CUMULATIVE CAUSATION AND RAPID DIVERGENCE: AN EFFICIENCY ASSESSMENT OF INTERNAL MIGRATION IN SLOVAKIA (2001–2024)

Marcela Káčerová[1], Slavomír Ondoš[2], Kristián Slota[3]

---

[1] *Comenius University in Bratislava, Faculty of Natural Sciences, Department of Economic and Social Geography, Demography and Territorial Development, e-mail: marcela.kacerova@uniba.sk, https://orcid.org/0000-0003-2423-8251*

[2] *Creative Industry Košice, Kukučínova 2, 040 01 Košice, e-mail: slavomir.ondos@cike.sk, https://orcid.org/ 0000-0002-0847-1208*

[3] *Comenius University in Bratislava, Faculty of Natural Sciences, Department of Economic and Social Geography, Demography and Territorial Development, e-mail: slota@gmail.com*

Abstract: This study investigates the spatio-temporal dynamics and structural causes of internal migration polarization in Slovakia (2001–2024), testing the cumulative causation hypothesis. Using district-level data and three indices – including spatial efficiency metrics – we map persistent clustering. Results confirm an entrenched core-periphery system. A highly efficient cluster of sustained gains is confined to the Bratislava metropolitan region, while chronic structural losses dominate Eastern and Northern Slovakia, confirming the entrenched backwash effect. Crucially, clustering intensity in efficiency metrics accelerated sharply post-2008, validating accelerated divergence and rejecting the neoclassical equilibrium model. The spatial structure of migration efficiency, not raw volume, is the definitive factor driving human capital erosion and demographic aging in the periphery.

Keywords: backwash effects, core-periphery, cumulative causation, demographic polarization, migration efficiency, Slovakia, spatial clustering

1 INTRODUCTION

Internal migration drives regional economic restructuring and indicates change. Central and Eastern European (CEE) nations, like Slovakia, exhibit unique dynamics. Post-1989 reforms and EU integration fundamentally reshaped population mobility (Rowe and Patias, 2020). Unlike Western trends, CEE consistently shows population concentration (Rowe and Patias, 2020), which, combined with selective international emigration, creates demographic and socio-political challenges (Lim, 2022). Economic transformation has polarized activity, clustering investment, high-

skills, and infrastructure. Migration both reflects and deepens this emerging core-periphery structure (Storper, 2018), accelerating regional divergence (e.g., Croatia's accelerating divergence, Borozan, 2017; Slovakia's intensifying east-west movement, Novotný et al., 2023). Global patterns confirm this polarization. Determinants include path dependence, wages, economic scale, and education. Migration is also a vital labor market adjustment mechanism, generally being procyclical and strongly affected by labor conditions (Saks and Wozniak, 2007). It can mitigate up to a third of negative wage effects from economic shocks. Ultimately, movement intensity strongly correlates with national development indicators globally (Bell et al., 2015).

Post-socialist dynamics and urban change

The post-socialist transition triggered rapid and unexpected demographic processes (Bleha, 2019), fundamentally altering urban development and regional policy in Slovakia (Buček, 1999, 2016). This transition led to the emergence of a migration hierarchy characterized by spatial polarization. While some regions rely on innovation and external factors (Plešivčák and Buček, 2017), others experience mild urban shrinkage, a process often locally overlooked (Buček and Bleha, 2013). Addressing depopulation, particularly in former mining cities, necessitates improved intergovernmental support (Bleha and Buček, 2023). Regional differentiation fuels varied migration patterns, with major metropolitan areas showing spatially segregated suburbanization (Sýkora and Čermák, 1998; Kok and Kovács, 1999; Čermák et al., 2009; Krišjāne and Bērziņš, 2012). The age structure of migrants is a key indicator of different regional development stages.

Slovakia is marked by significant intra-EU regional economic disparity, exemplified by Bratislava's GDP per capita substantially exceeding the national average. Consequently, understanding internal migration is crucial for assessing regional cohesion (Michálek et al., 2018). Divergence remains the dominant Slovak regional trend (Matlovič et al., 2008; Michálek et al., 2018), which disintegrates spatial equity and increases urban-rural inequality (Ondoš et al., 2024). Spatial analysis reveals a contrast between internal decentralization and polarization toward key centers (Pregi and Novotný, 2025).

Movement is primarily driven by economic factors such as wage differences and job availability (Levický et al., 2024; Lichner et al., 2024; Jikia, 2025). However, not all movement aligns with human capital theory; certain demographic groups cite non-economic motives like housing, family, and health, particularly in Roma-populated municipalities (Baláž et al., 2023; Slavíková and Šprocha, 2023). These migration trends significantly impact regional labor markets (Janotka et al., 2014; Ondoš and Káčerová, 2015), highlighting the need for a comprehensive framework to analyze both traditional and emerging patterns (Michálek and Podolák, 2011).

Previous studies have established a generalized West-East migration dichotomy in Slovakia, where the West consistently gains population and the East consistently loses. The key analytical challenge, however, lies in systematically quantifying flow efficiency and mapping the persistence of multi-decadal clustering. This study add-

resses this gap (Długosz, 2022; Pregi and Novotný, 2025) by employing a longitudinal, spatially-explicit perspective. This approach allows for the explicit testing of core-periphery divergence and cumulative causation models over time. This study poses three core research questions: (1) How have internal migration intensity and national clustering evolved, specifically in relation to major contemporary economic cycles? (2) Which districts exhibited persistent attraction or repulsion across efficiency indices over the two decades? (3) How do these persistent spatial patterns validate regional growth models? Specifically, does the core-periphery structure driven by cumulative causation hold true in this post-socialist environment? Based on these questions and existing evidence, three research hypotheses are posited.

(H1) Core concentration

The Bratislava metropolitan region and its immediate suburban districts are expected to demonstrate persistently high-level clustering across all spatial efficiency indices. This confirms their established role as concentrated hubs for economic growth and intense suburban expansion.

Bratislava has been the primary driver of post-socialist transformation and rapid economic growth (Korec and Ondoš, 2009, 2021). This growth concentrates high-value firms, including banking, business services, and trade (Smith, 1999). Migration patterns reflect this intense core concentration coupled with subsequent decentralization (Novotný, 2016). Vigorous suburbanization in the hinterland, which attracts younger immigrants, exhibits positive migration efficiency (Farkas and Klobučník, 2021). Zone formation in these areas is determined by factors such as economic activity, education, and family status, rather than merely geographical distance (Šveda et al., 2016). Furthermore, large-scale infrastructure projects (e.g., motorways) enhance accessibility, strengthening urbanism (Šveda and Barlík, 2018; Šveda and Pazúr, 2018; Ďurček et al., 2020, Rusnak et al., 2023). This uneven development and reliance on capital underpin the concentration along the key Bratislava-Žilina corridor (Jacobs, 2017).

(H2) Peripheral decline

Eastern and specific peripheral Southern and Central Slovak districts are hypothesized to exhibit persistent low-level clustering. This pattern reflects chronic structural economic deficits, leading to selective out-migration and subsequent demographic polarization.

While migration concentrates the population in metropolitan regions, peripheral regions, particularly in the East, experience corresponding depletion (Novotný et al., 2023). This decline stems from chronic, post-socialist structural economic deficits. Specifically, periphery districts face significant economic disadvantage, weakening their ability to retain residents (Horbulák et al., 2023). Historically, state socialist integration created branch plant economies, which struggled significantly after 1989 (Smith, 2000). This combination of old and new economic structures fuels regional fragmentation and divergence (Smith, 1998). Consequently, these districts show a persistent negative migration balance (Jikia, 2025), reflecting ongoing challenges in economic diversification and the need for more targeted public support.

(H3) Accelerated polarization

Migration dynamics are expected to show an intensification of spatial clustering following the recovery period after the global financial crisis. Specifically, efficiency metrics will exhibit a higher and more rapid concentration than the raw migration balance. This indicates an increasingly concentrated efficiency of attraction in the core regions.

The period after the 2008 global financial crisis marked a pivotal economic and spatial shift. While some EU regional clusters maintained stability, the post-crisis environment entrenched neoliberal urbanism and austerity policies, which disproportionately shifted economic risks and favored spatial concentration. Core urban areas reorganized, experiencing increased demographic heterogeneity and a population shift from the cores to the rings, which intensified suburbanization and created nested urban business hierarchies. Regional resilience is demonstrably influenced by stronger institutions and higher investment (Annoni et al., 2019), both of which are concentrated in Slovak core regions. This localized economic vitality disproportionately increases migration attraction efficiency. Therefore, the structural forces of cumulative causation are amplified post-crisis, making the core more efficient at converting economic opportunity into concentrated demographic gain – a trend best captured by efficiency indices rather than gross numbers (Janoschka, 2020).

2 THEORETICAL FRAMEWORK

Neoclassical models, efficiency metrics, and structural divergence

The neoclassical model traditionally posits internal migration as an equilibrating force, where labor moves from low-wage to high-wage regions, ultimately reducing interregional inequality. While this view has limited empirical support (e.g., China, where reduced migration costs aided labor reallocation and benefited certain regions and groups, Alvarez et al., 2021), the mechanism is highly context-dependent. Many observed patterns directly contradict neoclassical predictions. For instance, migration flows in regions like Serbia drive divergence, not convergence (González et al., 2024), and internal emigration in Turkey often increases inequality in sending areas (Bayraktar and Özyılmaz, 2017). These contradictions highlight how rigidities in housing and labor markets prevent migration from being a purely equilibrating mechanism. A more nuanced theory suggests that equilibrium models are better suited for short-distance movement, while disequilibrium models better capture long-distance patterns (Biagi et al., 2011), with higher education significantly reducing this friction of distance (Schwartz, 1973).

To accurately capture the impact of these structural forces, analysis must move beyond simple net flows and employ spatial efficiency metrics (Newbold and Peterson, 2001). These metrics are essential, given the substantial economic consequences of high-skilled migration for regional growth and innovation (Faggian and McCann, 2008; Faggian et al., 2017). The broader context for these dynamics is

informed by the theory of demographic revolution and modern spatial demography (Raymer et al., 2018).

Migration efficiency serves as a core measure of regional demographic and economic resilience (Schwartz, 1971). High efficiency signals a crucial capacity to convert total mobility into a net demographic gain, which is vital for human capital accumulation and resilience across the urban–rural hierarchy (Crown et al., 2018; Giannakis and Bruggeman, 2020; Feng et al., 2022; Rokita-Poskart et al., 2025). Conversely, high negative efficiency indicates a structural inability to retain population, leading to chronic decline.

This focus on efficiency is necessary because migration frequently drives divergence rather than convergence (Incaltarau et al., 2021), characterizing migrants as differential contributors to regional development and sustainability. The attraction efficiency metric further refines the analysis by using distance-weighting to isolate a region's genuine "magnet effect" (Newbold and Peterson, 2001). For example, a high attraction efficiency in the Bratislava core confirms its ability to overcome the friction of distance and concentrate long-distance flows, reflecting its superior economic status and robust social networks. Thus, calculating and mapping these efficiency metrics offers a refined, nuanced understanding of how migration reinforces or undermines regional development.

The dominance of cumulative causation and the backwash effect

The enduring regional dichotomy in Slovakia is best explained by Gunnar Myrdal's theory of cumulative causation, a structuralist model where an initial economic advantage triggers self-reinforcing mechanisms that intensify disparities, leading to non-equilibrium growth. This advantage is sustained by increasing returns, urban clustering, and knowledge spillovers (McCombie and Thirlwall, 1994). Structural shifts in high-tech industries are now often treated as an endogenous process within this framework (Araujo, 2013; Magacho and McCombie, 2020). While recent growth models emphasize spatial factors, micro-level firm heterogeneity, and entrepreneurship, and some critique the theory as overly pessimistic, regional convergence in Central and Eastern Europe remains weak (Monastiriotis, 2014).

In the Slovak context, cumulative causation operates primarily through the backwash effect, which systematically drains the periphery, mirroring patterns observed in Poland (Szczech-Pietkiewicz, 2017). This backwash encompasses multiple channels, including the outflow of human capital, government income, and capital (Gaile, 2010). Critically, it leads to the chronic outflow of young, educated residents (Partridge et al., 2007), which weakens the local tax base, reduces entrepreneurship, and accelerates demographic aging (Kollai, 2021).

The counter-mechanism, the spread effect – where core growth diffuses outwards – has been structurally insufficient to overcome pervasive backwash in Slovakia. Although policies focused on growth poles and integrated systems can generate some spread (Petrakos et al., 2016; Santos-Paulino et al., 2019; Lim et al., 2025), backwash often dominates (Barkley et al., 1996; Henry et al., 1997). This particularly affects distant rural communities (Lehtonen et al., 2015), leading to growth in-

versely related to smaller cities (Chen and Partridge, 2013) where the critical industrial mass has not been widely achieved (Puga and Venables, 1996). Spread effects are typically limited to immediately adjacent rural areas (Henry et al., 2001; Ke and Feser, 2010).

Furthermore, the observed migratory streams are highly selective, disproportionately attracting the younger, working-age, and more educated populace to urban centers (Lange, 2015). This results in a qualitative erosion of the peripheral labor force, accelerated demographic aging (Maier and Franke, 2025), and reduced regional innovation capacity (Gregory and Patuelli, 2015). This deepening demographic polarization represents a significant structural risk (Storper, 2018), mirroring trends in regions like Eastern Germany (Herfert, 2007) and the Baltics (Lang et al., 2021). The dynamic is further complicated by uneven international migration flows (Williams, 2009), making the interpretation of these spatial patterns critical for evidence-based policy formulation, even when political factors may occasionally overshadow demographic variables (Sundqvist, 2021).

Structuralist models, EU integration, and Slovak divergence

Post-socialist liberalization largely validates structuralist models over the neoclassical view, confirming that internal migration drives regional divergence by accelerating existing imbalances (Petrakos, 2001). This pattern is evident in Central and Eastern Europe and manifests in Slovakia as intensifying East-West movement and migration up the urban hierarchy (Novotný et al., 2023), rooted in historical subregions and amplified by global production integration (Stan and Erne, 2014). The critical outcome for sending regions is the deterioration of population and human capital (Novotný, 2019), a process identifiable through spatial autocorrelation methods (Pregi and Novotný, 2025). While high-skilled migration can theoretically stimulate local growth (Kubis and Schneider, 2016), the overall effect in many post-socialist economies remains a modest net human capital loss (Kubis and Schneider, 2016).

The most significant structural shocks – post-1989 and subsequent EU integration – cemented these spatial disparities. These events concentrated foreign direct investment and high-value services primarily in Western Slovakia, establishing a persistent migration magnet that contributed to Slovakia's high regional disparity (Petrakos, 2001; Kriss et al., 2019). While national GDP growth accelerated post-accession, this external shock simultaneously exacerbated intraregional disparities and the West-East gradient (Matlovič et al., 2018; Camagni et al., 2020). This widening gap negatively impacts overall economic growth, especially in new member states (Pietak, 2024), suggesting that EU cohesion funding has limited success in effectively addressing structural imbalances (Madanipour et al., 2021; Egri and Lengyel, 2024). The shock of external integration hastened the disintegration of spatial equity, leading to pronounced divergence as knowledge-based activities consolidated in the core (Ondoš et al., 2024), establishing internal migration as both a direct consequence and a self-reinforcing driver of regional polarization (Jordan, 2006).

Internal migration in Slovakia is shaped by these converging theoretical forces. The transition to a market economy initiated a new phase of migration characterized by urbanization and suburbanization around economic centers (Bezák, 2000). Research confirms these flows are primarily driven by classical socioeconomic factors such as job opportunities and income disparities (Divinský, 2009; Jurčová, 2010). This movement reflects a spatial transformation where suburbanization drives the expansion of functional urban areas in Bratislava and Košice (Šveda and Šuška, 2019), often appealing due to housing and transport options (Kakaš et al., 2017; Brandén and Haandrikman, 2019). Crucially, this is a selective process (Šprocha, 2011), resulting in a brain drain from the periphery as skilled labor concentrates in the core (Čermák, 2005; Šprocha et al., 2017). The resulting spatial polarization has intensified over the past two decades (Bezák, 2006). Ultimately, substantial migration disparities are not solely explained by suburbanization; persistent deficiencies in infrastructure, educational opportunities, and public services in the East play a key role (Ďurček et al., 2024), while post-industrial areas continue to grapple with urban shrinkage (Buček et al., 2022).

3   MATERIAL AND METHODS

The analysis utilizes internal migration flow data, specifically annual changes in permanent residence, sourced from the Statistical Office of the Slovak Republic. The study's geographical unit comprises all 79 administrative districts in Slovakia, covering the period from 2001 to 2024. To capture long-term structural trends and minimize statistical noise, the data is processed using a symmetric 5-year moving window approach, which generates twenty overlapping windows (e.g., 2003–2007 through 2020–2024). For each window, annual immigration (I) and emigration (E) flows are summed, and the population base (P) is taken as the mid-year value of the central year. This longitudinal technique provides a smoothed, detailed view of how spatial polarization has structurally evolved over two decades. The methodology for assessing migration dynamics relies on three core indices:

$$GMBR = (I - E) / P \times 1{,}000$$
$$MEI = (I - E) / (I + E) \times 100$$
$$IAE = \Sigma\, d \,.\, (I - E) / \Sigma\, d \,.\, (I + E) \times 100$$

The Gross Migration Balance Rate (GMBR) measures the simple net population change relative to the population base. The Migration Efficiency Index (MEI) assesses the effectiveness of migration by measuring net migration against the total volume of movement, ranging from total outflow to total inflow, thus providing insight into the flow's productivity. The third is the Index of Attraction Efficiency (IAE), a refined spatial indicator that incorporates distance friction to capture a region's true capacity for centripetal attraction relative to centrifugal dispersal within the national system.

Longitudinal data summarizing migration trends across four central subperiods in Table 1 confirms accelerating divergence. Specifically, the mean values for the efficiency indices (MEI and IAE) become progressively more negative, indicating a growing national net loss of residents over time. Simultaneously, the IAE's standard deviation consistently increases, suggesting a growing spatial disparity in the long-distance attraction capacity among regions.

Table 1 Evolution of Migration Indices (2003–2022). Metrics are computed using a 5-year symmetric moving window, summarized in four subperiods

		Min	Max	Mean	SD
2003-2007	GMBR	-63.6	131.5	-2.8	19.9
	MEI	-31.3	54.8	-3.8	14.9
	IAE	-52.6	64.4	-7.3	23.3
2008-2012	GMBR	-60.1	153.9	-3.2	23.3
	MEI	-36.5	58.8	-6.2	15.8
	IAE	-55.0	69.9	-11.1	26.8
2013-2017	GMBR	-61.3	158.7	-4.3	24.8
	MEI	-48.7	54.8	-9.0	17.1
	IAE	-66.8	68.9	-14.9	30.2
2018-2022	GMBR	-44.8	153.5	-5.0	22.9
	MEI	-50.9	52.4	-9.6	17.5
	IAE	-68.4	68.3	-15.8	30.4

Source: Statistical Office of the Slovak Republic (2025)

Table 2 shows the distance profile, confirming the increasing relevance of long-distance flows. While short-distance migration (0–49 km) slightly declines (from 64.8% to 62.4%), long-distance migration (200+ km) consistently increases, rising from 6.7% to 9.1%. This trend reinforces the observed IAE disparity and underscores the growing influence of the national core.

Table 2 Distance Profile of Internal Migration Proportion (%). The proportion of internal migrations is shown across specified distance bands in four subperiods of the observed time series

Distance (km)	2003–2007	2008–2012	2013–2017	2018–2022
0–49	64.8	63.3	62.5	62.4
50–99	16.3	15.9	15.5	15.4
100–199	12.2	13.0	13.2	13.1
200+	6.7	7.9	8.8	9.1

Source: Statistical Office of the Slovak Republic (2025)

Spatial autocorrelation and persistence mapping

Global Moran's I is applied annually to GMBR, MEI, and IAE across all moving windows. This quantifies the overall degree of positive spatial autocorrelation, confirming the existence of a highly structured core-periphery system where high gains cluster with high gains, and high losses cluster with high losses. Local Indicators of Spatial Association (LISA) then identify the specific geographic location and cluster typology: areas of high gain with high-gain neighbors (High-High), areas of chronic loss with loss-suffering neighbors (Low-Low), local centers with high gains surrounded by low-loss neighbors (High-Low), and siphoning areas with local losses adjacent to high-gain centers (Low-High). The final step involves creating a synthetic categorical map to visualize persistence. A district is classified under a specific typology if it was assigned to that statistically significant cluster type ($p < 0.05$) at least once across all twenty 5-year moving windows, for any of the three indices. This strict criterion highlights only the most stable, structurally relevant migration regimes over the two decades, serving as the empirical test for the core concentration and peripheral decline hypotheses.

4   RESULTS

Migration scale and economic cycles

The analysis reveals that while the overall scale of mobility remained structurally stable, the intensity of spatial polarization accelerated following the post-crisis economic recovery. Time series analysis of the internal movement scale (Table 3 and Figure 1) indicates that mobility levels remained generally robust over the entire period, peaking slightly around the 2017–2018 moving window. A clear temporary dip, corresponding to the global financial crisis of 2008–2010, is present. Specifically, the migration scale dropped from an index value of 81.0 to 79.6 during the crisis period, suggesting a brief hesitation in large-scale residential shifts during macro-economic uncertainty. However, the subsequent economic recovery saw a quick stabilization and increase in the overall volume of internal movement, eventually reaching an index value of 86.7 by the 2018–2022 period. This stability in the volume of internal movement suggests that while macro-economic fluctuations may briefly temper movement, the fundamental, structural drivers of regional flow – the vast economic disparity between the core and periphery – remained firmly in place, sustaining a dynamic level of internal redistribution. The persistence of these underlying drivers is crucial to understanding the subsequent acceleration of spatial polarization.

Table 3 Spatial Autocorrelation and Migration Scale (2003–2022). Global Moran's I for the three migration indices and scale of internal migration (per 1,000 inhabitants) averaged in four subperiods. All metrics quantified in a symmetric 5-year moving window

| | Migration Scale | Moran's I | | |
		GMBR	MEI	IAE
2003–2007	81.0	0.26	0.32	0.78
2008–2012	79.6	0.21	0.30	0.82
2013–2017	84.8	0.26	0.36	0.84
2018–2022	86.7	0.26	0.35	0.84

Source: Statistical Office of the Slovak Republic (2025)

Created with Datawrapper
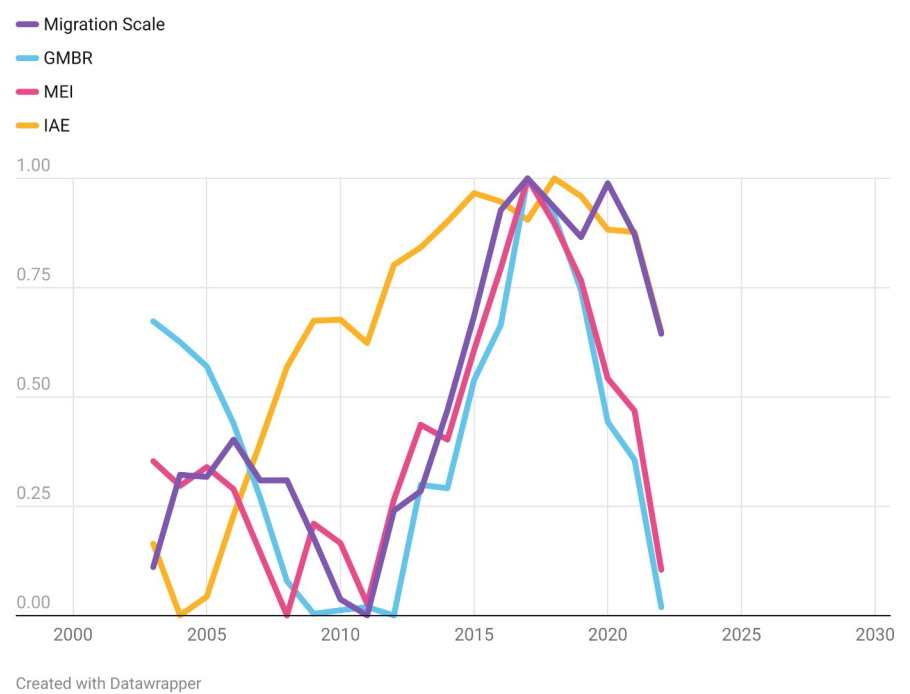
Figure 1 Time Series of Internal Migration Scale and Global Moran's I. Internal migration scaling per population, and the global Moran's I for the three migration indices (GMBR, MEI, and IAE), all across 2001–2024 using 5-year moving symmetric windows and unifying scale 0–1. Source: Statistical Office of the Slovak Republic (2025)

Evolution of spatial polarization

The core finding confirms a highly structured core-periphery system. Analysis of Global Moran's I for all migration indices (GMBR, MEI, and IAE) demonstrates strong, positive spatial autocorrelation throughout the entire observation period. All calculated values are highly significant ($p < 0.05$), providing powerful evidence that internal migration gains and losses in Slovakia are highly concentrated and geographically clustered.

The intensity of this spatial clustering evolved in direct response to macro-economic conditions. Clustering strength for GMBR and MEI experienced a marked temporary decrease during the 2008–2012 period. For instance, GMBR's Global Moran's I dropped from 0.26 to 0.21. This deceleration reflected that economic uncertainty inhibited long-distance, highly capital-intensive moves, such as suburban housing acquisition. This temporary instability diminished the propensity for high-risk, geographically distant moves. However, following the economic recovery post-2012, polarization rapidly rebounded and intensified. All efficiency indices peaked and reached their apex in the later periods (MEI peaked at 0.36 in 2013–2017, and IAE stabilized at its highest point of 0.84). This pattern strongly validates the hypothesis of accelerated polarization, which predicted a post-crisis acceleration of clustering, particularly in the efficiency metrics (refer to Table 3 and Figure 1).

The most significant finding is the hierarchical clustering intensity among the metrics: the distance-weighted IAE consistently exhibited the highest clustering (peaking at 0.84), followed by the MEI (peaking at 0.36), both significantly higher than the raw GMBR's I-statistic (0.26). This structural difference demonstrates that the geographical spatial structure of migration efficiency – the regional capacity to effectively attract and retain population – is the most deeply entrenched and spatially concentrated phenomenon in Slovak internal migration. The core's capacity to convert population mobility into a net, long-term gain is far more geographically localized than the sheer volume of movement itself. This strongly supports the theoretical distinction between the gross volume of movement and the concentrated efficiency of attraction.

The synthetic LISA analysis clearly defines Slovakia's persistent structural core-periphery divide (Figure 2).

Persistent spatial clustering

The high-gain clusters (HH) that validate the core concentration hypothesis are geographically precise and overwhelmingly concentrated in the Bratislava metropolitan region. This zone, encompassing the capital's districts and immediate peri-urban districts (Malacky, Pezinok, Senec), acts as a persistent center of high migration gain. It leverages housing and quality of life to complement the capital's strong employment and economic advantage, thereby reinforcing the cumulative causation process.

Conversely, the chronic loss clusters (LL) confirm peripheral decline and reveal the deep geographical extent of demographic loss, largely dominating Eastern Slovakia. Persistent low-low clustering covers nearly all districts in the Košice and

Prešov regions, alongside parts of the Banská Bystrica region. This pervasive pattern signifies chronic net losses, structural economic lagging, and limited investment. These regions function as the primary source areas for the national migratory stream toward the core, demonstrating entrenched backwash effects.
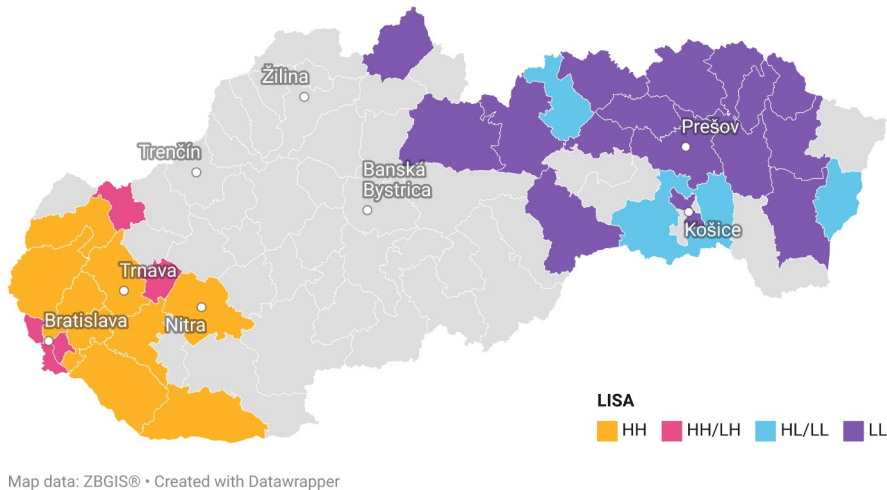

Map data: ZBGIS® · Created with Datawrapper

Figure 2 LISA Classification of Persistent Migration Regimes. Districts are categorized based on statistically significant clustering (p < 0.05). A district is classified if it appeared in the cluster type at least once over the observed period 2001–2024. Source: GKÚ Bratislava – ZBGIS (2025); Statistical Office of the Slovak Republic (2025)

Transitional and local zones (mixed clusters) highlight dynamic transition areas. Siphoning zones (LH) suffer local net migration loss despite being adjacent to powerful high-gain neighbors (e.g., Hlohovec, Myjava, and three Bratislava city districts). They act as key source areas for the core, experiencing selective out-migration and residential displacement. Local Anchors (HL) represent local population concentrators, experiencing high gains but surrounded by loss-suffering districts. They are visible around Košice-okolie and two peripheral regional centers (Kežmarok, Sobrance). These are localized growth islands whose attraction force is insufficient to generate sustainable spread effects capable of competing with the national core.

5 DISCUSSION

The synthesis of temporal and spatial results provides strong empirical validation for the theory of cumulative causation in shaping Slovakia's demographic land-

scape. The strong and accelerating spatial concentration post-2012, particularly in the efficiency metrics, confirms that regional growth is a self-reinforcing process of divergence. The entrenched core-periphery structure is evident: the highly efficient migration gains concentrated in the West deepen the region's human capital advantage (Faggian et al., 2017). Conversely, the persistent, chronic loss status in the East ensures that long-term backwash effects (Partridge et al., 2007; Kollai, 2021) continue largely unabated. The persistence of these structures over two decades demonstrates that the core-periphery model is deeply ingrained in the country's socio-economic geography (Storper, 2018), decisively supporting the structuralist framework over the neoclassical equilibrium model.

The persistent classification of Bratislava's suburban districts as areas of sustained high gains underscores a crucial aspect of national migration dynamics. The primary engine of national migration gain is not solely the dense city center but the decentralized peri-urban housing market and infrastructure linked to the capital's vast employment density. This pattern is highly effective because it leverages the capital area's concentrated GDP and service economy (Smith, 2019; Korec and Ondoš, 2021) while simultaneously providing better living conditions, notably housing (Šveda et al., 2016; Farkas and Klobučník, 2021). This appeal to housing is a major driver of family migration (Feijten and Mulder, 2010) and directly contributes to the country's extreme regional inequality (Kriss et al., 2019).

The persistently low efficiency values in the districts with chronic loss are highly indicative of regional structural failure. These districts do not merely suffer numerical population losses; they are fundamentally inefficient at mobilizing any available internal migration flows for local benefit, reflecting a chronic imbalance between high outflow and negligible inflow. This lack of efficiency points toward a critical deficit in non-economic factors. While economic reasons (job scarcity) are primary drivers of outflow (Levický et al., 2024; Jikia, 2025), the inability to attract even limited return or compensatory migration suggests deep deficiencies in regional livability, such as the quality of public services, education infrastructure, or institutional capacity (Ďurček et al., 2024; Ondoš et al., 2024). This persistent inefficiency locks these districts into a cycle of demographic decline and reinforces the effects of selective out-migration (Šprocha et al., 2017), which accelerates demographic aging and ensures long-term socio-economic vulnerability.

6 CONCLUSION

This study mapped the dynamics of internal migration in Slovakia from 2001 to 2024, providing decisive evidence for a deeply entrenched and accelerating core-periphery structure. Analysis of migration rate, efficiency, and distance-weighted attraction decisively validates the cumulative causation theory in the post-socialist context, firmly rejecting the neoclassical equilibrium model.

The findings confirm two distinct spatial regimes: core concentration, marked by a persistent cluster in the Bratislava metropolitan region, functions as the domi-

nant demographic engine with the highest attraction efficiency; and peripheral decline, which validates chronic, large-scale structural loss via persistent clustering across the Eastern and peripheral Northern districts, confirming the entrenched dominance of the backwash effect due to profound structural inefficiency. Temporal analysis further confirmed accelerated polarization: the intensity of spatial clustering, particularly in the efficiency metrics, accelerated sharply post-2008, demonstrating that macro-economic shocks amplify underlying structural divergence.

The key theoretical finding is that the spatial structure of migration efficiency is the most concentrated phenomenon; thus, the qualitative capacity to attract and retain human capital – rather than just raw movement volume – is the definitive factor driving divergence. This process leads to the qualitative erosion of the labor force and accelerated demographic aging in the peripheral loss clusters.

Ultimately, the two-decade persistence of these clustered structures signifies that passive regional development policies are insufficient to counter these powerful, self-reinforcing mechanisms. Moving forward, policy must be spatially targeted: this includes managing the rapid peri-urban expansion of the core, prioritizing investment in diversified job creation and enhanced regional livability in the periphery, and strengthening transitional regional hubs to function as sustainable counter-poles to the national core.

References

ALVAREZ, M., BERNARD, A., LIESKE, S. N. 2021. Understanding internal migration trends in OECD countries. *Population, Space and Place*, 27(7), e2451. DOI: https://doi.org/10.1002/psp.2451.

ANNONI, P., DE DOMINICIS, L., KHABIRPOUR, N. 2019. Location matters: A spatial econometric analysis of regional resilience in the European Union. *Growth and Change*, 50(3), 824-855. DOI: https://doi.org/10.1111/grow.12311.

ARAUJO, R. A. 2013. Cumulative causation in a structural economic dynamic approach to economic growth and uneven development. *Structural Change and Economic Dynamics*, 24, 130-140. DOI: https://doi.org/10.1016/j.strueco.2012.09.001.

BALÁŽ, V., LICHNER, I., JECK, T. 2023. Geography of migration motives: Matching migration motives with socioeconomic data. *Moravian Geographical Reports*, 31(3), 141-152. DOI: https://doi.org/10.2478/mgr-2023-0013.

BARKLEY, D., HENRY, M., BAO, S. 1996. Identifying "Spread" versus "Backwash" Effects in Regional Economic Areas: A Density Functions Approach. *Land Economics*, 72(3), 336-357. DOI: https://doi.org/10.2307/3147201.

BAYRAKTAR, Y., ÖZYILMAZ, A. 2017. The role of ınternal migration on regional ınequality: Turkey example. *Turkish Journal of Middle Eastern Studies*, Special Issue 1 - Middle East and Migration, 9-30. DOI: https://doi.org/10.26513/tocd.317663.

BELL, M., CHARLES-EDWARDS, E., UEFFING, P., STILLWELL, J., KUPISZEWSKI, M., KUPISZEWSKA, D. 2015. Internal Migration and Development: Comparing Migration Intensities Around the World. *Population and Development Review*, 41(1), 33-58. DOI: https://doi.org/10.1111/j.1728-4457.2015.00025.x.

BEZÁK, A. 2000. Funkčné mestské regióny na Slovensku. Bratislava: Geografický ústav SAV. *Geographia Slovaca*, 15.

BEZÁK, A. 2006. Vnútorné migrácie na Slovensku: súčasné trendy a priestorové vzorce. *Geografický časopis*, 58(1), 15-44.

BIAGI, B., FAGGIAN, A., MCCANN, P. 2011. Long and Short Distance Migration in Italy: The Role of Economic, Social and Environmental Characteristics. *Spatial Economic Analysis*, 6(1), 111-131. DOI: https://doi.org/10.1080/17421772.2010.540035.

BLEHA, B. 2019. How much can societal turning points affect forecasts' accuracy in Europe? Case of post-communistic transformation in Slovakia and the Czech Republic. *European Journal of Futures Research*, 7, 1-12. DOI: https://doi.org/10.1186/s40309-019-0158-z.

BLEHA, B., BUČEK, J. 2023. Depopulation differences in Slovak former mining cities: The role of geographical conditions and local interventions. *Papers in Applied Geography*, 10(1), 34-52. DOI: https://doi.org/10.1080/23754931.2023.2255872.

BOROZAN, D. 2017. Internal migration, regional economic convergence, and growth in Croatia. *International Regional Science Review*, 40(2), 141-163. DOI: https://doi.org/10.1177/0160017615572889.

BRANDÉN, M., HAANDRIKMAN, K. 2019. Who moves to whom? Gender differences in the distance moved to a shared residence. *European Journal of Population*, 35, 435-458. DOI: https://doi.org/10.1007/s10680-018-9490-4.

BUČEK, M. 1999. Regional disparities in transition in the Slovak Republic. *European Urban and Regional Studies*, 6(4), 360-364. DOI: https://doi.org/10.1177/096977649900600411.

BUČEK, J. 2016. Urban development policy challenges in East-Central Europe: Governance, city regions and financialisation. *Quaestiones Geographicae*, 35(2), 26-37. DOI: https://doi.org/10.1515/quageo-2016-0012.

BUČEK, J., BLEHA, B. 2013. Urban shrinkage as a challenge to local development planning in Slovakia. *Moravian Geographical Reports*, 21(1), 2-15. DOI: https://doi.org/10.2478/mgr-2013-0001.

BUČEK, J., BLEHA, B., RICHTER, M. 2022. Coping with shrinkage in old and young mining cities in Slovakia: The cases of Banská Štiavnica and Prievidza. In: Wu, C., Gunko, M., Stryjakiewicz, T., Zhou, K. (eds.) *Postsocialist Shrinking Cities*. London, Routledge, 276-294. DOI: https://doi.org/10.4324/9780367815011-22.

CAMAGNI, R., CAPELLO, R., CERISOLA, S., FRATESI, U. 2020. Fighting gravity: Institutional changes and regional disparities in the EU. *Economic Geography*, 96(2), 108-136. DOI: https://doi.org/10.1080/00130095.2020.1717943.

ČERMÁK, Z. 2005. Migrace a suburbanizační procesy v České. Demografie, 47(3), 169-176.

ČERMÁK, Z., HAMPL, M., MÜLLER, J. 2009. Contemporary tendencies of population development of metropolitan areas in Czechia: Is an important turn coming? *Geografie*, 114, 37-51. DOI: https://doi.org/10.37040/geografie2009114010037.

CHEN, A., PARTRIDGE, M. 2013. When are cities engines of growth in China? Spread and backwash effects across the urban hierarchy. *Regional Studies*, 47(8), 1313-1331. DOI: https://doi.org/10.1080/00343404.2011.589831.

CROWN, D., JAQUET, T., FAGGIAN, A. 2018. Interregional Migration and Implications for Regional Resilience. In: Biagi, B., Faggian, A., Rajbhandari, I., Venhorst, V. A. (eds.) *New Frontiers in Interregional Migration Research*. Cham, Springer, 231-252. DOI: https://doi.org/10.1007/978-3-319-75886-2_11.

DIVINSKÝ, B. 2009. *Migračné trendy v Slovenskej republike po vstupe krajiny do EÚ (2004 – 2008)*. Bratislava, IOM Medzinárodná organizácia pre migráciu.

DŁUGOSZ, M. 2022. Zastosowanie autokorelacji przestrzennej v badaniach migracji wewnętrznych. *Prace Geograficzne*, 167, 7-27. DOI: https://doi.org/10.4467/20833113pg.22.005.16218.

ĎURČEK, P., FITALOVÁ, A., VIZVÁRY, L. 2024. Endogenous determinants and regional policy: Chalenges in reducing regional disparities in Slovakia. Acta Geographica Universitatis Comenianae, 68(1), 27-48.

ĎURČEK, P., NOVÁKOVÁ, G., HORŇÁK, M., KUSENDOVÁ, D. 2020. How will new orbital motorways reshape accessibility in Bratislava metropolitan area? *Bulletin of Geography. Socio-economic Series*, 50, 83-100. DOI: https://doi.org/10.2478/bog-2020-0034.

EGRI, Z., LENGYEL, I. 2024. Convergence and Catch-Up of the Region Types in the Central and Eastern European Countries. *Applied Spatial Analysis and Policy*, 17, 393-415. DOI: https://doi.org/10.1007/s12061-023-09551-w.

FAGGIAN, A., MCCANN, P. 2008. Human Capital, Graduate Migration and Innovation in British Regions. *Cambridge Journal of Economics*, 33(2), 317-333. DOI: https://doi.org/10.1093/cje/ben042.

FAGGIAN, A., RAJBHANDARI, I., DOTZEL, K. 2017. The interregional migration of human capital and its regional consequences: a review. *Regional Studies*, 51(1), 128-143. DOI: https://doi.org/10.1080/00343404.2016.1263388.

FARKAS, R., KLOBUČNÍK, M. 2021. Residential suburbanisation in the hinterland of Bratislava – a case study of municipalities in the Austrian border area. *Hungarian Geographical Bulletin*, 70(4), 311-323. DOI: https://doi.org/10.15201/hungeobull.70.4.2.

FEIJTEN, P., MULDER, C. H. 2010. Gender, divorce and housing – A life course perspective. In: Reuschke, D. (ed.) *Wohnen und gender. Theoretische, politische, soziale und räumliche Aspekte*. Wiesbaden, VS Verlag for Sozialwissenschaften, 175-193. [online] [cit. 2025-02-21]. Available at: <https://hdl.handle.net/11245/1.311487>

FENG, Y., LEE, C., PENG, D. 2022. Does regional integration improve economic resilience? Evidence from urban agglomerations in China. *Sustainable Cities and Society*, 88, 104273. DOI: https://doi.org/10.1016/j.scs.2022.104273.

GIANNAKIS, E., BRUGGEMAN, A. 2020. Regional disparities in economic resilience in the European Union across the urban–rural divide. *Regional Studies*, 54(9), 1200-1213. DOI: https://doi.org/10.1080/00343404.2019.1698720.

INCALTARAU, C., PASCARIU, G., DUARTE, A., NIJKAMP, P. 2021. Migration, regional growth and convergence: a spatial econometric study on Romania. *The Annals of Regional Science*, 66, 497-532. DOI: https://doi.org/10.1007/s00168-020-01019-w.

JACOBS, A. 2017. Nested dependent city-regions: FDI, uneven development, and Slovakia's Bratislava, Nitra, Trenčín, Trnava, and Žilina city-regions. *Journal of Urban Affairs*, 39(6), 800-818. DOI: https://doi.org/10.1080/07352166.2017.1282768.

JANOSCHKA, M., ALEXANDRI, G., RAMOS, H., VIVES-MIRÓ, S. 2020. Tracing the socio-spatial logics of transnational landlords' real estate investment: Blackstone in Madrid. *European Urban and Regional Studies*, 27(2), 125-141. DOI: https://doi.org/10.1177/0969776418822061.

JANOTKA, M., GAZDA, V., HORVÁTH, D. 2014. Migration Trends Among Regional clusters in Slovakia. *The Engineering Economics*, 24(5), 437-446. DOI: https://doi.org/10.5755/j01.ee.24.5.3377.

JIKIA, M. 2025. Migration trends in Slovakia: An analysis of post-EU enlargement. *Journal of Development Studies*, 5(1), 54-63. DOI: https://doi.org/10.52340/jds.2024.05.05.06.

JORDAN, P. 2006. EU enlargement, the new Central European member states, and Austria. *Eurasian Geography and Economics*, 47(6), 662-682. DOI: https://doi.org/10.2747/1538-7216.47.6.662.

JURČOVÁ, D. 2010. *Migračné toky v Slovenskej republike*. Bratislava, Infostat, VDC.

KE, S., FESER, E. 2010. Count on the growth pole strategy for regional economic growth? Spread–backwash effects in Greater Central China. *Regional Studies*, 44(9), 1131-1147. DOI: https://doi.org/10.1080/00343400903373601.

KOK, H., KOVÁCS, Z. 1999. The process of suburbanization in the agglomeration of Budapest. *Netherlands Journal of Housing and the Built Environment*, 14, 119-141. DOI: https://doi.org/10.1007/bf02496818.

KOLLAI, I. 2021. Developmental or Impoverishing Urban Cores? The Case of Slovakia. In: Lützenkirchen, M., et al. (eds.) *Developmental and Impoverishing Urban Cores*. Cham, Springer, 197-216. DOI: https://doi.org/10.1007/978-3-030-71987-6_10.

KOREC, P., ONDOŠ, S. 2009. The development of urban structure of Bratislava in the time of post-socialist transformation. *Quaestiones Geographicae*, 28(2), 53-64.

KOREC, P., ONDOŠ, S. 2021. Socio-economic development in Bratislava during post-socialism. In: Tátrai, P., Piricsi, G. (eds.) *Growth and Change in Post-socialist Cities of Central Europe*. Abingdon, Routledge. DOI: https://doi.org/10.4324/9781003039792-7.

KRISS, P., WOLSZCZAK, G., BENČ, V., PAKSIMA, S., SALAZAR, J., CHRZANOWSKI, P., LICCIARDI, G. 2019. *Slovakia Catching-Up Regions – Overview Report*. Washington D. C., World Bank.

KRIŠJĀNE, Z., BĒRZIŅŠ, M. 2012. Post-socialist urban trends: New patterns and motivations for migration in the suburban areas of Rīga, Latvia. *Urban Studies*, 49(2), 289-306. DOI: https://doi.org/10.1177/0042098011402232.

KUBIS, A., SCHNEIDER, L. 2016. Regional migration, growth and convergence – A spatial dynamic panel model of Germany. *Regional Studies*, 50(11), 1789-1803. DOI: https://doi.org/10.1080/00343404.2015.1059932.

LANG, T., BURNEIKA, D., NOORKÕIV, R., PLÜSCHKE-ALTOF, B., POCIŪTĖ-SEREIKIENĖ, G., SECHI, G. 2021. Socio-spatial polarisation and policy response: Perspectives for regional development in the Baltic States. *European Urban and Regional Studies*, 29(1), 21-44. DOI: https://doi.org/10.1177/09697764211023553.

LANGE, T. 2015. Socio-economic and political responses to regional polarisation and socio-spatial peripheralisation in Central and Eastern Europe: a research agenda. *Hungarian Geographical Bulletin*, 64(3), 171-185. DOI: https://doi.org/10.15201/hungeobull.64.3.2.

LEHTONEN, O., WUORI, O., MUILU, T. 2015. Comparing the extend of the spread effects: Rural-urban commuting in Finnish working regions. *Journal of Geographic Information System*, 7(1), 29-42. DOI: https://doi.org/10.4236/jgis.2015.71003.

LEVICKÝ, M., PAPCUNOVÁ, V., URBANÍKOVÁ, M., KOZLOKOVÁ, A. 2024. Development and causes of migration in lagging regions in the years 2017–2021: A case study of the Slovak Republic. *Acta Polytechnica CTU Proceedings*, 46, 53-64. DOI: https://doi.org/10.14311/app.2024.46.0053.

LICHNER, I., BALÁŽ, V., JECK, T. 2024. Between spaces: Unravelling motives and distances in internal migration. *Population, Space and Place*, 30(8), e2818. DOI: https://doi.org/10.1002/psp.2818.

LIM, J. 2022. The electoral consequences of international migration in sending countries: Evidence from Central and Eastern Europe. *Comparative Political Studies*, 56(1), 36-64. DOI: https://doi.org/10.1177/00104140221089646.

LIM, J., KWON, D., HA, S. 2025. Revisiting the growth poles: Regional disparity and population redistribution policy. *The Annals of Regional Science*, 74(22). DOI: https://doi.org/10.1007/s00168-025-01357-7.

MADANIPOUR, A., SHUCKSMITH, M., BROOKS, E. 2021. The concept of spatial justice and the European Union's territorial cohesion. *European Planning Studies*, 30(5), 807-824. DOI: https://doi.org/10.1080/09654313.2021.1928040.

MAGACHO, G., MCCOMBIE, J. 2020. Structural change and cumulative causation: A Kaldorian approach. *Metroeconomica*, 71(3), 633-660. DOI: https://doi.org/10.1111/meca.12295.

MAIER, K., FRANKE, D. 2025. Development of socio-spatial polarisation in Czechia. *Geografie*, 130(1), 35-63. DOI: https://doi.org/10.37040/geografie.2025.004.

MATLOVIČ, R., KLAMÁR, R., MATLOVIČOVÁ, K. 2008. Vývoj regionálnych disparít začiatkom 21. storočia na Slovensku vo svetle vybraných indikátorov. *Regionální studia*, 2(2), 2-12.

MATLOVIČ, R., KLAMÁR, R., KOZOŇ, J., IVANOVA, M., MICHALKO, M. 2018. Spatial polarity and spatial polarization in the context of supranational and national scales: Regions of Visegrad countries after their accession to the EU. *Bulletin of Geography. Socioeconomic Series*, 41, 59-78. DOI: https://doi.org/10.2478/bog-2018-0026.

MCCOMBIE, J., THIRLWALL, A. 1994. Export-led growth, regional problems and cumulative causation. In: McCombie, J., Thirlwall, A. (eds.) *Economic Growth and the Balance-of-Payments Constraint*. London, Macmillan Education UK, 457-481. DOI: https://doi.org/10.1007/978-1-349-23121-8_8.

MICHÁLEK, A., PODOLÁK, P. 2011. Impact of Key Socio-Economic Disparities on Migration in Slovakia: Economic Diversification vs. Traditional Pattern. *Ekonomický časopis*, 18(1), 71-87. DOI: https://doi.org/10.2478/v10105-011-0005-0.

MICHÁLEK, A., PODOLÁK, P., SLÁDEKOVÁ MADAJOVÁ, M. 2018. Dynamics of regional disparities in Slovakia in 2001 and 2011. *Bulletin of Geography. Socio-economic Series*, 42, 99-114. DOI: https://doi.org/10.2478/bog-2018-0033.

MONASTIRIOTIS, V. 2014. Regional growth and national development: Transition in Central and Eastern Europe and the regional Kuznets curve in the East and the West. *Spatial Economic Analysis*, 9(2), 142-161. DOI: https://doi.org/10.1080/17421772.2014.891156.

NEWBOLD, K., PETERSON, D. 2001. Distance weighted migration measures. *Papers in Regional Science*, 80(3), 371-380. DOI: https://doi.org/10.1111/j.1435-5597.2001.tb01805.x.

NOVOTNÝ, L. 2016. Urban development and migration processes in the urban region of Bratislava from the post-socialist transformation until the global economic crisis. *Urban Geography*, 37(7), 1009-1029. DOI: https://doi.org/10.1080/02723638.2016.1139413.

NOVOTNÝ, L. 2019. Impact of migration on rural region in post-socialist Slovakia. In: Bański, J. (ed.) *Three Decades of Transformation in the East-Central European Countryside*. Cham, Springer, 147-170. DOI: https://doi.org/10.1007/978-3-030-21237-7_8.

NOVOTNÝ, L., PREGI, L., NOVOTNÁ, J. 2023. East-West or up the urban hierarchy? Internal migration patterns in Slovakia since post-socialist transformation to Covid-19 pandemic. *Eurasian Geography and Economics*, 65(8), 904-931. DOI: https://doi.org/10.1080/15387216.2023.2220344.

ONDOŠ, S., KÁČEROVÁ, M. 2015. Migration responses to regional labor market conditions in Slovakia. *Ekonomický časopis*, 63(2), 188-212.

ONDOŠ, S., SINČÁKOVÁ, Ž., HUDEC, O. 2024. The re-emergence of left-behind regions: the end of spatial equity and the rise of dynamic movements in Slovakia, 1990-2020. *Regional Statistics*, 14(2), 258-282. DOI: https://doi.org/10.15196/rs140203.

PARTRIDGE, M., BOLLMAN, R., OLFERT, M., ALASIA, A. 2007. Riding the wave of urban growth in the countryside: Spread, backwash, or stagnation? *Land Economics*, 83(2), 128-152. DOI: https://doi.org/10.3368/le.83.2.128.

PETRAKOS, G. 2001. Patterns of regional inequality in transition economies. *European Planning Studies*, 9(3), 359-383. DOI: https://doi.org/10.1080/713666485.

PETRAKOS, G., TSIAPA, M., KALLIORAS, D. 2016. Regional inequalities in the European Neighborhood Policy countries: The effects of growth and integration. *Environment and Planning C: Government and Policy*, 34(4), 698-716. DOI: https://doi.org/10.1177/0263774x15614730.

PIETAK, L. 2024. Effect of regional disparities on national economic growth. A spatial panel data evidence from EU countries in 2000–2020. *The Journal of Economic Inequality*. DOI: https://doi.org/10.1007/s10888-024-09658-1.

PLEŠIVČÁK, M., BUČEK, J. 2017. In the centre, but still on the periphery: Is there any room for development of socio-economically deprived region in Slovakia? *International Journal of Social Economics*, 44(11), 1539-1558. DOI: https://doi.org/10.1108/ijse-01-2016-0023.

PREGI, L., NOVOTNÝ, L. 2025. Spatial autocorrelation methods in identifying migration patterns: Case study of Slovakia. *Applied Spatial Analysis and Policy*, 18(1): 12. DOI: https://doi.org/10.1007/s12061-024-09615-5.

PUGA, D., VENABLES, A. 1996. The spread of industry: Spatial agglomeration in economic development. *Journal of The Japanese and International Economies*, 10(4), 440-464. DOI: https://doi.org/10.1006/jjie.1996.0025.

RAYMER, J., WILLEKENS, F., ROGERS, A. 2018. Spatial demography: A unifying core and agenda for further research. *Population, Space and Place*, 25(4), e2179. DOI: https://doi.org/10.1002/psp.2179.

ROKITA-POSKART, D., ADAMSKA, M., PLATJE, J., MĄKOLSKA-FRANKOWSKA, I., POSKART, R. 2025. Educational migration and demographic resilience: The role of student mobility in local development. *Economics and Environment*, 91(4), 1-15. DOI: https://doi.org/10.34659/eis.2024.91.4.1016.

ROWE, F., PATIAS, N. 2020. Mapping the spatial patterns of internal migration in Europe. *Regional Studies, Regional Science*, 7(1), 390-393. DOI: https://doi.org/10.1080/21681376.2020.1811139

RUSNÁK, J., KOREC, P., PLEŠIVČÁK, M. 2023. The trade-off between national growth and interregional inequality: Three decades of regional development in Slovakia. Geografický časopis / Geographical Journal, (75) 3, 391-311. 0016-7193

SAKS, R., WOZNIAK, A. 2007. Labor reallocation over the business cycle: New evidence from internal migration. *Journal of Labor Economics*, 29(4), 697-739. DOI: https://doi.org/10.1086/660772.

SANTOS-PAULINO, A., DICAPRIO, A., SOKOLOVA, M. 2019. The development trinity: How regional integration impacts growth, inequality and poverty. *The World Economy*, 42(7), 1961-1993. DOI: https://doi.org/10.1111/twec.12788.

SCHWARTZ, A. 1971. On efficiency of migration. *Journal of Human Resources*, 6(2), 193-205. DOI: https://doi.org/10.2307/144917.

SCHWARTZ, A. 1973. Interpreting the effect of distance on migration. *Journal of Political Economy*, 81(5), 1153-1169. DOI: https://doi.org/10.1086/260111.

STAN, S., ERNE, R. 2014. Explaining Romanian labor migration: From development gaps to development trajectories. *Labor History*, 55(1), 21-46. DOI: https://doi.org/10.1080/0023656x.2013.843841.

SLAVÍKOVÁ, N., ŠPROCHA, B. 2023. Internal migration from and to municipalities in Slovakia with the highest proportion of people living in Roma settlements. *Demografie*, 65(4), 321-331. DOI: https://doi.org/10.54694/dem.0321.

SMITH, A. 1998. *Reconstructing the Regional Economy. Industrial Transformation and Regional Development in Slovakia*. Cheltenham, Edward Elgar Publishing.

SMITH, A. 1999. Which transition? Some thoughts on 'some features and problems of the transformation process in Slovakia' by Ján Paulov. In: Carter, F. W., Maik, W. (eds.) *Shock-Shift in an Enlarged Europe*. London: Routledge, 131-136. DOI: https://doi.org/10.4324/9780429434907-13.

SMITH, A. 2000. Ethnicity, economic polarization and regional inequality in Southern Slovakia. *Growth and Change*, 31(2), 151-178. DOI: https://doi.org/10.1111/0017-4815.00124.

ŠPROCHA, B. 2011. Vnútorná migrácia podľa najvyššieho dokončeného vzdelania na Slovensku. *Prognostické práce*, 3(3), 213-246.

ŠPROCHA, B., BLEHA, B., VAŇO, B., BUČEK, J. 2017. *Perspektívy, riziká a výzvy demografického vývoja najväčších miest Slovenska*. Bratislava, Infostat.

STORPER, M. 2018. Separate worlds? Explaining the current wave of regional economic polarization. *Journal of Economic Geography*, 18(2), 247-270. DOI: https://doi.org/10.1093/jeg/lby011.

SUNDQVIST, E. 2021. Demographic challenges in regional development: A study of regional political leadership in Sweden and Finland. *Regional Federal Studies*, 33(3), 287-305. DOI: https://doi.org/10.1080/13597566.2021.1959322.

ŠVEDA, M., BARLÍK, P. 2018. Daily commuting in the Bratislava metropolitan area: Case study with mobile positioning data. *Papers in Applied Geography*, 4(4), 409-423. DOI: https://doi.org/10.1080/23754931.2018.1540357.

ŠVEDA, M., MADAJOVÁ, M., PODOLÁK, P. 2016. Behind the differentiation of suburban development in the hinterland of Bratislava, Slovakia. *Sociologický časopis - Czech Sociological Review*, 52(6), 893-926. DOI: https://doi.org/10.13060/00380288.2016.52.6.290.

ŠVEDA, M., PAZÚR, R. 2018. Priestorové formy rezidenčnej suburbanizácie v zázemí Bratislavy. *Geografický časopis / Geographical Journal*, 70(3), 231-258. DOI: https://doi.org/10.31577/geogrcas.2018.70.3.13.

ŠVEDA, M., ŠUŠKA, P. 2019. *Suburbanizácia: Ako sa mení zázemie Bratislavy*? Bratislava, Geografický ústav SAV.

SÝKORA, L., ČERMÁK, Z. 1998. City growth and migration patterns in the context of 'communist' and 'transitory' periods in Prague's urban development. *Espace, Populations, Sociétés*, 3, 405-416. DOI: https://doi.org/10.3406/espos.1998.1856.

SZCZECH-PIETKIEWICZ, E. 2017. Competitiveness of Cities and Their Regions in Poland – Changes in the Light of the Growth Pole Concept. In: Rynarzewska, T., Pintilie, S. (eds.) *Local and Regional Competitiveness*. Bingley, Emerald Publishing Limited, 153-169. DOI: https://doi.org/10.1108/978-1-78714-495-820171008.

WILLIAMS, A. 2009. International migration, uneven regional development and polarization. *European Urban and Regional Studies*, 16(3), 309-322. DOI: https://doi.org/10.1177/0969776409104695.

Kumulatívna kauzalita a rýchla divergencia: Posúdenie efektivity vnútornej migrácie na Slovensku (2001 – 2024)

Súhrn

Táto štúdia predkladá detailnú analýzu časopriestorovej dynamiky a štrukturálnych príčin polarizácie vnútornej migrácie na Slovensku v rokoch 2001 až 2024. Hlavným cieľom bolo testovanie hypotézy kumulatívnej kauzality a overenie, či interná migrácia vedie k regionálnej konvergencii alebo divergencii. Analýza bola založená na longitudinálnych údajoch z okresov, pričom boli použité symetrické 5-ročné kĺzavé okná na zachytenie dlhodobých štrukturálnych trendov. Pre hodnotenie migrácie boli použité tri ukazovatele: hrubá miera migračného salda (GMBR), index migračnej efektivity (MEI) a priestorovo vážený index efektivity príťažlivosti (IAE).

V teoretickej časti spochybňujeme neoklasický model konvergencie, ktorý je v podmienkach ekonomík so štrukturálnou nerovnováhou empiricky neudržateľný. Štúdia potvrdzuje dominanciu modelu kumulatívnej kauzality, kde počiatočné ekonomické výhody generujú samoregulačné mechanizmy prehlbujúce regionálne nerovnosti. Tento proces je realizovaný prostredníctvom spätného prenosu, ktorý má za následok chronický odliv mladého a vzdelaného ľudského kapitálu z periférie do ekonomických centier. To oslabuje miestnu hospodársku základňu a urýchľuje demografické starnutie. Kľúčový analytický prínos spočíva v aplikácii metrík migračnej efektivity, ktoré kvantifikujú schopnosť regiónu premeniť celkovú mobilitu na čistý demografický zisk a odrážajú tak reálnu štrukturálnu silu príťažlivosti.

Analýza potvrdila existenciu trvalého, vysoko efektívneho jadrového klastra, geograficky vymedzeného na bratislavský región a priľahlé okresy. Táto zóna funguje

ako kľúčový motor migračného systému, pričom jej vysoká efektivita je daná koncentráciou zamestnanosti s vysokou pridanou hodnotou, dynamickým trhom bývania a nadštandardnou kvalitou života. Tento región vykazuje najvyššiu efektivitu pri získavaní diaľkovej migrácie.

Na opačnom konci spektra bol identifikovaný rozsiahly periférny klaster chronických strát, pokrývajúci východné a časti severného Slovenska (regióny Košíc, Prešova a Banskobystrického kraja). Tieto okresy netrpia len absolútnymi demografickými stratami, ale sú štrukturálne neefektívne – nedokážu mobilizovať migračné zdroje na vlastný rozvoj. To indikuje chronický deficit v kvalite verejných služieb, vzdelávania a inštitucionálnej kapacity, čím sa prehlbuje ich zraniteľnosť.

Zistenia ukazujú, že intenzita priestorovej polarizácie sa po roku 2012 výrazne zrýchlila, pričom metriky efektivity dosiahli po globálnej finančnej kríze vrcholné hodnoty pozitívnej autokorelácie. Makroekonomický šok neviedol ku konvergencii, ale amplifikoval už existujúce štrukturálne nerovnováhy, čím posilnil samoregulačný mechanizmus divergencie a rastúci podiel diaľkovej migrácie.

Syntéza výsledkov poskytuje empirickú podporu pre teóriu kumulatívnej kauzality, potvrdzujúc, že vnútorná migrácia na Slovensku je dominantne divergenčný proces. Priestorová štruktúra migračnej efektivity, a nie hrubý migračný objem, predstavuje jav s najširším dosahom. Kvalitatívna schopnosť regiónov priťahovať a udržať si ľudský kapitál je rozhodujúcim determinantom prehlbujúcej sa divergencie. Dôsledkom je erózia kvality pracovnej sily a zrýchlené starnutie v periférnych oblastiach. Dve desaťročia perzistencia týchto dynamických štruktúr poukazujú na neúčinnosť pasívnych regionálnych politík voči silným endogénnym mechanizmom.