Papers in Regional Science 103 (2024) 100062

Contents lists available at ScienceDirect

Papers in Regional Science

journal homepage: www.sciencedirect.com/journal/papers-in-regional-science

The effects of internal migration on regional convergence: Evidence from Serbia

Maria Candelaria Barrios González [a,*], Maja Jandrić [b], Dejan Molnar [b], Svetozar Tanasković [b]

[a] Departamento de Economía Aplicada y Métodos Cuantitativos, Universidad de La Laguna, Spain
[b] Faculty of Economics and Business, University of Belgrade, Belgrade, Serbia

ARTICLE INFO

JEL Classifications:
J61
O15
O47
O52

Keywords:
Regional convergence
Internal migration
Regional disparities
Panel analysis
GMM

ABSTRACT

The paper investigates the effects of internal migration flows on regional convergence in Serbia, a country with large regional disparities, during the period 2000–2018. For this purpose, we implement both the net and the gross (in- and out-) migration approaches. We undertake separate analyses for different categories of the migrant population to explore the impact of migrations involving different levels of human capital. The results show that internal migration flows between NUTS3 units in the observed period mainly fostered divergence, thus contradicting the neoclassical theory. This effect is especially pronounced when considering migrations of the active population and prime-age specialists.

1. Introduction

The Solow analysis (Solow, 1956, 1957) as well as work done by R.J. Barro (1991), Barro and Sala-i-Martin (1995), and Mankiw et al. (1992) have set a strong foundation for research on the convergence of income levels across countries. The vast amount of literature on this topic has explored issues of absolute and conditional β-convergence, and one of the important empirical findings is "the iron law of convergence"—the fact that in many cases the estimated rate of convergence is close to 2 % per year (Lehmann et al., 2020; Barro, 2015; Gennaioli et al., 2014). One significant avenue of research is connected to the convergence of regional incomes per capita within a country (Badinger et al., 2004), which has gained even more importance in the last few decades as regional convergence is one of the crucial issues for EU integration (Bunea, 2012) and also for the EU cohesion policy (Bachtler et al., 2017; Cerqua et al., 2022; Mohl, 2016).

Migration and human capital are considered important drivers of growth and convergence (Lehmann et al., 2020). According to neoclassical theory, if labor is homogeneous, migration from poor to rich regions will add to the convergence process. However, if labor is heterogeneous, the effect of migration on the convergence process is ambiguous (Østbye and Westerlund, 2007). If workers endowed with more human capital migrate to more developed regions, the loss of human capital can slow growth in the poorer region of origin, while the opposite happens in the destination region. This may result in a negative effect of migration on convergence. On the other hand, if migration leads to an increase in human capital in the less developed regions and a decrease in the richest, then internal migration flows will reinforce the convergence process (Maza, 2006). The importance of taking into account the heterogeneity of the labor force is also recognized in numerous empirical studies focused on the effect of internal migration on regional economic growth and convergence (Etzo, 2008).

As long-term regional inequalities in income can have a significant negative impact on the performance of the national economy (Armstrong and Taylor, 2000), understanding the mechanisms that lie behind increasing regional disparities is a necessary precondition for tackling this issue. The results of previous research on the impact of internal migration on the convergence process are largely inconsistent and point to the importance of specific features of internal migration flows that could affect their final impact on the regional convergence process. In relation to Serbia, several studies indicate persistent regional disparities and the absence of convergence (Barrios et al., 2021; Manić

* Corresponding author at: Facultad de Economía, Empresa y Turismo, Apartado 456, Camino de la Hornera, 37, 38200-San, Cristóbal de La Laguna, S/C de Tenerife, Spain.
E-mail address: cbarrios@ull.edu.es (M.C.B. González).

https://doi.org/10.1016/j.pirs.2024.100062
Received 29 February 2024; Received in revised form 19 August 2024; Accepted 22 October 2024
Available online 5 November 2024

et al., 2012; Molnar, 2016; Molnar and Jandrić, 2019), but the effect of internal migration on regional convergence is unexplored.

Serbia is a country with significant and persistent regional disparities. The country has a turbulent political and economic heritage and is currently in the process of EU accession. Due to harmonization with EU legislation, the current regionalization of the country is based on the EU nomenclature of territorial units for statistics (NUTS). There are two NUTS1-level (macro) regions, five NUTS2-level regions, thirty NUTS3-level subregions, and a corresponding number of cities and municipalities. Spatial differences in development at the subregional (NUTS3) level are considerable, with the clearly dominant position of the Belgrade (capital city) district. Previous research has shown that the center-periphery model of growth prevails in Serbia (Molnar and Jandrić, 2019) and that club convergence is present, with two convergence clubs and the Belgrade district, with the latter showing no signs of convergence with any of the other clubs (Barrios et al., 2021). Due to problems of inter- and intraregional disparities and their persistence, some cities and districts have had a significant negative cumulative change in the number of inhabitants during the last two decades (Molnar and Jandrić, 2019), with internal migration being an important factor in population change. These unfavorable demographic effects could reinforce regional disparities, as the loss of human capital may reduce the chances of the less developed districts catching up with the more developed ones. Possible explanations for such trends could be found in the theoretical and empirical literature that indicates the existence of escalator regions and their effect on uneven spatial growth and development. Escalator regions are mostly high-concentrated (urban) areas where mostly young people move (getting on the escalator) to take advantage of educational, professional, housing, and social networking opportunities. Escalator (elevator) effects are linked with residence predominantly in larger urban agglomerations (Fielding, 1992; Gordon et al., 2015; Champion, 2012; Stiles, 2017).

The main goal of this article is to test the effect of net and gross internal migration flows on regional convergence in terms of a neoclassical model. Using data for gross internal migration of various population groups, we attempt to capture the possible asymmetric influence of groups with different levels of human capital on regional convergence in Serbia. Inferences in this article are based on panel data analysis carried out for the period 2000–2018.

This study makes some main contributions to the empirical literature. First, to our knowledge this is the first time the impact of internal migration on regional convergence in Serbia has been examined. Second, the research takes into account the concept of labor heterogeneity; i.e., it starts from the fact that the educational and qualification structure of migrants is important for regional convergence, not only their number. Therefore, the impact of gross (in- and out-) migrations of different population groups is analyzed, with special emphasis on those who are younger and more active and who are presumed to work in better-quality jobs. Third, data on internal migration at the subregional level in Serbia have not been analyzed in this way until now, as far as we know. To be specific, the data on net migration were used in the analysis, while for the purposes of this paper we recalculated the appropriate rates of gross (in- and out-) migration. Fourth, this type of analysis is important from the point of view of public policy to act on migration flows in order to balance regional disparities. Our results provide empirical confirmation of the hypothesis that internal migration flows did not add to regional convergence in Serbia.

Our results point to the conclusion that internal migration flows between NUTS 3 units (subregions) in Serbia foster divergence and that this effect is more pronounced when we focus on internal migration flows of active populations and young professionals. Contrary to the expectation based on neoclassical theory, we conclude that internal migration does not work as an equalizing mechanism regarding regional inequalities in Serbia.

Optimism regarding regional convergence, which derives from neoclassical theory, is being questioned when the problem is considered from the perspective of endogenous growth theory. Territorial (regional) differences in the level of development persistently exist, due to the accumulation of knowledge and investment in human capital, as well as in technologically advanced knowledge-intensive industries, since the law of diminishing returns never begins to work in more developed areas (Stimson et al., 2011). In more developed regions, we should expect a concentration of activities with growing yields, which are, as a rule, knowledge-intensive and high-technology production. Diffusion of knowledge and innovative activities towards other, less developed regions is neither a simple nor an autonomous process. In less developed regions, there is not enough absorptive capacity for new activities based on I&R, which further marginalizes them over time. Their economic structure remains based on traditional productions in which the laws of diminishing or constant returns operate. Based on the assumptions presented, it follows that spontaneous convergence of income per capita between regions does not exist, and that divergence is a process that will most likely occur. Starting from these theoretical assumptions and assuming that there is no "pure" beta-convergence between regions in Serbia, during the previous period empirical research was conducted to examine the existence of other forms of convergence, such as club convergence. The results obtained in those studies indicate the existence of two (Barrios et al., 2021), or three convergence clubs in Serbia (Molnar and Jandrić, 2019). In future research on the sigma or club convergence, the effect of migration should also be considered.

The paper is organized as follows: Section 2 briefly discusses the theoretical foundations and most relevant empirical evidence related to the topic. Section 3 drafts the research strategy, with special reference to the methodology, data, and identification of internal migration in Serbia. Results and discussions are explained in Section 4. Finally, Section 5 summarizes the main conclusions.

2. Literature review

This section describes the theoretical background and the empirical evidence on which our empirical analysis is based. From a theoretical background there are two main channels through which migration is related to GDP per capita growth rate. The first channel is called the *quantity effect*. If migrants are homogeneous in their human capital content, neoclassical theory predicts that migration should act as a channel for growth convergence because migrants generally tend to move from poor to rich regions. This should lead to a rise in the per capita income in the poorer regions and a decrease in the rich regions (i.e., absolute convergence).

However, if migrants are heterogeneous and if the average human capital content of migrants is higher than the human capital content of non-migrants, the effect of migration on growth and convergence can be either positive or negative. This leads us to the second channel through which migration can affect economic development, the *composition effect*. This was first pointed out by Friedberg and Hunt (1995), who used it as the main explanation for the large number of empirical studies showing that migration does not turn out to have the effect predicted by neoclassical theory (or is not statistically significant). Therefore, when people are heterogeneous and when migrants have more human capital (on average) than non-migrants, the *composition effect* has a positive effect on the per capita GDP growth in a receiving region. Thus, the final impact of migration on the regional convergence process depends on which of the two effects dominates (quantitative vs. composition).

If migrants are observed as heterogeneous in terms of human capital, the final effect on convergence will depend on the nature of human capital redistribution. It is usually assumed that people migrate from poorer to richer regions. However, there are migration determinants other than economic factors—amenities such as climate, infrastructure, availability of public services—and in some cases people move from more developed to economically less developed regions endowed with more amenities. One example is Russia, where internal flows of migrants with, on average, higher amounts of human capital (relative to the

natives) were mainly from regions that were "richer in monetary terms but 'poorer' in terms of the general quality of life" (Lehmann et al., 2020; Oshchepkov, 2015).

Generally, if labor force flows cause a *brain-gain* effect, i.e., an increase in human capital in the less developed regions, migration will have a positive impact on convergence. However, if the work force flows evoke a *brain-drain* effect (an increase in human capital in the more developed at the expense of the less developed regions), it may dominate and cause a negative net effect on convergence. Additional research of the *brain-drain* versus *brain-gain* issue may be conducted by controlling for the variability in human capital.

Despite the large volume of theoretical and empirical literature dedicated to the estimation of the effects of internal migration on the economic convergence of regions, there is no unique answer to the question of how internal migration affects the regional convergence process. One of the earliest attempts to estimate the effect of migration on convergence was made by Barro et al. (1991). According to their findings, migration contributes very marginally to convergence across regions within the European Union and in the USA. In contrast, the meta-analysis provided by Ozgen et al. (2010) shows that internal net migration contributes marginally to divergence. Maza (2006) finds that in Spain out-migrants tend to move to regions with high per capita income and, consequently, migratory flows add to the slow process of regional convergence, while Peeters (2008) concludes that patterns of in-migration in the 1990s in Belgium provided the basis for a cumulative process of divergence of per capita incomes and a growing spatial concentration of high income locations in the amenity-rich southwestern part of the province. Østbye and Westerlund`s (2007) findings show that, although Sweden and Norway are similar in many ways, migration has had very different effects on convergence in these two countries. Migration appears to facilitate convergence in Sweden, while the opposite holds in Norway. Huber and Tondl (2012) analyze EU-27 NUTS2-level regions and also find that migration contributes to divergence rather than convergence. A similar result is obtained by Borozan (2017), who assesses the effects of internal migration on convergence and growth in terms of a neoclassical model in Croatia and shows that the effect of migration on convergence is mostly inconsistent with expectations based on neoclassical theory: net migration accelerates regional disparities in Croatia, while gross migration slows them down. On the other hand, Lehmann et al. (2020) find that interregional migration and interdependencies of the growth experience of Russian regions contribute to economic convergence among them. This result is explained by the fact that the amount of human capital of migrants is, on average, higher than that of the natives, and also by the fact that in Russia most interregional migration flows go from the richer northern and eastern regions to the relatively poorer western and southern regions, which, however, have a higher quality of life. Thanks to the human capital structure of migrants, immigration tends to accelerate economic growth in the receiving regions, and, in this way, due to specific characteristics of migration flows, internal migration contributes to economic convergence among Russian regions. In their analysis of the influence of internal migrations on convergence in Turkey, Kırdar and Saracoğlu (2008) reach the same conclusion: there is a positive impact of migration on regional convergence. The results obtained for Turkey are explained by higher internal migration flows and specific situations where a majority of internal migrants are low-skilled workers moving from rural to urban areas.

These diverse results point to the importance of understanding the specific characteristics of internal migration flows in each country in a certain period which, in the end, determine the final effect of internal migration flows on the regional convergence process.

3. Methodology and data

3.1. Basic model

In empirical convergence studies, β-convergence is usually explored by estimating the relationship between the initial level of income (GDP or GVA) per capita and its (average) annual growth (Wolszczak-Derlacz, 2009). By doing this, one can test the main hypothesis that output per capita depends on the lagged level of the dependent variable (Østbye and Westerlund, 2007):

$$\Delta \ln y_{i,t} = \alpha + \gamma \ln\left(y_{i,t-1}\right) + \eta_i + \nu_t + u_{i,t} \quad (1)$$

with $\Delta \ln y_{i,t}$ – the log difference in per capita income in time period t
$\ln\left(y_{i,t-1}\right)$ – the logarithm of per capita income in time period $t-1$
η_i – an individual effect for the region
ν_t – a time effect
$u_{i,t}$ – an error term.
Eq. (1) can be rewritten as:

$$\ln y_{it} = \alpha + (1-\gamma)\ln\left(y_{i,t-1}\right) + \eta_i + \nu_t + u_{i,t} \quad (2)$$

or, assuming that $1 - \gamma = \beta$:

$$\ln y_{it} = \alpha + \beta \ln\left(y_{i,t-1}\right) + \eta_i + \nu_t + u_{i,t} \quad (3)$$

If the coefficient β on the lagged dependent variable is significant and lower than 1, without further conditioning covariates, we can conclude that there is an absolute β-convergence.

If we extend the model to include structural factors in order to test for conditional convergence, we have:

$$\ln y_{it} = \alpha + \beta \ln\left(y_{i,t-1}\right) + \delta \ln x_{1,i,t} + \eta_i + \nu_t + u_{i,t} \quad (4)$$

with the additional variables $x_{1,i,t}$, where we have included:

a) the population growth rate and
b) the share of employment in the primary sector, including agriculture, forestry, fishing and mining and quarrying (a proxy for the economic structure of the district).

Additional variables are selected on the basis of previous empirical research focused on the impact of internal migration on regional growth and/or economic convergence, bearing in mind constraints connected to data availability in Serbia. Various studies use population growth as an additional variable (e.g., Wolszczak-Derlacz, 2009; Etzo, 2008; Huber and Tondl, 2012) as well as the sectoral composition of a region, mainly proxied by employment structure in economic sectors (Fratesi and Percoco, 2014; 2012; Huber and Tondl, 2012).

The choice of the proper explanatory variables for the conditional β-convergence is of great importance, although there is no unique theoretical and empirical common view regarding their selection. Próchniak and Witkowski (2013) present important findings in this regard, as they use 20 potential growth factors in the estimation of a convergence model in a group of post-communist countries without imposing an a priori defined set of control variables, relying on the Bayesian averaging of classical estimates (BACE) approach. According to their results, the most important determinant for economic growth seems to be human capital accumulation, followed by some demographic variables, including population growth. Investment rate showed a very small inclusion probability, which was assumed to be connected to the possibility that in transition countries investment outlays do not always flow to the most productive areas (Próchniak and Witkowski, 2013, p. 22.). Also, their results point to a positive effect of EU enlargement on economic growth. These results send important messages to policymakers in this group of countries, both for national

and regional-oriented policies. Methodologically, this points to the importance of including human capital variables in the model. However, due to data constraints, it was not possible to include variables related to human capital, and in order to overcome this deficiency and to consider the quality of human capital in regional migration and the convergence processes, we separately analyze the migration flows of different groups of migrants, which will be further explained below.

3.2. Estimating the impact of migration on convergence

To estimate the effect of migration on the β-coefficient, we add a variable $m_{i,t}$, which is a generic symbol for different measures of migration that are taken into account in the analysis (net migration rates, as well as gross measures of in- and out-migration, for different population groups).

$$\ln y_{it} = \alpha + \beta \ln\left(y_{i,t-1}\right) + \theta m_{i,t} + \delta \ln x_{1,i,t} + \eta_i + \nu_t + u_{i,t} \tag{5}$$

The impact of migration on convergence is estimated by including the migration rate in the growth regression and examining its impact on the convergence coefficient. When migration is included in the set of independent variables in the regression, its effects are controlled in the model with an estimated coefficient. But when migration is excluded from the regression, its effects are allowed to influence the convergence process through the coefficient on the lagged GDP. From Eq. (5), if there is a decrease in the coefficient on lagged GDP when migration is excluded from the model, we can conclude that migration is speeding up convergence and vice versa (Wolszczak-Derlacz, 2009).

The approximate speed of the convergence process may be deduced from the estimate of the parameter on the lagged dependent variable (y_{t-1}). The lower the absolute value of this parameter, the greater the estimated rate of convergence (Østbye and Westerlund, 2007).

If migration leads to an increase in human capital in the destination regions at the expense of the regions of origin, migration could have a negative net effect on convergence. If this is the case, allowing migration to influence the convergence process (i.e., its exclusion from the set of variables) would lead to a larger beta coefficient and a smaller rate of convergence. Hence, we can conclude that migration slows down the convergence process, or even stimulates divergence.

Neoclassical theory predicts that higher net internal migration will have a negative impact on per capita growth rate, as will gross in-migration, while gross out-migration will have a positive impact on growth. In this sense, higher net migration is expected to have a positive impact on convergence. It is recognized in the literature that including only net migration measures could lead to neglecting a possible asymmetric effect of in- and out-migration (i.e., immigration rates might have the same but not a symmetric impact on growth) as well as neglecting possible heterogeneity in the human capital of migrants (Borozan, 2017; Bunea, 2012; Etzo, 2011; Østbye and Westerlund, 2007). Due to differences in the human capital of migrants, gross migration flows may lead to considerable redistribution of human capital among regions, even when net migration, which only takes into account the difference between in- and out-migration, is close to zero (Østbye and Westerlund, 2007).

In this sense, we estimate the effect of the net migration rate (NMR), the (gross) out-migration rate (OMR) and the (gross) in-migration rate (IMR), where

$$NMR_{t,i} = \frac{I_{t,i} - E_{t,i}}{M_t} x1000 \tag{6}$$

$$OMR_{t,i} = \frac{E_{t,i}}{M_{t,i}} x1000 \tag{7}$$

$$IMR_{t,i} = \frac{I_{t,i}}{M_{t,i}} x1000 \tag{8}$$

with I representing the number of persons who moved in a specific district i in a year t, E the number of people that left district i in the year t, and M being the mid-year population in the district. After estimating the effects of the total net and gross (in- and out-) migration rates, we separately analyze the migration effects of the following groups: a) a group aged 20–44, b) the economically active population, and c) occupations with the highest skill levels according to the ISCO-08 classifications.

Including the previously described selected controlling variables, we obtain the full model:

$$\ln y_{it} = \alpha + \beta \ln\left(y_{i,t-1}\right) + \theta m^*_{i,t} + \tau popgr_{i,t} + \omega share\_prim_{i,t} + \eta_i + \nu_t + u_{i,t} \tag{9}$$

with $popgr_{i,t}$ – population growth rate,
$share\_prim_{i,t}$ – share of employment in the primary sector,
$m^*_{i,t}$ – migration measure.

3.3. Data

To estimate the effects of internal migration on regional convergence in Serbia based on Eq. (9), data on the NUTS 3 level (sub) regions from the Statistical Office of the Republic of Serbia (SORS) were used for the period 2000–2018 for 25 counties.[1]

Data on the real gross value added (GVA) per capita during the period 2000–2018 were calculated on the basis of available SORS data. Data on the NUTS 3 level of GVA at current prices in Serbian dinars (RSD) were transformed to real GVA by using national deflators for the observed period and the estimated number of inhabitants at the NUTS 3 level provided by the Statistical Office of the Republic of Serbia.

The data on internal migration for the same period were obtained from the SORS, which collects and processes the data on persons who move permanently within the borders of the Republic of Serbia and thereafter apply for registration or deregistration of the place of usual residence to the Ministry of the Interior, which is in charge of keeping track of usual residence records. The records with registration/deregistration data for the preceding month are sent by the Ministry of the Interior to the SORS. Based on the information provided in the registration/deregistration form, the migration statistics are calculated. Although some basic data on internal migration are available online on the SORS website, the data we used in this paper are not publicly available, since they were additionally processed for the purpose of this research.

Since the analysis focuses on internal migration, only the migration flows between NUTS 3 districts were included. We used net migration data, net migration data for specific population groups (aged 25–44, economically active, and professionals and managers), as well as gross in- and gross out-migration data for the entire population and for three selected subgroups of the migrant population. By introducing the data on these three subgroups, we tried to test the impact of movements of the higher-quality workforce on regional convergence in Serbia.

[1] The Republic of Serbia has two NUTS1 units: Serbia North and Serbia South. Both of them are comprised of NUTS 2 regions: Serbia North consists of two NUTS 2—the Belgrade region and the Vojvodina region, while Serbia South comprises three NUTS 2—the Šumadija and Western Serbia region, the Southern and Eastern Serbia region, and the Kosovo and Metohija region. The NUTS 2 level regions in Serbia are made up of territorial units of the lower NUTS 3 level subregions: seven in Vojvodina, nine in Šumadija and Western Serbia and eight in Southern and Eastern Serbia, plus Belgrade (capital city region). The southern province Kosovo and Metohija has five subregions at the NUTS 3 level, but, due to data constraints, it is excluded from the analysis. For more details about the legal status of Kosovo and Metohija, see the United Nations Security Council Resolution 1244 and the opinion of the International Court of Justice on the Declaration of Independence of Kosovo*.

Annual population growth rates were calculated using SORS data on the number of citizens in specific NUTS 3 counties for each year (2000–2018) from the sample.

We tried to capture and use the economic structure of the district as a control variable in the regression by calculating, for each district, the share of the labor force engaged in the primary sector (i.e., agriculture, forestry, fishing, and mining and quarrying) relative to the total number of workers in that district. For these calculations, we used annual SORS data on the sectoral structure of the number of employees for each district/county during the observed period (2000–2018).

In the observed period (2000–2018), the net migration rates were generally lower in the NUTS 3 districts with a lower gross value added per capita. Out of 25 districts, only two districts had positive net migration rates in the 2000–2018 period: the Belgrade district, as a capital, and the South Bačka District, with the important regional center Novi Sad in the northern part of the country (Fig. 1).

At the same time, these two districts had the highest values of GVA per capita in the observed period, with Belgrade consistently having the highest values and the South Bačka district being in second place in almost all observed years. Previous studies aimed at providing a methodology for determining the internal migration potential of regions within a country have shown that economic factors have a significant role in shaping internal migration flows in Serbia, although other factors, such as amenities, cannot be neglected in the analysis (Arandarenko et al., 2020).

If we analyse the internal migration of two occupation groups with the highest skill levels, managers and professionals, we can observe that the Belgrade and South Bačka districts had the highest immigration rates in the period 2000–2018 (Fig. 2).

Such features of internal migration, with strong and consistent flows toward richer regions and with workers endowed with more human capital moving in the same direction, led us to the hypothesis that internal migration flows in Serbia could slow down convergence in GVA per capita within the country (i.e., have a divergent effect).

4. Results and discussion

In our study, we chose a system generalized method of moments (system GMM) approach (Arellano and Bover, 1995; Blundell and Bond, 1998) as it represents a robust approach for the estimation of panel data in cases when there are other potential endogenous variables in the model. Many other convergence studies are based on this approach (Borozan, 2017; Huber and Tondl, 2012; Lehmann et al., 2020; Østbye and Westerlund, 2007; Wolszczak-Derlacz, 2009; Badinger et al., 2004; Niebuhr et al., 2012). For each regression, tests of first and second order autocorrelation are reported, and the Hansen J-statistic, which is more valid when the homoscedasticity assumption is relaxed. All the control variables that represent inward and outward gross migration rates for the specific groups are included in the reported models as endogenous. This was done since there is a plethora of empirical papers concluding that the level of income at the origin or destination area is one of the main factors of internal migrations (for example Piras, 2017; Kondo and Okubo, 2015; Gries et al., 2016). In order to deal with the problem of endogeneity in our model and with limitation regarding the availability of the indicators that could be used as an instrument outside of the dataset, we chose the system GMM estimator as a viable approach. Keeping in mind the problem of instrument proliferation, which is typical for system GMM estimator (Roodman, 2019) variables were instrumented by their second lags and at most 6 additional lags in both the levels and difference equation. In addition to this, using collapsed instruments throughout, led to a favourable number of instruments, which is lower than the number of groups in the panel for each of

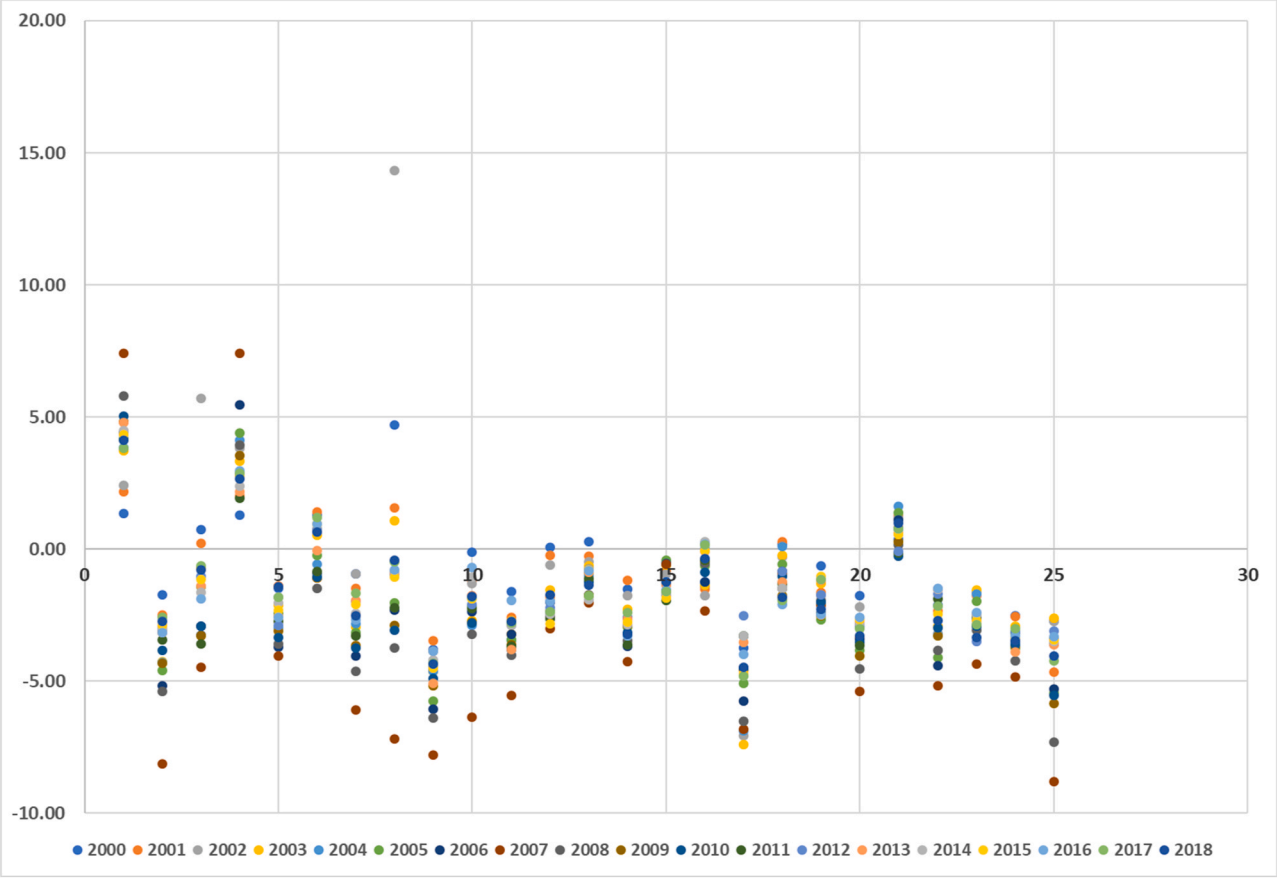

Fig. 1. Total NMRs in NUTS 3 districts, 2000–2018. Source: SORS, Authors' calculations.

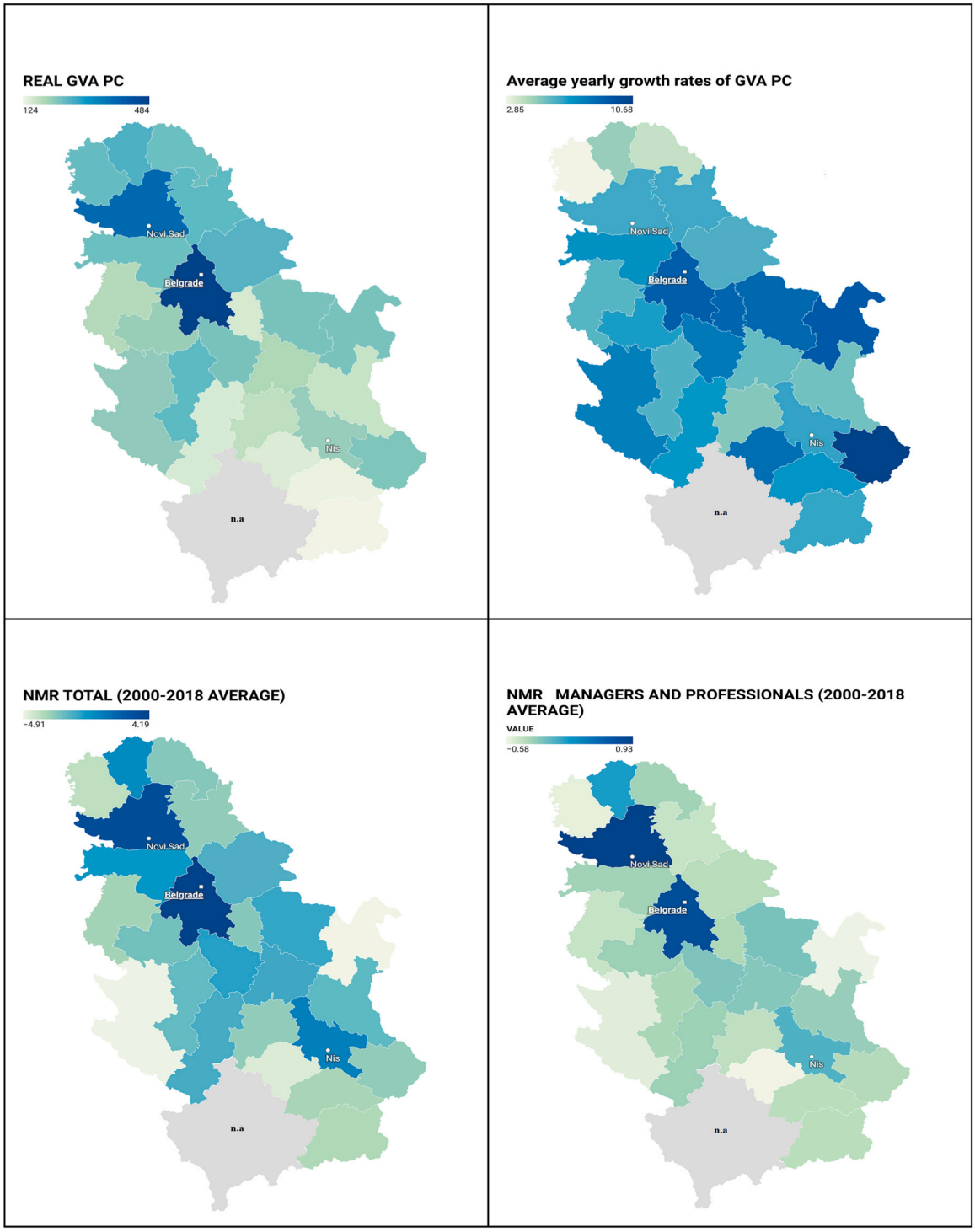

Fig. 2. Maps illustrating some of the variables. Source: SORS, Authors' calculation.

models.

The results are shown in Table 1. Column (1) provides the absolute convergence results for the model—i.e., the model includes only the lagged value of GVA as the explanatory variable. The beta coefficient (β) is close to 1, indicating that there is a very weak absolute convergence. Column (2) presents the results for conditional convergence, with the additional explanatory variables population growth and share of employed in the primary sector. The obtained β coefficient (0.885) also points to weak convergence. Although this finding is in line with neo-classical theory, it is not supported by other empirical studies for post-transition economies such as those for Romania (Bunea, 2011), Poland (Wolszczak-Derlacz, 2009), or Croatia (Borozan, 2017). The obtained value of the β coefficient from the equation for conditional convergence will serve as a benchmark for estimating the impact of migration variables on the convergence process. The effect of internal migration on the convergence process is evaluated by examining changes in the β coefficient after adding various migration variables. When we include NMRs as explanatory variables (column 3), the coefficient β increases to 0.912 and the speed of convergence falls from 0.68 % (column 2) to 0.51 % (column 3), which indicates that net migrations add to the convergence

Table 1
GMM system estimation of regional growth.

	Absolute 1	Conditional 2	Net 3	Gross 4	Gross -A 5	Gross -B 6	Gross -C 7	Gross -D 8
Yt	0.987*** (0.0118)	0.885*** (0.058)	0.912*** (0.027)	0.876*** (0.034)	0.854*** (0.042)	0.859*** (0.095)	0.770*** (0.059)	0.836*** (0.054)
NMR total			0.028*** (0.008)					
rPOP		−0.155** (0.061)	−0.113*** (0.031)	−0.175*** (0.058)	−0.252*** (0.071)	−0.177*** (0.053)	−0.106** (0.050)	−0.055** (0.026)
P. Sector		−0.030** (0.014)	−0.011* (0.006)	−0.014** (0.006)	−0.011* (0.006)	−0.043** (0.018)	−0.013** (0.005)	−0.013** (0.006)
IMR				0.036* (0.019)				
OMR				−0.060*** (0.019)				
IMR 25–44					0.140** (0.056)			
OMR 25–44					−0.150*** (0.048)			
IMR P&A						0.124 (0.159)		
OMR P&A						−0.173 (0.128)		
IMR active							0.038 (0.025)	
OMR active							−0.072*** (0.022)	
IMR interaction								0.020** (0.012)
OMR interaction								0.014 (0.012)
Implied rate of convergence, %	0.073	0.679	0.512	0.735	0.877	0.844	1.452	0.995
Half-life	959.4	108.15	141.43	100.27	85.11	88.14	53.9	75.73
Test statistics								
First-order serial correlation	−2.98 (0.003)	−2.77 (0.006)	−3.02 (0.003)	−2.70 (0.007)	−2.37 (0.018)	−2.84 (0.004)	−3.01 (0.003)	−2.97 (0.003)
Second-order serial correlation	−1.04 (0.300)	0.19 (0.853)	−0.28 (0.780)	−0.03 (0.977)	0.34 (0.736)	0.23 (0.822)	−0.81 (0.419)	−0.43 (0.664)
no. of groups/no. of instruments	25/4	25/22	25/13	25/21	25/21	25/16	25/21	25/21
Hansen J test of overidentifying restrictions:	1.15 (0.563)	23.85 (0.160)	11.99 (0.152)	19.60 (0.188)	20.37 (0.158)	13.71 (0.186)	22.47 (0.096)	23.29 (0.078)

Notes: Calculations were performed using STATA 16 software with the user-written command xtabond2. All regressions are presented with robust standard errors in brackets. **** significant at the 1 % level, ** significant at the 5 % level, * significant at the 10 % level.

process. This is in line with findings for Poland in Wolszczak-Derlacz (2009), where the implied speed of convergence in the reduced form of the equation was estimated to be 3.2 % annually and, conditional on net migration rates, fell to 2.2 % on treating migration as an exogenous variable and to zero on instrumenting migration using its lags. Borozan (2017) finds that in Croatia net migration behaves in accordance with neoclassical theory with respect to its sign, although this is statistically insignificant. Given these results, considering only net migration rates, migration can be seen as an important source of convergence.

However, different results are obtained when we introduce gross migrations (columns 4–8). Results for the model that takes into account total gross migration (column 4) show that adding in- and out-migrations as explanatory variables lowers the β coefficient to 0.876; i.e., increases the speed of convergence from 0.68 % in the model specification without migration to 0.735 % in the model with total gross migration rates. This means that gross migrations slow down the convergence process and that the composition effect dominates the quantity effect. This is in line with findings for Norway, where taking into account gross migration increases the rate of convergence from 3.9 % to 8.7 % (Østbye and Westerlund, 2007), although the estimated speeds of convergence in Serbia are lower. The findings of Bunea (2012) also show that the speed of convergence is increased after including gross migration in Romania and Hungary. In the research on Croatia, it was shown that gross in- and out-migration mitigate divergence, although they do not have enough power to revert the existing trend to convergence (Borozan, 2017).

Columns 5–7 refer to the specifications of the model considering internal migrants from the age group 25–44 (column 5), professionals and artists (column 6), and the active population (column 7). Column 8 refers to the model specification where we include interaction between the age group 25–44 and the occupation group professionals and artists.

In all specifications with different groups of internal migrants, when using gross migration rates, the results show that gross migration slows down the convergence process. The change in the speed of convergence is the largest in the model specification with the active population (from 0.68 % in the basic conditional convergence equation to 1.45 % in column 7). The second-largest change in the speed of convergence is found in the specification with the interaction between the age group 25–44 and the occupation group professionals and artists (1 % in column 8). These results indicate that migration of both the active population and prime-age professionals make a stronger contribution to slowing down the convergence process.

It also appears that in-migration and out-migration work fairly symmetrically, which is in line with findings for Sweden (Østbye and Westerlund, 2007), Romania (Bunea, 2012), and Croatia (Borozan, 2017). The only exception is the case of interaction between the age group 25–44 and the occupation group professionals and artists, where both in- and out-migration have a positive sign. However, in this case, only immigration flows have a statistically significant positive coefficient, which implies that inflows of prime-age professionals contribute significantly to the development of the destination area.

In all other model specifications, in-migration (out-migration) does not have a negative (positive) impact on output per capita, as would be expected in a neoclassical growth model with homogeneous labor. The signs of the coefficients are generally in line with the hypothesis of heterogeneous labor, in which migrants with higher human capital

move to more developed regions and there is a positive sign for immigration and a negative sign for emigration.

In addition, the coefficients for out-migration flows are larger and have a higher statistical significance than the coefficients for in-migration rates. These results suggest that emigration generally hurts regions of origin more than immigration contributes to the development of the regions of destination. This may be the result of the marginal contribution to human capital in the more developed region being lower than the marginal loss in more deprived regions of origin due to already higher levels of human capital in the more developed regions. It is only in the specification given in column 6 (professionals and artists) that none of these coefficients turns out to be significant. Another exception in this sense is observable in model specification (8), i.e., in the case of prime-age professionals, where the positive impact of immigration is stronger than the impact of emigration. In this specification, the impact of emigration is positive, but not statistically significant.

5. Conclusions

This article has briefly analyzed the effect of internal migration on regional convergence and economic growth in Serbia using the neoclassical model. Our findings in this research do not support the neoclassical hypothesis about the migration effect on the regional convergence process as it relates to Serbia during the analyzed period (2000–2018). Relying on data on net migration, it is concluded that migration works in the direction of convergence. However, by employing data on total gross migration in our model, we come to conclusions contrary to those predicted by neoclassical theory and conclude that internal migration slows down the convergence process. In the next step, we deepened our analysis by including the information that people who migrate have different abilities, education, and skills (heterogeneous human capital). To determine how the quality of migrants' human capital affects the process of regional convergence, we used data on the gross migration of certain population groups. In our model specifications, we analyzed internal migrants from the age group 25–44, professionals and artists, and the active population. We also used a model specification in which we considered the interaction between the age group 25–44 and the occupation group professionals and artists. In all specifications with different groups of internal migrants, using gross migration rates, the results show that gross migration slows down the convergence process.

These results indicate that migration of the active population and prime-age professionals made a stronger contribution to slowdown of the convergence process in Serbia in the period 2000–2018. The signs of the estimated coefficients in our regressions are in line with the hypothesis of the heterogeneous human capital of internal migrants, where migrants with higher human capital move to more developed regions (there is a positive sign for immigration and a negative sign for emigration). An important finding in our empirical analysis is that the coefficients for out-migration flows are generally larger and have higher statistical significance than the coefficients for in-migration rates (with the exception of the migrant category professional and artists, where none of the estimated coefficients are significant). These results suggest that the detrimental effect of emigration on the regions of origin is greater than the contribution of immigration to development in the destination regions. This may be the result of a smaller marginal contribution to human capital in the more developed region in comparison to the marginal loss in the more deprived regions of origin due to the higher levels of human capital existing in the more developed regions (the *brain drain* effect is stronger than *brain gain*).

The focus of regional policy in Serbia in the coming period should be to create conditions for the more productive engagement of a higher quality labor force in less developed regions, which would initially prevent the emigration of active, young, and educated professionals from less developed regions (Vidyattama, 2016; Piras, 2017; Di Berardino et al., 2019; Biedka et al., 2022). With the implementation of modern technological solutions and the opportunities offered by the Industrial Revolution 4.0, the processes of digitalization and internetization of business can serve as a good basis for reversing migration trends. Economically less developed regions have several advantages such as natural and environmental benefits and amenities and quality living and working conditions (which may be particularly interesting in a post-pandemic context and a "new normality"). The task of the state, especially in the context of European integration and the use of European development funds for regional development (EU Cohesion Policy), is to create conditions for the implementation of quality infrastructure and other (cultural, recreational, educational, health) projects that will make less developed areas more attractive for life and work. Quality living conditions could then attract young, educated, and creative professionals who, as we have seen, have a significant impact on the dynamics of regional economic disparities in Serbia.

CRediT authorship contribution statement

Svetozar Tanasković: Data curation, Formal analysis, Methodology, Resources, Software, Writing – review & editing. **Dejan Molnar:** Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Resources, Writing – review & editing. **Maja Jandrić:** Data curation, Formal analysis, Funding acquisition, Investigation, Writing – review & editing. **María Candelaria Barrios González:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Funding

This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Sample

The sample used in this study comprises 25 districts in Serbia. The Republic of Serbia has two NUTS 1 units: Serbia North and Serbia South. Both of them are comprised of NUTS 2 regions: Serbia North consists of two NUTS 2—the Belgrade region and the Vojvodina region—while Serbia South comprises three NUTS 2—the Šumadija and Western Serbia region, the Southern and Eastern Serbia region and the Kosovo and Metohija region. The NUTS 2-level regions in Serbia are made up of territorial units of the lower NUTS3 level subregions: seven in Vojvodina, nine in Šumadija and Western Serbia and eight in Southern and Eastern Serbia, plus Belgrade (capital city region). The southern province Kosovo and Metohija has five subregions at the NUTS 3 level, but, due to data constraints, it is excluded from the analysis. For more details about the legal status of Kosovo and Metohija, see the United Nations Security Resolution 1244 and the opinion of the International Court of Justice on the Declaration of Independence of Kosovo*.

NUTS 1	NUTS 2	NUTS 3
Serbia North	Belgrade region	Beogradska oblast
	Vojvodina region	Severnobačka oblast, Srednjobanatska oblast, Severnobanatska oblast, Južnobanatska oblast, Zapadnobačka oblast, Južnobačka oblast, Sremska oblast
Serbia South	Šumadija and Western Serbia region	Zlatiborska oblast, Kolubarska oblast, Mačvanska oblast, Moravička oblast, Pomoravska oblast, Rasinska oblast, Raška oblast, Šumadijska oblast
	Southern and Eastern Serbia region	Borska oblast, Braničevska oblast, Zaječarska oblast, Jablanička oblast, Nišavska oblast, Pirotska oblast, Podunavska oblast, Pčinjska oblast, Toplička oblast
	Kosovo and Metohija region (not included in the analysis)	

Appendix B. Descriptive statistics for dependent and explanatory variables

Variable	Obs	Mean	Std. dev.	Min	Max
logY	425	12,21	0,48	11,12	13,54
NMR total	425	−1,89	2,59	−8,80	14,33
rPOP	425	−0,76	0,88	−10,73	3,41
P. Sector	425	5,98	4,53	0,69	38,43
IMR	425	5,42	1,97	1,71	21,21
OMR	425	7,31	1,89	3,39	17,30
INR 25–44	425	2,29	0,89	0,65	6,49
OMR 25–44	425	3,34	0,82	1,49	7,43
IMR P&A	425	0,72	0,42	0,09	2,56
OMR P&A	425	0,95	0,37	0,36	2,19
IMR active	425	2,38	1,01	0,61	7,33
OMR active	425	3,44	1,46	1,22	10,60

Appendix C. List of variables. Variable definitions and their sources

Variable	Definition	Data Source
Gross value added (GVA) per capita	Real GVA per capita - NUTS 3 level of GVA at current prices in Serbian dinars were transformed to real GVA by using national deflators for the observed period and the estimated number of inhabitants at the NUTS 3 level	Statistical Office of the Republic of Serbia (SORS)
Annual population growth rates	Annual percentage change of population on NUTS 3 level	SORS
Share of the labour force engaged in the primary sector	Share of registered employment in the primary sector (agriculture, forestry, fishing, mining and quarrying) in the total registered employment.	SORS
Net migration rate (NMR)	$\frac{I_{t,i} - E_{t,i}}{M_t} x1000^*$	Authors' calculation based on SORS data
(Gross) in-migration rate (IMR)	$\frac{I_{t,i}}{M_{t,i}} x1000^*$	Authors' calculation based on SORS data
(Gross) out-migration rate (OMR)	$\frac{E_{t,i}}{M_{t,i}} x1000^*$	Authors' calculation based on SORS data

* I – number of persons who moved in a specific district *i* in a year *t*, E – the number of people that left district *i* in the year *t*, M being the mid-year population in the district.

References

Arandarenko, M., Corrente, S., Jandrić, M., Stamenković, M., 2020. Multiple criteria decision aiding as a prediction tool for migration potential of regions. Eur. J. Oper. Res. 284 (3), 1154–1166. https://doi.org/10.1016/j.ejor.2020.01.046.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. J. Econ. 68 (1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D.

Armstrong, H., Taylor, J., 2000. Regional Economics and Policy. Blackwell Publishing, Hoboken, New Jersey.

Bachtler, J., Berkowitz, P., Hardy, S., Muravska, T., 2017. Regional Studies Association. EU Cohesion Policy. Routledge.

Badinger, H., Müller, W., Tondl, G., 2004. Regional convergence in the European Union, 1985-1999: a spatial dynamic panel analysis. Reg. Stud. 38 (3), 241–253. https://doi.org/10.1080/0034340042000211105.

Barrios, M.C., Jandrić, M., Molnar, D., Tanasković, S., 2021. Convergence clubs in different regions of Serbia. Appl. Econ. Lett. 28 (7), 594–598. https://doi.org/10.1080/13504851.2020.1765960.

Barro, R.J., 1991. Economic growth in a cross-section of countries. Q. J. Econ. 106 (2), 407–443. https://doi.org/10.2307/2937943.

Barro, R.J., 2015. Convergence and modernisation. Econ. J. 125 (585), 911–942. https://doi.org/10.1111/ecoj.12247.

Barro, R.J., Sala-i-Martin, X., 1995. Economic Growth. McGraw-Hill, Singapore.

Barro, R.J., Sala-i-Martin, X., Blanchard, O.J., Hall, R.E., 1991. Convergence across states and regions. Brook. Pap. Econ. Act. 107–182. https://doi.org/10.2307/2534639.

Biedka, W., Herbst, M., Rok, J., Wojcik, P., 2022. The local-level impact of human capital investment within the EU cohesion policy in Poland. Pap. Reg. Sci. 101 (2), 303–326.

Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. J. Econ. 87 (1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8.

Borozan, D., 2017. Internal migration, regional economic convergence, and growth in Croatia. Int. Reg. Sci. Rev. 40 (2), 141–163. https://doi.org/10.1177/0160017615572889.

Bunea, D., 2011. Cross-county internal migration and convergence in Romania. Ann. Univ. Apulensis Ser. Oeconomica 13 (2), 508–521.

Bunea, D., 2012. Is internal migration relevant to regional convergence? Comparative analysis across five European countries. Rom. J. Reg. Sci. 6 (2), 53–72.

Cerqua, A., Pellegrini, G., Tarola, O., 2022. Can regional policies shape migration flows? Pap. Reg. Sci. 101 (3), 515–537.

Champion, Tony, 2012. Testing the return migration element of the 'escalator region' model: an analysis of migration into and out of south-east England, 1966–2001. Camb. J. Reg., Econ. Soc. 5 (2), 255–270. https://doi.org/10.1093/cjres/rsr045.

Di Berardino, C., D'Ingiullo, D., Quaglione, D., Sarra, A., 2019. Migration and institutional quality across Italian provinces: The role of human capital. Pap. Reg. Sci. 98 (2), 843–860.

Etzo, I., 2008. Internal migration: A review of the literature. MPRA Paper 8783.

Etzo, I., 2011. The determinants of the recent interregional migration flows in Italy: a panel data analysis. J. Reg. Sci. 51 (5), 948–966. https://doi.org/10.1111/j.1467-9787.2011.00730.x.
Fielding, A.J., 1992. Migration and social mobility: South East England as an escalator region. Reg. Stud. 26 (1), 1–15. https://doi.org/10.1080/00343409212331346741.
Fratesi, U., Percoco, M., 2014. Selective migration, regional growth and convergence: evidence from Italy. Reg. Stud. 48 (10), 1650–1668. https://doi.org/10.1080/00343404.2013.843162.
Friedberg, R., Hunt, J., 1995. The impact of immigrants on host country wages, employment and growth. J. Econ. Perspect. 9 (2), 23–44.
Gennaioli, N., La Porta, R., Lopez De Silanes, F., Shleifer, A., 2014. Growth in regions. J. Econ. Growth 19, 259–309.
Gordon, I., Champion, T., Coombes, M., 2015. Urban escalators and interregional elevators: the difference that location, mobility, and sectoral specialisation make to occupational progression. Environ. Plan. A: Econ. Space 47 (3), 588–606. https://doi.org/10.1068/a130125p.
Gries, T., Kraft, M., Simon, M., 2016. Explaining inter-provincial migration in China. Pap. Reg. Sci. 95 (4), 709–732.
Huber, P., Tondl, G., 2012. Migration and regional convergence in the European Union. Empirica 39 (4), 439–460. https://doi.org/10.1007/s10663-012-9199-2.
Kırdar, M.G., Saracoğlu, D.S., 2008. Migration and regional convergence: an empirical investigation for Turkey. Pap. Reg. Sci. 87 (4), 545–566. https://doi.org/10.1111/j.1435-5957.2008.00178.x.
Kondo, K., Okubo, T., 2015. Interregional labour migration and real wage disparities: evidence from Japan. Pap. Reg. Sci. 94 (1), 67–88.
Lehmann, H., Oshchepkov, A.Y., Silvagni, M., 2020. Regional convergence in Russia: Estimating a neoclassical growth model. Higher School of Economics Research Paper No. WP BRP, 232. https://doi.org/10.2139/ssrn.3627173.
Manić, E., Popović, S., Molnar, D., 2012. Regional disparities and regional development: the case of Serbia. Mitt. Der Österreichischen Geogr. Ges. 154, 191–211. https://doi.org/10.1553/moegg154s191.
Mankiw, N.G., Romer, D., Weil, D.N., 1992. A contribution to the empirics of economic growth. Q. J. Econ. 107 (2), 407–437. https://doi.org/10.2307/2118477.
Maza, A., 2006. Migrations and regional convergence: the case of Spain. Jahrb. Reg. 26 (2), 191–202. https://doi.org/10.1007/s10037-006-0009-9.
Mohl, P., 2016. Empirical Evidence on the Macroeconomic Effects of EU Cohesion Policy. Springer Gabler. https://doi.org/10.1007/978-3-658-13852-3.
Molnar, D., 2016. Regionalne nejednakosti i privredni rast: teorijsko-empirijska analiza. CID Ekonomski fakultet u Beogradu i Banat-info, Beograd.
Molnar, D., Jandrić, M., 2019. Unutarregionalne nejednakosti u Srbiji–testiranje klupske konvergencije. Zbornik Matice srpske za društvene nauke/Matica Srpska Soc. Sci. Q. 70 (169), 1. https://doi.org/10.2298/ZMSDN1969091M.
Niebuhr, A., Granato, N., Haas, A., Hamann, S., 2012. Does labour mobility reduce disparities between regional labour markets in Germany? Reg. Stud. 46 (7), 841–858. https://doi.org/10.1080/00343404.2010.532118.
Oshchepkov, A., 2015. Compensating wage differentials across Russian regions. Geographical Labor Market Imbalances: Recent Explanations and Cures 65–105. https://doi.org/10.1007/978-3-642-55203-8_4.
Østbye, S., Westerlund, O., 2007. Is migration important for regional convergence? Comparative evidence for Norwegian and Swedish counties, 1980–2000. Reg. Stud. 41 (7), 901–915. https://doi.org/10.1080/00343400601142761.
Ozgen, C., Nijkamp, P., Poot, J., 2010. The effect of migration on income growth and convergence: meta-analytic evidence. Pap. Reg. Sci. 89 (3), 537–561. https://doi.org/10.1111/j.1435-5957.2010.00313.x.
Peeters, L., 2008. Selective in-migration and income convergence and divergence across Belgian municipalities. Reg. Stud. 42 (7), 905–921. https://doi.org/10.1080/00343400701541839.
Piras, R., 2017. A long-run analysis of push and pull factors of internal migration in Italy. Estimation of a gravity model with human capital using homogeneous and heterogeneous approaches. Pap. Reg. Sci. 96 (3), 571–603.
Próchniak, M., Witkowski, B., 2013. Real β-convergence of transition countries: Robust approach. East. Eur. Econ. 51 (3), 6–26.
Roodman, D., 2009. A note on the theme of too many instruments. Oxf. Bull. Econ. Stat. 71 (1), 135–158.
Solow, R.M., 1956. A contribution to the theory of economic growth. Q. J. Econ. 70 (1), 65–94. https://doi.org/10.2307/1884513.
Solow, R.M., 1957. Technical change and the aggregate production function. Rev. Econ. Stat. 39 (3), 312–320. https://doi.org/10.2307/1926047.
Stiles, A. (2017), Escalator Regions in the 21st Century: Examining the relationship between social mobility and internal migration within England and Wales during recent decades, Working Papers, No. 2017/4. UCL Migration Research Unit [ONS LS].
Stimson, R.R.R., Stough, P., Nijkamp, 2011. Endogenous Regional Development: Perspectives, Measurement and Empirical Investigation. Edward Elgar, Cheltenham, UK.
Vidyattama, Y., 2016. Inter-provincial migration and 1975–2005 regional growth in Indonesia. Pap. Reg. Sci. 95, S87–S105.
Wolszczak-Derlacz, J., 2009. Does migration lead to economic convergence in an enlarged European market? Bank i Kredyt 40 (4), 73–90.