tend to grow faster than richer regions, and hence gaps between regions for this indicator will be reduced. Barro and Sala-i-Martin add a migration variable to the model above and show that migration does not influence convergence. A large amount of later research estimated similar models with different sets of control variables, different instruments for the migration rate, for cross section and panel data (for regions in different countries and for different time spans). In Table 1 a summary of different studies is presented. There are various results with positive, negative and insignificant relationships between migration and convergence.

Table 1. *Empirical studies of migration and convergence***.**

Authors	**Country/Period**	**Effect (convergence)**[3]	**Indicator**
Persson (1994)	Sweden (1906-1990)	+	Per capita income
Raymond & García (1996)	Spain (60s-80s)	+	Income
Cashin & Sahay (1996)	India (1961-1991)	Weak +	Per capita income
Lugovoy et al. (2006)	Russia (1998-2004)	+	GDP per capita
Maza (2006)	Spain (1995-2002)	+	GDP per capita
Østbye & Westerlund (2007)	Sweden (1980-2000)	+	GDP per capita
Kırdar & Saraçoğlu (2008)	Turkey (1975-2000)	Strong +	Income
Hierro & Maza (2010)	Spain (1996–2005)	Weak +	Income
Barro & Sala-i Martin (1991, 1992)	USA (1880-1982) Japan (1930-1987)	No	Per capita income
Cardenas, Ponton (1995)	Colombia (1960-1989)	No	Income
Gezici & Hewings (2004)	Turkey (1987-1997)	No	GDP per capita
Soto & Torche(2004)	Chile (1975-2000)	No	Income Productivity level
Toya, Hosono &Makino (2004)	Philippines (1980-2000)	No	GDP per capita

[3]"+" means that migration leads to convergence, "-" means that migration leads to divergence, "No" means that migration does not affect convergence.

Authors	**Country/Period**	**Effect (convergence)**[3]	**Indicator**
Roses & Sanchez-Alonso (2004)	Spain (1850-1930)	No and weak "+" for urban wage	Wage
Čadil & Kaderabkova (2006)	Czech Republic (1995-2004)	No	GDP per capita Nominal wage
Wolszczak-Derlacz (2009a)	EU(27) (1990-2007)	No	GDP per capita
Rattsø & Stokke (2010)	Norway (1972-2003)	No	Per capita income
Shioji (2001)	Japan (1960-1990)	Weak -	Income
Peeters(2008)	Belgium (1991-2000)	-	Per capita income
Østbye & Westerlund (2007)	Norway (1980-2000)	-	GDP per capita
Etzo (2008)	Italy (1983-2002)	- Different effects of in- and outmigration	GDP per capita
Araghi & Rahmani (2011)	Iran (2000-2006)	-	GDP per capita
Basile, Girardi & Mantuano (2012)	Italy (1995-2006)	-	Unemployment rate
Nakamura (2008)	Japan (1955-2005)	+ 1970-75 1989-94 –divergence	GDP per capita
Wolszczak-Derlacz (2009b)	Poland (1995-2006)	No (internal) -(international outflow)	GDP per capita
Phan & Coxhead (2010)	Vietnam (1999-2002)	+ and -	Per capita income
Niebuhr et al. (2012)	Germany (1995-2005)	+ No	Unemployment rate Wage
Bunea (2011)	Romania (2004-2009)	No Weak +	GDP per capita Unemployment
Capasso, Carillo & De Siano (2011)	Italy (1964-2002)	- (high skill) + (low skill)	GDP per capita

Authors	Country/Period	Effect (convergence)[3]	Indicator
Huber & Tondl (2012)	EU(27) (2000-2007)	No (Unemployment) - GDP per capita - productivity	Unemployment GDP per capita Productivity

2. Econometric specification

Empirical testing of the influence of migration on convergence may be done in at least two ways. They are: (1) the Computable General Equilibrium (CGE) model and an econometrical calculation of the statistical relationships using metadata studies, and (2) convergence models (Huber & Tondl, 2012). In this paper we use the second approach. We consider a basic conditional β-convergence model similar to Barro and Sala-I-Martin (1991). However, we extend their approach by exploiting the model data structure using:

$$\ln\left(\frac{y_{i,t}}{y_{i,t-1}}\right)=\alpha_i+\delta_t-\beta\ln\left(y_{i,t-1}\right)+\gamma\text{Migration}_{i,t-1}+\sum_{k=1}^{K}\theta_k \text{X}_{k,i,t}+\varepsilon_{i,t} \quad (1)$$

where $y_{i,t}$ is the dependent variable for region i in year t. We consider three dependent variables: wages, income, and unemployment rate. α_i is a fixed effect, which allow to control for unobserved spatial heterogeneity; δ_t is a time effect in order to control for common country factors affecting dynamics of considering factors. $\text{X}_{k,i,t}$ is the set of explanatory variables, i is the region index, k is the index of an independent variable. β, γ *and* θ_j are the calculated coefficients. β represents the convergence. If $\beta > 0$, then there is a conditional β-convergence: it means that rich regions have lower growth rates than poor regions and there is a convergence between regions. $\varepsilon_{i,t}$ is the remainder disturbance.

The control variables for the wage equation are demographic indicators (population growth rate, share of young people, share of old people), the number of students, and the infant mortality rate as an indicator of development. Population growth rate is considered to measure agglomeration effects. For the 2005-2010 subsample we also include the sector structure of the economy (the share of labor in different sectors[4]) including agricultural workers, mining workers, and workers in education and health. For the unemployment rate we use the same set of explanatory variables. For the income equation the model is more complicated. As mentioned, there are three parts to income. They are wages, social transfers, and capital income. Therefore, we include factors which influence all of these. We add the same variables as for the wage equation, and add transfers (from federal to regional budgets), and investment per capita. This allows an evaluation of the role of government in income convergence and the contribution of capital mobility.

We can rewrite equation (1):

$$\ln\left(y_{i,t}\right)=\alpha_i+\delta_t+\left(1-\beta\right)\ln\left(y_{i,t-1}\right)+\gamma \text{Migration}_{i,t-1}+\sum_{k=1}^{K}\theta_k \text{X}_{k,i,t}+\varepsilon_{i,t} \qquad (2)$$

Equation (2) is a dynamic panel data model because there is a lag of dependent variables as additional an independent variable. In this case, we capture different regional characteristics. However, we add the spatial lag to equation (3) in order to take into account spatial autocorrelation. The spatial lag term may either help capture the role of externalities arising from neighborhood characteristics or it may act as a proxy for omitted variables clustered in space (LeSage and Pace, 2009). Previous regional research in Russia (Lugovoy et al., 2007, Kholodilin et al., 2012, Kolomak, 2013, Kadochnikov, Fedyunina, 2013) shows that we need include spatial interactions in the model. Elhorst et al. (2010) found that the speed of convergence when ignoring spatial interaction effects is biased; however, this bias decreases by including fixed effects and by reducing the time span for which the growth rate is measured.

$$\ln\left(y_{i,t}\right)=\alpha_i+\delta_t+\left(1-\beta\right)\ln\left(y_{i,t-1}\right)+\rho\sum_{j=1}^{J}\omega_{i,j}\ln\left(y_{j,t}\right)+\gamma \text{Migration}_{i,t-1}+\sum_{k=1}^{K}\theta_k \text{X}_{k,i,t}+\varepsilon_{i,t} \qquad (3)$$

We analyze a spillover effect including the weighted average of the values of our dependent variables for all regions, without the region for which the dependent variable is on

[4]We cannot construct these variables for the years before 2005 because there is no data due to a change in industrial classification in 2004.

the left side of equation (3). The weight for this variable ω_{ij} is the inverse distance between region *i* and all other regions[5]. Therefore, equation (3) is a dynamic panel data model with a spatial effects. To test the spatial correlation significance for our dependent variable we use Moran's I statistics. For equation (3) we use the Blundell and Bond (1998) system GMM: two equations, in levels and in first differences, are calculated simultaneously. The equation in levels is instrumented with lagged differences, and the equation in differences instrumented with a lagged variable in levels. First differences remove unobserved time-invariant region-specific effects. Kukenova and Monteiro (2008) show that it is possible to use the system GMM results for analysing models involving spatial components. Therefore, we use the lags of variables as the instruments. We use the Sargan test for overidentification instrumental variables and the Arellano-Bond test for autocorrelation. First order correlation is expected, but not higher order correlation.

The main variable of interest is migration ($\text{Migration}_{i,t-1}$). The net internal migration rate is the migration variable in our model. In case of neoclassical mechanisms dominating the effects of migration on wage and income interregional disparities, one expects the coefficient of net internal migration rate to be negative and positive in the unemployment rate equation. We also consider separately immigration and emigration as Østbye and Westerlund (2007), the net external migration rate, and the overall migration rate. The effect of immigration and emigration maybe asymmetrical due to selective migration. Gross migration flows may lead to significant interregional redistribution of human capital due to possible heterogeneity even when net migration is zero. The same is true for different effect of internal and external migration flows. If external immigrants have different skills than labor force in the receiving region, considerable labor demand effects of immigration might result (Elhorst, 2003). If traditional neoclassical theory mark the impact of migration on interregional disparities in equation (3) the outward flows will have positive effects on wage and income and negative on unemployment rate whereas the inward flows will decrease wage and income and increase unemployment. We include different migration variables with a lag

[5] The distance between regions is a physical distance between their capitals by railway. If there is no railway between cities, we use alternative ways of estimating distances, i.e. by roads, by sea. We standardize weight matrix by row.

in order to take into account the potential endogeneity of this variable. Guriev and Vakulenko (2013) show that people in Russia move to regions with higher wages and a lower unemployment rate and move out of regions with lower wages and a higher unemployment rate. Therefore, we have a simultaneity problem between migration and income.

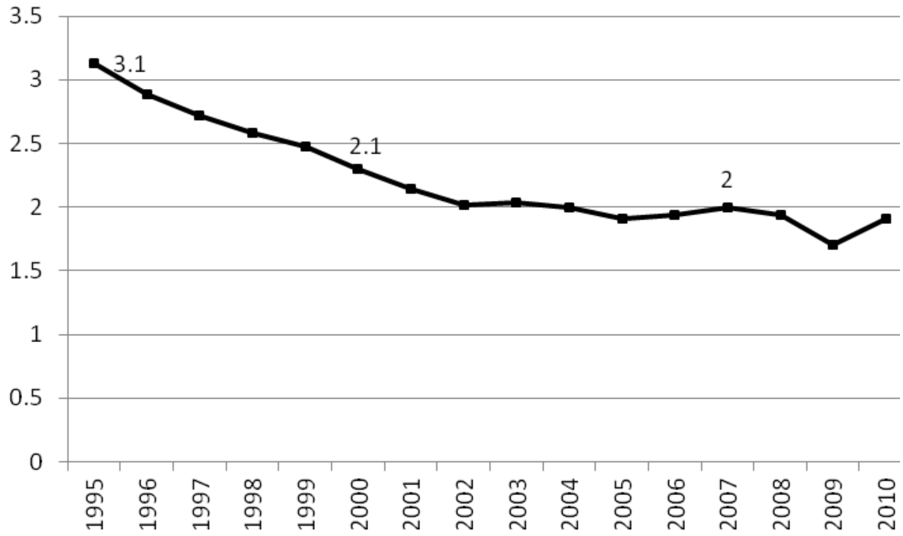
3. Data

We use official data of the Russian statistical data service (Rosstat)[6] for 77 Russian regions from 1995 to 2010. We drop Ingushetia, Chechnya and Chukotka because of the unavailability of data, and 9 autonomous districts (Nenets, Komi-Perm, Taimyr/Dolgano-Nenets, Khanty-Mansijsk, Yamalo-Nenets, Aginsk Buryat, Evenk, Ust-Ordyn Buryat, and Koryak) which are administratively parts of other regions. The dependent variables are real wages, real income and the annual unemployment rate. Descriptive statistics of all variables are presented in Table 5 in the appendix. In order to make wages and income comparable between regions and for different years, we calculate real wages and real income as a ratio of nominal income and wages to subsistence level in corresponding region. There are no subsistence level data for 2000; we interpolated this year as an average of 1999 and 2001.

To find the relationship between migration rates and economic indicators we consider the available data on migration which is the number of registered migrants. A person is considered to be a migrant in these statistics if they have relocated and changed their residence registration address. We consider both internal and external migration together and separately. Figure 1 presents the dynamics of internal migration in Russia. We can see that the volume of migration is decreasing over time and it has stabilized at around 2 million people per year in 2000s[7].

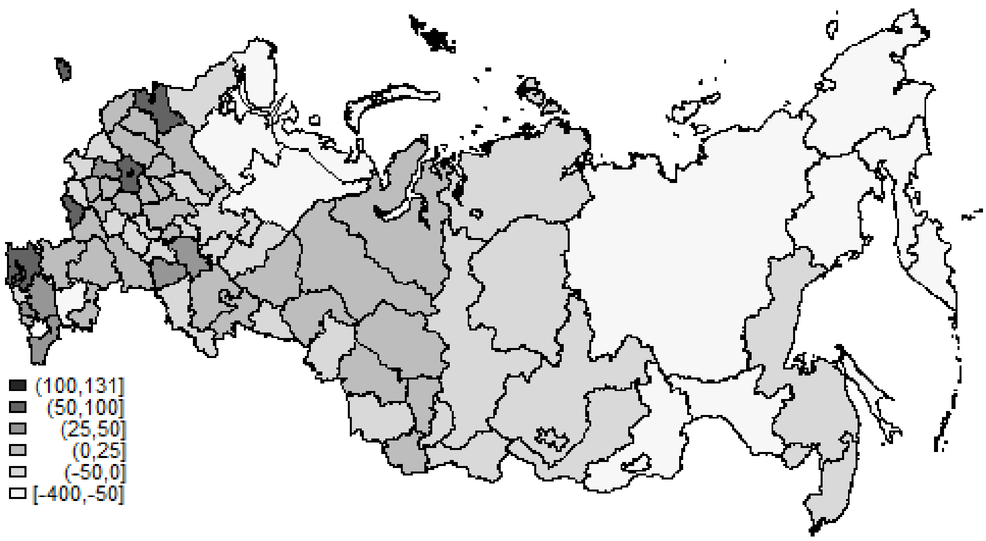
[6] www.gks.ru, Russian Regions.
[7] However, it is only the number of registered migrants. Not all people register when they move. Therefore, we do not know actual number.

Figure 1. *Internal migration in Russia 1995-2010.*



The main direction of migration flows in Russia is from east to west (see Figure 2) and this is called *westward drift* in the literature (Mkrtchyan, 2004). Two of the eight federal districts in Russia have positive net migration rate; the Central district (which includes Moscow), and the North West district (which includes Saint Petersburg).

Figure 2. *The average migration rate per 10 000 people 1997-2009*



4. Results

4.1. Wages

First we look at 2001-2010, when a decline in inter-regional differences for wage was observed, as Guriev and Vakulenko (2012) show. Then we estimate the β-convergence model. Table 6 in the appendix presents Moran's I statistics for wage. We reject the hypothesis of zero spatial autocorrelation values at 5% significance level for all years. Therefore, the spatial lag in the model is reasonable. Table 2 presents the results of the wage equation. We find β-convergence for wages. The spatial lag and the first time lag for wages are significant for different specifications of the model. To interpret spatial models we have to calculate direct and indirect effects and their sum, which is called as total effect. In spatial panel dynamic models, we obtain average total effect (ATE) for each explanatory variable by simply computing $\beta/(1-\rho)$ [8] (LeSage, Pace, 2009). In our case ATE for time lag of dependent variable in Table 2 column (1) is approximately 0.69, i.e. 0.398/(1-0.426). Therefore, it is less than 1, which argue β-convergence for wages. Net external migration and net internal migration are insignificant in all specifications of the model. However, if we consider them separately, the result is different. Emigration is significant and has positive coefficient[9], it leads to a wage increase in the sending region as people move from regions with lower wages to regions with higher wages (Guriev & Vakulenko, 2013). As a result such moving tends to equalize wages in different regions. Nevertheless, immigration is insignificant. The results of the Sargan test and the Arellano-Bond test for autocorrelation are presented in the last lines of Table 2. We cannot reject the hypotheses that there is no second order autocorrelation and that the over identifying restrictions are valid at 5% significance level.

The ATE for time lag is less than one, therefore, there is β-convergence for all specifications. This coefficient for time lag becomes smaller when we exclude spatial lag from the model (Table 2, column 6). The model without spatial lag has problem with Sargan test.

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[8] These are coefficients from equation (3).

[9] We do not consider direct and indirect effects estimates (LeSage, Pace, 2009), because we are interested in effect of migration on convergence, but not on level of the dependent variable. More detail see section 5.4.

Table 2. **Results for wage 2001-2010.**

VARIABLES	(1) Asymmetric influence with external migration	(2) Asymmetric influence	(3) Net migration	(4) Net overall migration	(5) Without migration	(6) Asymmetric influence without spatial lag
Time lag: wage (t-1)	0.398***	0.412***	0.438***	0.461***	0.461***	0.589***
	(0.095)	(0.102)	(0.107)	(0.113)	(0.113)	(0.056)
Spatial lag	0.426***	0.438***	0.356***	0.369***	0.363***	
	(0.110)	(0.101)	(0.132)	(0.122)	(0.125)	
Emigration (t-1)	0.011*	0.006				0.028***
	(0.007)	(0.005)				(0.010)
Immigration (t-1)	0.002	0.009				-0.020**
	(0.005)	(0.006)				(0.009)
Net external migration rate (t-1)	0.006		0.007			0.016***
	(0.005)		(0.005)			(0.006)
Net internal migration rate (t-1)			-0.008			0.589***
			(0.006)			(0.056)
Net migration rate (t-1)				0.001		
				(0.002)		
Population growth	-0.672**	-0.659**	-0.478*	-0.510*	-0.471*	-0.305
	(0.328)	(0.320)	(0.270)	(0.267)	(0.246)	(0.346)
Share of young (log)	-0.323**	-0.251**	-0.324**	-0.223**	-0.220**	-0.480**
	(0.132)	(0.115)	(0.132)	(0.109)	(0.105)	(0.196)
Share of old (log)	-0.292*	-0.226	-0.380**	-0.322**	-0.304**	-0.471***
	(0.173)	(0.141)	(0.183)	(0.157)	(0.141)	(0.172)
Number of students (log)	0.120***	0.113***	0.116***	0.107***	0.110***	0.318***
	(0.038)	(0.037)	(0.037)	(0.033)	(0.036)	(0.075)
Time dummies and constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	770	770	770	770	770	770
Number of regions	77	77	77	77	77	77
Number of instruments	67	66	66	65	64	47
AR(2), p-value	0.90	0.99	0.91	0.74	0.74	0.52
Sargan test, p-value	0.14	0.15	0.13	0.12	0.15	0.001

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

The results for 1995-2010 are presented in Table 7 in the appendix and estimates for 2005-2010 are shown in Table 8 in the appendix. For 1995-2010 and 2005-2010 years emigration is significant and has a positive sign. Therefore, the results for wages are consistent with the neoclassical theoretical model.

4.2. Income

Table 6 in the appendix presents Moran's I statistics for per capita income. We cannot reject the hypothesis of zero spatial autocorrelation for income at 5% significance level from 1997. However, we include spatial lag of dependent model in the model. The results for the income equation are presented in Table 3. The coefficient for time lag is significant and average total effect for it is less than one, therefore there is a β-convergence. The emigration is significant and has positive sign as in wage equation with asymmetric influence of migration (Table 3, column 2). The immigration is also significant and has a negative sign (Table 3, column 2). Net migration rate is significant and has negative sign (Table 3, column 4). These results are consistent with the neoclassical model. Emigration increases per capita income in sending regions. Higher immigration leads to lower income per capita in a region. The net external migration is insignificant for all specifications. This is due to the low level of registration of external migrants. There are many unregistered and illegal immigrants in Russia. The results of the Sargan test and the Arellano-Bond test for autocorrelation are presented in the last lines of Table 3. Our instruments are valid and there is no second order autocorrelation. Result without a spatial lag is presented in Table 3, column 6. This specification has problem with Sargan test. However, the total average effect for time lag coefficient is approximately 0.68 for different specifications and it is similar to time lag coefficient, which is 0.6 (Table 3, column 6).

Table 7 and Table 9 in the appendix show results for 1995-2010 and for 2005-2010 respectively. The immigration is significant and has negative sign for 1995-2010 time span. The emigration is significant and has positive sign for 2005-2010 when we also control for sectoral structure of the economy. We can conclude that results for income is explained by neoclassical paradigm.

Table 3. ***Results for income per capita 2001-2010.***

VARIABLES	(1) Asymmetric influence with external migration	(2) Asymmetric influence	(3) Net migration	(4) Net overall migration	(5) Without migration	(6) Asymmetric influence without spatial lag
Time lag: Income (t-1)	0.490***	0.491***	0.487***	0.492***	0.499***	0.607***
	(0.061)	(0.060)	(0.063)	(0.063)	(0.066)	(0.063)
Spatial lag	0.281***	0.278***	0.288***	0.288***	0.288***	
	(0.087)	(0.087)	(0.091)	(0.092)	(0.100)	
Emigration (t-1)	0.009	0.010*				0.009
	(0.006)	(0.005)				(0.008)
Immigration (t-1)	-0.012	-0.013**				-0.011
	(0.008)	(0.007)				(0.009)
Net external migration rate (t-1)	-0.001		-0.001			-0.001
	(0.004)		(0.004)			(0.005)
Net internal migration rate (t-1)			-0.009			
			(0.006)			
Net migration rate (t-1)				-0.005**		
				(0.002)		
Federal transferts per capita (log)	0.004	0.005	0.004	0.004	0.006	0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Investments per capita (log)	0.017	0.015	0.015	0.019	0.019	0.032*
	(0.015)	(0.016)	(0.015)	(0.017)	(0.016)	(0.019)
Population growth	-1.151***	-1.154***	-1.175***	-1.169***	-1.317***	-1.015***
	(0.337)	(0.333)	(0.332)	(0.335)	(0.344)	(0.327)
Share of young (log)	-0.303	-0.326	-0.324*	-0.276	-0.345*	-0.744***
	(0.198)	(0.206)	(0.197)	(0.210)	(0.195)	(0.237)
Share of old (log)	-0.085	-0.100	-0.065	-0.045	-0.174	-0.182
	(0.124)	(0.125)	(0.116)	(0.113)	(0.106)	(0.206)
Number of students (log)	0.111**	0.111**	0.115**	0.114**	0.092*	0.094*
	(0.050)	(0.050)	(0.050)	(0.049)	(0.048)	(0.053)
Time dummies and constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	634	634	634	634	634	634
Number of regions	73	73	73	73	73	73
Number of instruments	69	68	68	67	66	49
AR(2), p-value	0.72	0.71	0.70	0.69	0.53	0.44
Sargan test, p-value	0.18	0.19	0.19	0.18	0.17	0.04

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

4.3. *Unemployment*

Table 6 in the appendix presents Moran's I statistics for unemployment. We reject the hypothesis of zero spatial autocorrelation at 5% level. Therefore, we need to include a spatial lag in the model. The results for the unemployment equation are presented in the Table 4. The time lag of the dependent variable and the spatial lag are significant in all specifications. The average total effect of coefficient for time lag is approximately 0.74, i.e. less than one. There is a β-convergence for the unemployment rate. The spatial lag is positive. Therefore, unemployment rates for nearby regions are positively correlated. However, all migration variables are insignificant. The results of the Sargan test and the Arellano-Bond test for autocorrelation are presented in the last lines of Table 4. Our instruments are valid and there is no second order autocorrelation. There is a problem with Sargan test only for specification in the last column (Table 4).

The results are the same for 2005-2010 (Table 10 in the appendix). Results for 1995-2010 (Table 7 in the appendix) are unconvincing. There are significant variables of migration, however, the model has problem with Sargan test. Also time lag of dependent variable is insignificant in Table 7 column 6. The unemployment rate has highly volatile dynamic during 1995-2010. Therefore, it is better to consider and interpret shorter and more stable periods.

Table 4. *Results for unemployment 2001-201*0.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Asymmetric influence with external migration	Asymmetric influence	Net migration	Net overall migration	Without migration	Asymmetric influence without spatial lag
Time lag: Unemployment (t-1)	0.314***	0.312***	0.326***	0.331***	0.345***	0.336***
	(0.066)	(0.066)	(0.062)	(0.063)	(0.065)	(0.071)
Spatial lag	0.577***	0.564***	0.549***	0.519***	0.517***	
	(0.189)	(0.196)	(0.188)	(0.195)	(0.193)	
Emigration (t-1)	0.018	0.005				0.005
	(0.026)	(0.010)				(0.014)
Immigration (t-1)	-0.036	-0.024				-0.000
	(0.028)	(0.017)				(0.016)
Net external migration rate (t-1)	0.013		0.016			
	(0.023)		(0.028)			
Net internal migration rate (t-1)			-0.026			

			(0.030)			
Net migration rate (t-1)				-0.003		
				(0.005)		
Population growth	-1.760	-1.640	-1.757	-1.630	-1.670	-1.255
	(1.375)	(1.345)	(1.335)	(1.269)	(1.224)	(1.240)
Share of young (log)	0.693	0.717	0.769	0.783	0.750	1.454**
	(0.491)	(0.510)	(0.506)	(0.521)	(0.523)	(0.623)
Share of old (log)	-0.299	-0.257	-0.271	-0.268	-0.352	-0.062
	(0.338)	(0.347)	(0.304)	(0.320)	(0.311)	(0.537)
Number of students (log)	-0.086	-0.091	-0.047	-0.049	-0.050	-0.059
	(0.109)	(0.119)	(0.084)	(0.096)	(0.107)	(0.100)
Time dummies and constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	770	770	770	770	770	770
Number of regions	77	77	77	77	77	77
Number of instruments	67	66	66	65	64	46
AR(2), p-value	0.24	0.26	0.28	0.27	0.24	0.37
Sargan test, p-value	0.25	0.23	0.34	0.28	0.22	0.05

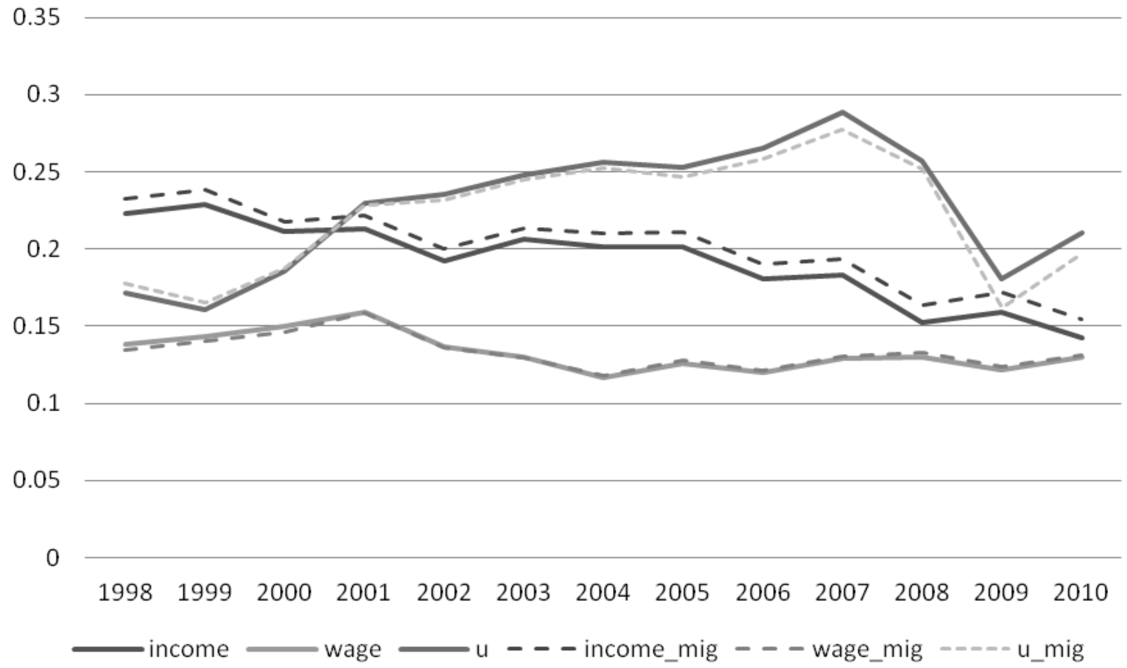
Robust standard errors in parenthesesn *** p<0.01, ** p<0.05, * p<0.1

4.4. Migration and convergence

There is another concept of convergence called σ -convergence or relative convergence. In this concept regions converge if inter-regional variance (Gini, Theil index, etc.) of real indicators decreases over time. Gluschenko (2009) shows that σ -convergence can be used to evaluate regional inequality in contrast to β-convergence. In order to evaluate the lessening of inequality due to migration we look at the Gini coefficient (alternatively standard deviation can be used). Figure 3 shows the dynamic of the Gini coefficient for real wages, real income and the unemployment rate. The Gini coefficient for income decreases over time, which means that differences in incomes decline. The Gini coefficient for wages has been decreasing since 2000 and the Gini coefficient for unemployment rate has been decreasing since 2007.

Using results of equation (3) with asymmetric influence of migration, we exclude the influence of immigration and emigration on wages, income and the unemployment rate. The dashed line in the Figure 3 are the Gini coefficients without migration, i.e. this is hypothetical inter-regional differences with zero migration. The difference between the solid and dashed lines is insignificant[10]. Therefore, the impact of migration on σ -convergence is very small.

Figure 3. *Dynamic of Gini coefficient for real wages, real income and unemployment rate with and without migration*



However, there are at least three reasons for such results. First, we consider only the number of registered migrants, which does not present true migration figures in Russia as not all people register when they change their place of residence. This aspect complicates the counting of migrants and the estimation of their effect on economic indicators. The second reason is generating different effects due to migration. In the theoretical section two main concepts which explain the effects of migration on labor market indicators were explained. Demand and supply side effects may compensate each other and the overall effect of migration can be insignificant. The last explanation for our results is the complexity of

[10] We construct confidence interval using command gconc for Stata (Kolenikov S., Sajaia Z., 2010). However, confidence intervals for true Gini coefficients are wide and they include Gini coefficients for estimated values (without migration). Therefore, we argue that there is no differences between them.

separating different causes of regional convergence. However, we control for the time dynamic of the variables and the spatial interaction between regions.

5. Conclusion

In this paper we analyze the influence of migration on the regional convergence of labor market indicators and per capita income in Russia. In 2000s in Russia there was a significant decrease in regional differences according to these indicators. One of the potential causes may be labor mobility. However, even according to different theories there is no unequivocal answer to this question. The result depends on model assumptions, the types of markets, the qualifications of the migrants etc. Most of these assumptions are difficult to check because of the unavailability of data. Much empirical research argues that this is an empirical question and we need to calculate the figures we observe and try to explain results using one of the theories.

This is an empirical paper. We consider a conditional β-convergence model with migration similar to Barro and Sala-i-Martin (1991), but on panel data and with spatial effects. We try to solve the endogeneity problem using variables with lags for instruments in the Blundell-Bond system GMM approach. We control for different sources of convergence for per capita income. We find a significant negative effect of net migration on wages and income. This effect is explained by emigration, which increases wages and income in the sending region. We also find negative effect of immigration on income. The regression results indicate that emigration and immigration do not work symmetrically. Our result is consistent with the neoclassical theory where the effect of labor demand side dominates the labor supply side effect that may be linked to externalities, changes in consumption and investment or selective migration. However, the impact of migration is small. In order to evaluate the lessening of inter-regional inequality due to migration we look at the Gini coefficient for real and hypothetical values of wage, income and unemployment rate assuming zero migration. Comparing the Gini coefficients for wages, per capita income and the unemployment rate with and without migration, we get the result that the difference is insignificant. Therefore, we conclude that migration does not lead to interregional σ-convergence. There could be three reasons for such effects. First, the number of internal migrants is small: only 2% of the total population, where 1% is inter-regional migration[11]. However, this is only the number of registered migrants. We do not know true values of migration. Second, there are a lot of different effects as different theories predict. Through these direct and indirect effects the overall impact of migration is small due to mutually compensating forces. Third, it is difficult to separate the effects of different sources of regional convergence. Guriev and Vakulenko (2012) show fiscal redistribution does not play a major role in convergence. The main source of income convergence is convergence in capital income due to capital mobility, the development of financial and real estate markets. Our results add to the conclusion that labor mobility did not play a significant role in wage, income and unemployment rate σ - convergence in Russia 1995-2010. Solution at least one of the above-mentioned problems may be possible improvements of the research agenda.

Finally, some policy implication can be drawn from this analysis. The migration flows in Russia are not the factor reducing inter-regional disparities. One of the explanation of this fact may be low labor mobility, especially inter-regional labor mobility. Therefore, the government should create economically favorable environment, i.e. develop rental housing, improve the system of mortgages and other important factors of migration which are discussed in correspondent papers (Guriev and Vakulenko, 2013, etc.). Another important thing is the improvement of the quality of statistical information about number of internal and particularly external migrants. We can't provide adequate assessment without actual figures. Special surveys could help to clarify the situation on local labor markets.

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[11]For comparison, it is 13.7%, 14.6% and 4.6% in the USA, Canada, and Japan accordingly for the period 2000-2006. Source: statistical services of these countries.

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Appendix

Table 5. *Definition of variables and their descriptive statistics*.

Variable	Description	Number of observations	Mean	Std. Dev.	Min	Max
Population	Number of population, 10,000 people	1248	183.88	160.73	4.91	1150.00
Emigration	Number of emigrants per 1000 habitants	1248	8.89	7.48	2.40	101.92
Immigration	Number of immigrants per 1000 habitants	1248	7.01	3.41	1.98	26.76
Net internal migration rate	Net internal migration per 1000 habitants	1248	-1.88	5.98	-80.61	8.24
Net external migration rate	Net external migration per 1000 habitants	1092	-0.76	6.02	-65.32	13.68
Unemployment rate		1248	10.12	4.63	0.80	32.40
Income	Per capita income with respect to subsistence level (log)	1248	0.63	0.36	-0.34	1.86
Wage	Wage with respect to subsistence level (log)	1248	0.76	0.34	-0.34	2.06
Share of young	Share of people less than working-age (log)	1248	2.93	0.20	2.51	3.58
Share of old	Share of people greater than working-age (log)	1248	2.96	0.26	1.65	3.31
Students	Number of students per 10,000 population (log)	1231	-1.21	0.56	-6.33	0.23
Share of agricultural workers	Number of agricultural workers with respect to employers	468	0.12	0.06	0.00	0.28
Share of mining workers	Number of mining workers with respect to employers	468	0.02	0.03	0.00	0.17
Share of workers in education	Number of workers in education with respect to employers	468	0.10	0.02	0.06	0.23
Share of workers in health	Number of workers in health with respect to employers	468	0.07	0.01	0.05	0.17
Transfers	Transfers to the equalization of fiscal capacity per capita (log)	708	7.45	1.33	-3.51	10.78
Investments per capita	Investments per capita (log)	1246	9.11	1.38	5.73	12.82

Table 6. *Moran's I statistics for unemployment rate, per capita income and wages.*

	Unemployment rate		Per capita income		Wage	
year	**I**	**z**	**I**	**z**	**I**	**z**
1995	0.087***	5.234	0.03**	2.291	0.053***	3.433
1996	0.093***	5.527	0.034***	2.518	0.032***	2.32
1997	0.139***	7.911	0.017*	1.6	0.052***	3.374
1998	0.124***	7.173	-0.004	0.463	0.036***	2.555
1999	0.207***	11.453	-0.024	-0.595	0.04***	2.772
2000	0.191***	10.685	-0.017	-0.213	0.047***	3.234
2001	0.157***	8.931	0.001	0.779	0.049***	3.384
2002	0.136***	7.89	-0.002	0.595	0.051***	3.582
2003	0.163***	9.318	-0.009	0.22	0.046***	3.367
2004	0.168***	9.496	-0.013	0.006	0.057***	3.894
2005	0.125***	7.494	-0.007	0.324	0.051***	3.539
2006	0.161***	9.086	0	0.697	0.054***	3.63
2007	0.156***	8.858	-0.011	0.09	0.046***	3.172
2008	0.121***	7.143	0.006	1.01	0.036***	2.59
2009	0.074***	4.573	0.012*	1.332	0.014*	1.416
2010	0.066***	4.2	0.002	0.785	0.048***	3.23

Notes: I is Moran's I statistics. Z is z statistics for testing hypothesis Ho: I=0.
Significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 7. *Results for wages, per capita income and unemployment rate 1995-2010.*

VARIABLES	(1) Wage	(2) Wage with spatial term	(3) Income	(4) Income with spatial term	(5) Unemploy-ment	(6) Unemploy-ment with spatial term
Y[12] (lag)	0.455***	0.330***	0.611***	0.533***	0.283***	0.135
	(0.025)	(0.072)	(0.058)	(0.058)	(0.053)	(0.147)
Spatial lag		0.337**		0.211**		0.861***
		(0.143)		(0.083)		
Emigration (t-1)	0.044***	0.027**	0.009	0.008	0.064***	0.029
	(0.010)	(0.011)	(0.007)	(0.006)	(0.016)	(0.040)
Immigration (t-1)	-0.034***	-0.019	-0.012	-0.017*	-0.071***	-0.071**
	(0.010)	(0.016)	(0.009)	(0.009)	(0.019)	(0.036)
Net external migration rate (t-1)	0.023***	0.016**	-0.000	0.001	0.032**	0.024
	(0.007)	(0.008)	(0.005)	(0.005)	(0.015)	(0.035)
Population growth	-0.017	-0.586	-0.984***	-1.136***	0.195	0.047
	(0.303)	(1.122)	(0.328)	(0.347)	(1.317)	(1.019)
Share of young (log)	-1.045***	-0.685***	-0.704***	-0.341*	1.724***	0.180
	(0.235)	(0.226)	(0.210)	(0.195)	(0.318)	(0.910)
Share of old (log)	-0.596***	-0.510**	-0.221	-0.176	0.569*	-0.692
	(0.207)	(0.205)	(0.160)	(0.113)	(0.316)	(1.096)
Number of students (log)	0.296***	0.193**	0.105**	0.125**	0.035	-0.004
	(0.086)	(0.097)	(0.052)	(0.053)	(0.136)	(0.168)
Transfers per capita (log)			0.008	0.005		
			(0.007)	(0.006)		
Investment per capita (log)			0.033*	0.018		
			(0.019)	(0.014)		
Constant, time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,001	1,001	695	695	1,001	1,001
Number of regions	77	77	73	73	77	77
Number of instruments	56	81	50	71	56	81
AR(2), p-value	0.29	0.55	0.46	0.70	0.14	0.85
Sargan test, p-value	0.01	0.37	0.06	0.23	0.00	0.53

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[12] Y is wage, income or unemployment rate correspondingly for (1)-(6) column.

Table 8. ***Results for wages 2005-2010.***

VARIABLES	(1)	(2)	(3)	(4)
	Asymmetric influence	Net migration	Net overall migration	Without migration
Wage (t-1)	0.190**	0.206***	0.197***	0.194***
	(0.074)	(0.067)	(0.068)	(0.066)
Spatial lag	0.755***	0.713***	0.728***	0.725***
	(0.108)	(0.093)	(0.097)	(0.088)
Emigration (t-1)	0.008**			
	(0.003)			
Immigration (t-1)	0.009			
	(0.006)			
Net internal migration rate (t-1)		-0.001		
		(0.003)		
Net migration rate (t-1)			-0.001	
			(0.001)	
Population growth	-0.342	-0.142	-0.150	-0.152
	(0.235)	(0.219)	(0.211)	(0.199)
Share of agricultural workers	-0.201	-0.176	-0.195	-0.196
	(0.249)	(0.214)	(0.217)	(0.219)
Share of mining workers	1.231	2.192	2.060	2.116
	(1.391)	(1.745)	(1.739)	(1.575)
Share of workers in education	-2.149***	-1.629***	-1.694***	-1.628***
	(0.605)	(0.619)	(0.574)	(0.583)
Share of workers in health	-1.341	-1.771	-1.732	-1.766
	(0.998)	(1.580)	(1.531)	(1.498)
Constant, time dummies	Yes	Yes	Yes	Yes
Observations	468	468	468	468
Number of regions[13]	78	78	78	78
Number of instruments	40	39	39	38
AR(2), p-value	0.73	0.96	0.97	0.98
Sargan test, p-value	0.20	0.11	0.13	0.18

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[13]In this specification we consider also Chukotka Autonomous Okrug.

Table 9. *Results for per capita income 2005-2010.*

VARIABLES	(1)	(2)	(3)	(4)
	Asymmetric influence	Net migration	Net overall migration	Without migration
Income (t-1)	0.393***	0.397***	0.396***	0.399***
	(0.084)	(0.086)	(0.086)	(0.084)
Spatial lag	0.399***	0.375**	0.384***	0.368**
	(0.152)	(0.147)	(0.147)	(0.145)
Emigration (t-1)	0.005*			
	(0.003)			
Immigration (t-1)	0.002			
	(0.006)			
Net internal migration rate (t-1)		-0.003		
		(0.003)		
Net migration rate (t-1)			-0.001	
			(0.001)	
Transfers per capita (log)	0.008	0.006	0.005	0.006
	(0.014)	(0.015)	(0.015)	(0.014)
Investments per capita (log)	0.024	0.029	0.029	0.030
	(0.028)	(0.026)	(0.026)	(0.026)
Population growth	-0.700**	-0.618*	-0.610*	-0.601
	(0.313)	(0.357)	(0.364)	(0.370)
Share of agricultural workers	-0.063	-0.079	-0.081	-0.105
	(0.114)	(0.148)	(0.149)	(0.147)
Share of mining workers	-1.552	-1.270	-1.154	-0.999
	(1.247)	(1.316)	(1.335)	(1.045)
Share of workers in education	-2.549***	-2.375***	-2.387***	-2.373***
	(0.807)	(0.810)	(0.817)	(0.753)
Share of workers in health	-1.355	-1.255	-1.288	-0.936
	(1.740)	(1.595)	(1.609)	(1.411)
Constant, time dummies	Yes	Yes	Yes	Yes
Observations	389	389	389	389
Number of regions	71	71	71	71
Number of instruments	42	41	41	40
AR(2), p-value	0.76	0.70	0.71	0.79
Sargan test, p-value	0.04	0.05	0.05	0.06

Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1

Table 10. *Results for unemployment rate 2005-2010.*

VARIABLES	(1)	(2)	(3)	(4)
	Asymmetric influence	Net migration	Net overall migration	Without migration
Unemployment (t-1)	0.139**	0.139***	0.137***	0.138***
	(0.054)	(0.051)	(0.050)	(0.051)
Spatial lag	0.851***	0.837***	0.849***	0.855***
	(0.099)	(0.098)	(0.099)	(0.101)
Emigration (t-1)	0.006			
	(0.018)			
Immigration (t-1)	-0.003			
	(0.016)			
Net internal migration rate (t-1)		-0.004		
		(0.013)		
Net migration rate (t-1)			0.002	
			(0.006)	
Population growth	-1.013	-0.974	-0.972	-0.921
	(0.856)	(0.839)	(0.827)	(0.841)
Share of young (log)	0.490	0.506	0.467	0.428
	(1.008)	(0.978)	(0.965)	(0.989)
Share of old (log)	0.489	0.493	0.410	0.412
	(0.605)	(0.600)	(0.610)	(0.634)
Number of students (log)	0.114	0.118	0.138	0.148
	(0.205)	(0.204)	(0.202)	(0.209)
Share of agricultural workers	-2.796*	-2.784*	-2.937*	-2.899*
	(1.502)	(1.532)	(1.597)	(1.628)
Share of mining workers	-1.173	-1.572	-1.633	-1.157
	(4.923)	(4.621)	(5.156)	(5.459)
Share of workers in education	11.756***	11.513***	11.391***	11.254***
	(3.928)	(3.723)	(3.707)	(3.524)
Share of workers in health	12.461***	12.300***	12.014***	11.605***
	(4.544)	(4.332)	(4.133)	(3.876)
Constant, time dummies	Yes	Yes	Yes	Yes
Observations	468	468	468	468
Number of regions	78	78	78	78
Number of instruments	43	42	42	41
AR(2), p-value	0.11	0.11	0.11	0.10
Sargan test, p-value	0.48	0.52	0.57	0.57

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1