

**THESES OF THE DOCTORAL (PhD)
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Ferenc Szilágyi

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TERRITORIAL PATTERNS, SECTORAL AND REGIONAL VULNERABILITY OF THE ECONOMY IN THE PARTIUM REGION

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Ferenc Szilágyi

Kaposvár

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Name of Doctoral School: **Doctoral School of Economic and Regional Sciences**

Discipline: **Management and Business Administration**

Head of Doctoral School: **Prof. Dr. Zoltán Bujdosó**
Hungarian University of Agriculture and Life Sciences,
Institute of Rural Development and Sustainable Economy

Supervisor: **Szilárd Podruzsik, PhD**
Institute of Economics of the ELTE Centre for Economic and Regional Studies

.....
Approval of Head of Doctoral School

.....
Approval of Supervisors

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1. INTRODUCTION AND OBJECTIVES

Over the past decades, the socio-economic structure of the Partium region has undergone substantial transformation. These changes stem partly from the region's distinctive borderland position and from the changing function of the border itself. It is also indisputable that sizeable infrastructural and, in places, extensive industrial investments have invigorated the regional economy. Romania's accession to Schengen in January 2025 may bring further decisive shifts in the economic and social development of the region, the careful assessment of which is crucial for Partium's long-term development strategy. The overarching purpose of the research is therefore to explore and evaluate the current trends unfolding in the region in detail. Schengen accession is expected to intensify the integration processes that have already been underway. To achieve this objective, the inquiry relies on four logically interlinked sub-studies, each with specific aims that analyse aspects of the contemporary development of the Partium region.

The first study employs a prognostic approach to evaluate the potential impact of Schengen accession on the Partium region. It compares the reintegration capacity of the Hungarian–Romanian borderland with that of Hungary's other Schengen border sections, with particular attention to the Hungarian–Croatian border, which became an internal Schengen frontier in 2023. Its central question is the extent to which the transformation of border functions can contribute to the catching-up of disadvantaged peripheries and to a reconfiguration of centre–periphery relations. Previous experience suggests that the opening of borders can trigger significant economic interactions in border areas; however, these effects do not materialise uniformly everywhere. Accordingly, the first chapter aims to gauge the positive integration effects that can be expected in the border zone of the Partium region and to identify where such effects may fall short of expectations due to regional specificities.

The second study scrutinises the characteristics of the Partium labour market. Following the economic crisis that unfolded at the end of the first decade of the millennium, the economies of the countries in the region grew dynamically year after year and converged significantly in an EU comparison. The findings suggest that Romania's border counties in the Partium region form a specific transitional zone between the Romanian and Hungarian national economies. This buffer role is evidenced by the fact that key labour-market indicators in the western border strip already approach Hungarian levels. In sectoral terms, the region has seen substantial development, especially in manufacturing and logistics, while

knowledge-intensive sectors have remained underrepresented; in the longer term, this shortcoming may constrain sustainable growth. The two main drivers of the region's economic transformation were, first, the Hungarian motorway network built around 2000 and, secondly, the relatively low Romanian wage level that had previously characterised the Partium region as well. Together, these factors greatly favoured the expansion of wage-sensitive, labour-intensive industries, particularly along the border. Overall, the second chapter draws attention to the spatial unevenness of Partium's economic catching-up: the favourable processes in the western borderlands do not automatically extend to the region as a whole. The aim here is therefore to reveal intra-regional differences within the Partium region in terms of labour-market conditions and developmental trajectories.

The third study focuses on regional sectoral resilience, using the highly shock-sensitive tourism sector as a case study. The COVID-19 pandemic made clear that, due to its reliance on international mobility and 'experience consumption', tourism is one of the most crisis-prone branches of the economy. The sudden collapse of demand, followed by a partial and asymmetric restart, demonstrated that a uniform crisis-management approach, which overlooks internal diversity, does not yield results in tourism. A systematic analysis of resilience is therefore doubly important: it enables the prior identification of vulnerable points and provides the foundations for targeted support and development programmes tailored to the local economic structure and place-specific resources. The highly diverse tourism offer of the Partium region – from border-adjacent transit hubs to thermal and mountain resorts – provides an excellent terrain on which to demonstrate why the same external shock exerts different intensities and temporal profiles across tourism segments. In summary, examining sectoral resilience is not merely of theoretical relevance; it also provides a practical basis for the crisis-management strategies of local actors and for improving the effectiveness of state or EU interventions. In this light, the third chapter aims to assess which areas within the tourism sector of the Partium region exhibited differing levels of resistance during the COVID shock, and what lessons can be drawn for future crisis management.

The concluding study investigates the attraction exerted by the major borderland cities and how this manifests itself in income disparities within Partium. Our results indicate that growth is concentrated around Arad (– Temesvár) and Nagyvárad: these centres direct the main flows of labour and capital, leading to stronger income differentials compared with their surroundings. Together with the Schengen opening and Romania's post-COVID recovery programmes, the prospects improve for the emergence of new cross-border industrial zones and clusters. Internal disparities, however, do not disappear: the northern counties –

Máramaros, Szatmár and Szilágy – continue to struggle with persistent lag. There are, nevertheless, counterexamples: mountain, rural and thermal tourism have revived in several northern locations in the years following the pandemic. This chapter illustrates how spatial inequality operates and how the ‘gravity’ of large cities shapes the region’s development pathway in the context of the Schengen opening and intensifying economic cooperation.

2. MATERIALS AND METHODS

Qualitative underpinning

The research comprised four interlinked empirical analyses, which, despite addressing distinct topics (the effects of Schengen integration, labour market differentials, tourism resilience, and income inequalities), were embedded in a common methodological framework. All investigations applied settlement-level, data-driven, spatially explicit analysis based on an integrated spatial database (gravity modelling, cluster analysis, spatial regression, resilience assessment). This consistent approach ensured coherence and comparability across the studies.

The theoretical foundations were provided by a review of the relevant literature. Hardi (2009) highlighted the key role of borderland twin cities in regional integration, while Péntzes (2013) demonstrated that, in the early 2010s, ties within the Romanian-Hungarian border area were still constrained by weak infrastructure and the paucity of crossing points. These suggest that improving border permeability alone is insufficient for peripheral catch-up; cross-border interactions also require adequate infrastructure and institutional cooperation. These insights framed the first analysis, which examined the prospective impact of Schengen accession on the Partium region using a prognostic approach.

The examination of the tourism sector's crisis resilience was likewise grounded in prior scholarship. The COVID-19 pandemic demonstrated that tourism – reliant on international mobility and 'experience consumption' – is among the most shock-sensitive branches of the economy; generic, one-size-fits-all crisis management is therefore ineffective. Hall (2017) and Dogru et al. (2024) emphasise that strategies neglecting internal heterogeneity fail, while Sharma et al. (2021) argue that systematic, sector-level resilience analysis is doubly beneficial: it identifies vulnerabilities in advance and underpins targeted, place-sensitive policies. The markedly diverse tourism offer of the Partium region, stretching from border-side transit hubs to thermal spas and mountain resorts, provided both justification and terrain for the third study's resilience-based methodological approach before and after the crisis.

Quantitative methodology

The quantitative backbone of the research was an integrated spatial database compiled by merging demographic and economic data from multiple sources. Records were linked at the local-authority (LAU) level using harmonised

geospatial identifiers. Spatial matching relied on the EU GISCO mapping database and digital boundary layers for LAU/NUTS regions.

The principal data sources included:

- detailed results of the 2021 Romanian census;
- municipal budget statements from the Romanian Ministry of Finance’s DPFBL database;
- time series from the INSSE TEMPO online database;
- and the census population matrix No. 1.03.

The multi-source, panel-like data structure ensured that all constructed indicators were entered into the statistical analyses in a uniform format. Accordingly, various methods – ranging from descriptive statistics and bespoke indicators to multivariate regressions and spatial-econometric models – could be applied reliably. The integrated database also allowed the inclusion of international comparison data, ensuring that the results remained interpretable within a broader international context.

Details of the statistical and geospatial methods employed

In the empirical investigations, a set of statistical and GIS methods was applied, tailored to the research questions. The principal procedures were as follows:

Borderland Population Concentration Index (BPCI)

In the first analysis, a new indicator was introduced to characterise the distribution of population along the border. Interpretable as a form of linear population density, the BPCI quantifies the number of residents living directly along the state frontier per kilometre of border, thereby signalling the potential intensity of cross-border interactions. To compute the index, we aggregated the population within a 20 km border strip and divided this by the length (in kilometres) of the land border segment under study. For comparability, values were rescaled to the 0–10 interval, where 10 corresponds to the maximum observed within Hungary’s Schengen borderlands (Pozsony County). The index was calculated for both sides of the Hungarian–Romanian border and, for comparison, for Hungary’s other Schengen border sections as well. The BPCI provided a unified metric for comparing borderland population density and served as a starting point for estimating spatial variation in integration potential following the Schengen opening.

Application of the gravity model

The gravity model, widely used in regional science, was employed as a central tool for estimating spatial interactions. By analogy with Newton's law of gravitation, the attraction between two 'masses' is typically proportional to an economic or demographic measure, while distance represents the 'friction' of interaction. We adapted the model to the borderland context, where one mass represented the population of the border-proximate city under examination (proxying city size and potential pull), and the other mass was the Schengen border-crossing point. For the distance term, we used road travel time (in minutes) rather than straight-line distance, as this better reflects adequate accessibility and infrastructure quality. Using the model, we calculated and mapped which sections of the Hungarian–Romanian border fall within the gravitational catchments of major borderland cities such as Debrecen, Szeged, Arad or Nagyvárad. The gravity-potential maps provided an overview of cross-border pull patterns and were compared with the BPCI values: where the model indicated strong urban influence, high BPCI values corroborated substantial population concentration across the frontier. Model outputs were visualised using GIS (QGIS) and Python, rendering the results amenable to cartographic analysis. In this way, the gravity model contributed to identifying potential cross-border economic nodes and laid the groundwork for further integration-focused inquiry.

Labour-market cluster analysis

The second empirical study examined the labour-market characteristics of the Partium region within a national comparative framework using multivariate cluster analysis. To capture the broader macro-regional context, all Romanian counties were included and grouped by numerous labour-market indicators (e.g. activity and employment rates, unemployment rate, employee share, share of industrial employment, etc.). Ward's hierarchical method yielded three well-separated county clusters. Cluster stability and the significance of between-group differences were assessed by one-way analysis of variance (ANOVA). The procedure demonstrated that the counties of the Partium region do not form a homogeneous group in labour market terms; it helped uncover intra-regional differences and positioned the Partium region within Romania's broader labour market typology.

Multivariate regression and spatial-econometric modelling

In the fourth part of the research, the determinants of income inequalities in the Partium region were examined using statistical models. At the settlement level, we first ran multivariate linear regressions and then refined the results using spatial econometric methods. The dependent variable was per-capita personal income tax revenue (RON per capita, 2023), a financial proxy for the incomes

generated locally. Explanatory variables were selected with reference to the literature and regional specificities: population size and density; geographical position (distance and travel time to key centres); and urbanisation category (DEGURBA, as a proxy for network position). As a first step, an OLS model was fitted to the full sample, after which model fit and statistical assumptions (e.g. heteroskedasticity and spatial autocorrelation) were checked. Since the tests confirmed spatial autocorrelation, standard spatial-lag and spatial-error specifications were used to filter neighbourhood effects (Fischer & Nijkamp, 2021). Following Andersson (2018), variables explicitly capturing settlement-network position (centre–periphery categories) were also included so as not to overlook structural factors. In line with domestic spatial-statistics practice (Pénzes, 2014), the final spatial-econometric models combined local characteristics (such as density and accessibility) with a spatial-lag term to capture the influence of neighbouring settlements. This comprehensive regression framework enabled the testing of whether income distribution in the Partium region is governed by a single dominant factor or by the joint effect of multiple drivers.

Time-series analysis of tourism resilience

The third analysis examined how the shock caused by the COVID-19 pandemic affected the tourism sector in the Partium region and the extent to which different areas proved resilient. To this end, a time-series database of tourism performance indicators was compiled for the period 2019–2023. The data collection encompassed the key indicators of the accommodation services branch in Partium. At the settlement level, we recorded, for example, the number of taxpaying tourism enterprises, total revenues, total expenditures, gross profit, and average employment. The resilience assessment was conducted within a multi-step quantitative framework. First, the above indicators for the final pre-pandemic ‘baseline’ year (2019) were compared with those for the downturn (2020–2021) and the rebound (2022–2023). Next, the magnitude of the shock and the speed of recovery were quantified: the decline in 2020 relative to 2019 was identified and the proportion of the baseline level regained by 2023 was calculated. Third, a spatial-typological comparison was conducted: the tourism destinations of the Partium region were categorised by type (e.g. urban business centres, transit corridors, rural/mountain resorts, thermal-tourism sites, etc.), and the resilience patterns of the categories were compared. As Sharma et al. (2021) argue, such resilience analysis has a two-fold practical value: it indicates in advance which areas are most vulnerable in a similar crisis and provides a basis for targeted crisis-management strategies. This approach enabled a differentiated evaluation of the

crisis impact, revealing where declines persisted and which areas recovered more quickly.

3. SUMMARY OF RESULTS

The four interlinked empirical studies collectively provide a comprehensive picture of the transformation of the socio-economic spatial structure of the Partium region and its present challenges. Spanning the assessment of regional integration processes, labour-market trends, tourism resilience, and intra-regional income disparities, the findings are interpretable within a single analytical framework and portray a ‘dual-faced’ border region. In some areas, the Schengen opening, infrastructure investment, and economic dynamism have brought about visible advances and cross-border (re)integration. Elsewhere, however – especially in peripheral, upland and rural zones – persistent lag, adverse demographic/migration tendencies, and the underdevelopment of knowledge-intensive sectors remain severe constraints. The main results of the four sub-studies are summarised below, in line with their respective methodological approaches.

The first empirical study adopted a prognostic approach to analyse the potential effects of Romania’s Schengen accession on the Partium region as of 1 January 2025, with particular attention to the reintegration capacity of the Hungarian–Romanian borderland. Two steps were taken: calculation of the Borderland Population Concentration Index (BPCI) across Hungary’s entire Schengen frontier and application of a regional adaptation of the Newtonian gravity model. In the latter, the ‘mass’ of border-proximate cities was proxied by resident population, while border crossings were assigned unit mass; distance frictions were represented by road travel time. The modelling produced gravity-potential maps indicating which settlements and areas of the Partium region fall within the gravitational pull of major borderland cities – especially Nagyvárad, Arad (or Temesvár in Banat).

The BPCI (Borderland Population Concentration Index) indicators revealed that the Hungarian-Romanian border section occupies an intermediate position among Hungary’s other Schengen border zones. Within the 20-km border strip examined, the proportion of the population (by county) averages 42 per cent, albeit with wide variation. On the Romanian side, counties along the central and northern stretches (Arad, Bihar, Szatmár) display outstanding BPCI values (approximately 2,000 points) and a 60 per cent border-strip population share. By contrast, on the Hungarian side, BPCI values are lower and more dispersed; the highest figures and shares occur along the southern section (in Csongrád-Csanád and Békés counties, where 50 per cent of the population lives within the border strip). The gravity-model results corroborated these differences. Comparing the computed

gravity-potential values with the BPCI indicators showed that where the model signalled a strong pull from borderland cities, high BPCI values typically coincided, signalling substantial population concentration across the frontier. This combined approach highlighted pronounced north–south contrasts within the Partium region: in the south, the mutual gravitational effects of the large cities (e.g. Arad, Temesvár, Nagyvárad) are shaping an increasingly integrated transnational urban network, whereas in the north (the Szatmár-Máramaros area) the absence of comparable poles results in much weaker spatial-organising forces (Figure 1).

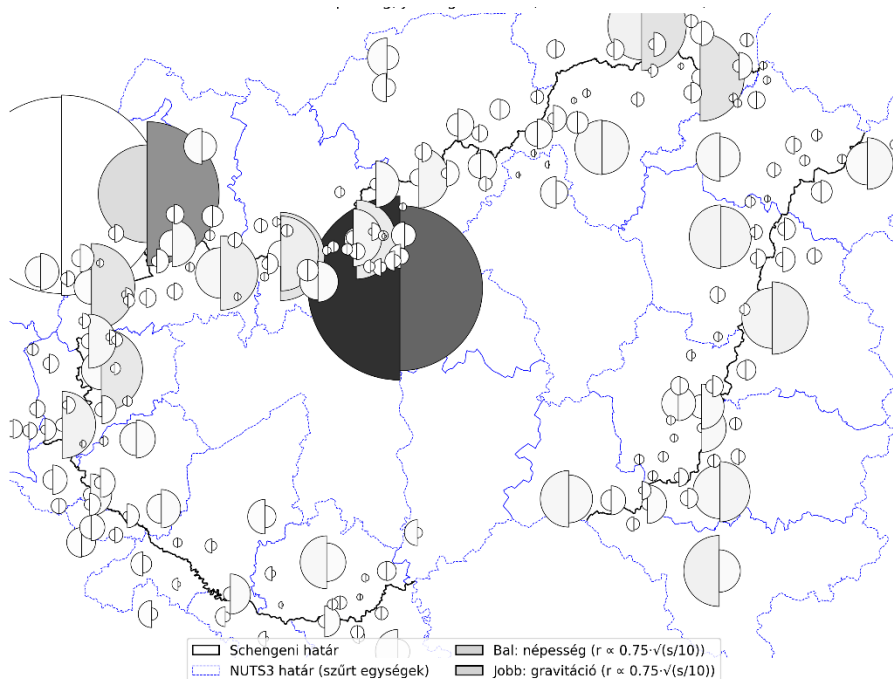


Figure 1: Population and gravitational weight of the cities examined

Source: author's own editing and calculations (Python) based on the 2021/22 censuses and OpenStreetMap databases

Consequently, the expected effects of the Schengen border opening are likewise differentiated: favourable socio-economic changes are most likely where earlier infrastructural development and urban-network linkages have already laid the foundations for integration. Our results align with previous findings in the literature. Péntzes (2013) demonstrated that, in the early 2010s, weak infrastructure and the scarcity of border-crossing points severely constrained cross-border integration. Our analysis also indicates that opening borders alone is insufficient for catch-up; while dismantling physical barriers creates new opportunities, capitalising on them requires the development of appropriate

transport infrastructure and institutional cooperation so that peripheral areas, too, can benefit from the strengthening of cross-border ties. In summary, the first analysis revealed that the Schengen process plays a dual role in the Partium region: it dismantles the physical barriers that once divided the region and invigorates cross-border interactions, but it also redefines the function of the border, to which local society must adapt. Thus, the borderland reintegration potential is realised only under specific conditions, and the favourable effects are geographically uneven.

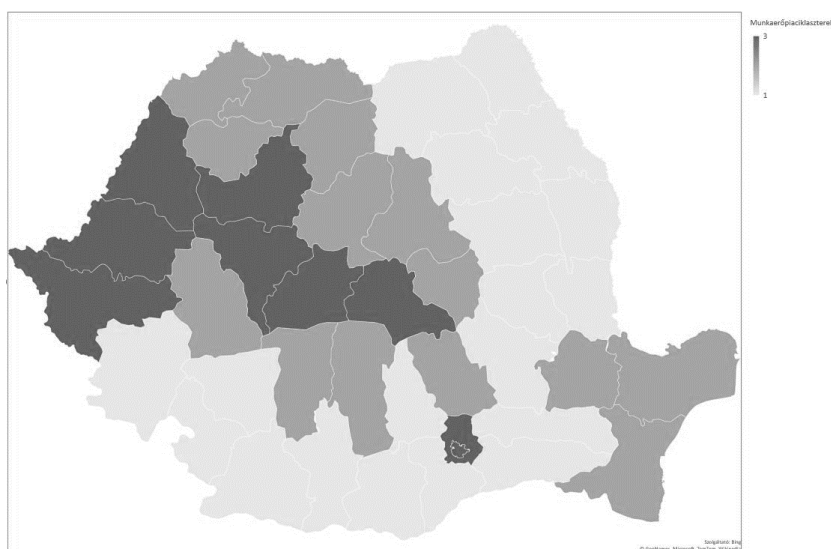


Figure 2: Map of the labour market cluster analysis (2022)

The second study examined labour-market specificities in the Partium region, focusing on its role as a transitional zone between the Romanian and Hungarian economies. Following the late-2000s crisis, national economies embarked on rapid growth, but development remained uneven, and regional disparities persisted. Our results show that Romania's Partium border counties act as a buffer between the two national economies, as indicators in the western border belt (e.g., employment rates, earnings) already approach Hungarian levels. Convergence is particularly visible in Arad and Bihor, the 'gateway' position of which confers advantages over the Romanian average. Manufacturing and logistics have been the principal drivers of structural change – enabled, inter alia, by the extension of Hungary's motorway network towards the Partium region around the 2000s and by lower Romanian wage levels – whereas knowledge-intensive sectors remain under-represented, potentially constraining sustainable growth. The favourable dynamics of the western belt do not automatically diffuse to the region as a whole.

To typify these patterns, we complemented hypothesis testing with multivariate cluster analysis for all 41 Romanian counties (activity and employment rates, unemployment, shares of industrial and transport employment, etc.). Ward's hierarchical procedure yielded three distinct clusters of counties (Figure 2.). The most advanced cluster – nine contiguous counties in western and central Romania plus Bucharest-Ilfov – includes Arad and Bihar, signalling convergence towards the national frontier group. A second, 'medium' cluster comprises 14 counties, among them the rest of the Partium region (Szatmár, Szilágy, Máramaros), forming a buffer around the core. The third cluster contains the least-developed counties (all of Moldavia and several southern counties). Thus, the counties of the Partium region can be divided into two subgroups: the southern gateway counties (Arad, Bihar) exhibit semi-peripheral features trending towards the core, while the northern counties tend to stagnate. These differences stem less from immutable regional traits than from borderland position and gateway functions; the state frontier is also a significant economic divide. Overall, the Partium region is a typical semi-periphery: the western fringe is converging towards core economies, yet a pronounced internal north–south fault line persists.

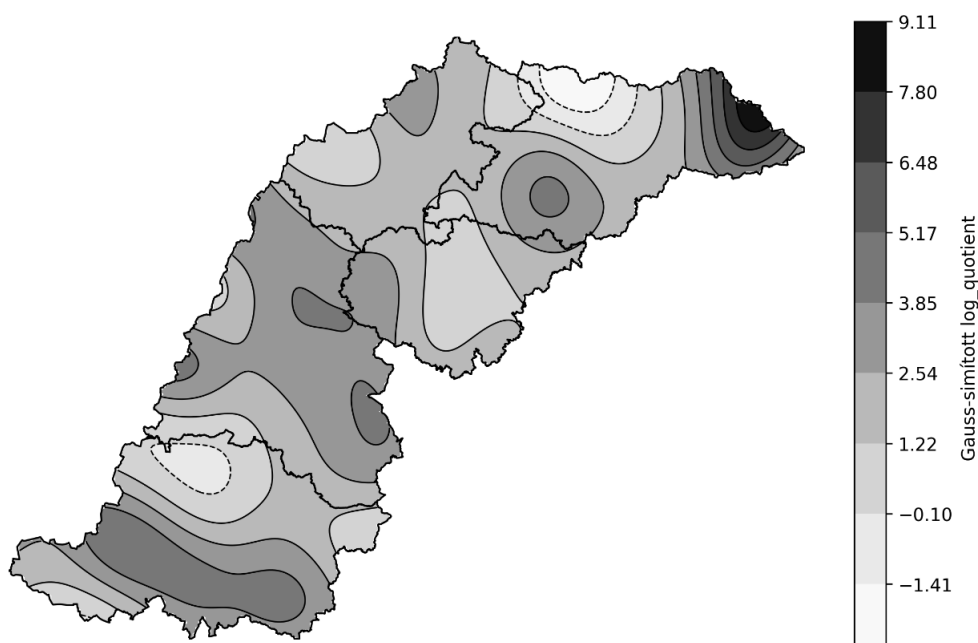


Figure 3: Changes in labour productivity between 2019 and 2023 in the accommodation services sector

Source: author's own editing (Python) based on Informații fiscale și bilanțuri MF, 2024

The third sub-study examined the question of regional sectoral resilience, taking the tourism sector of the Partium region as a case study. Due to its global

character, tourism is among the most vulnerable branches of the economy, and the COVID-19 pandemic struck it as a drastic shock. International and domestic tourist flows collapsed in 2020, followed by only a partial and uneven recovery. Our research covered the period 2019–2023, encompassing the last pre-pandemic ‘baseline’ year (2019), the most critical phase of the crisis (2020–2021) and the years of rebound (2022–2023), the latter further shaded by influences such as the proximity of the war in Ukraine and its indirect tourism effects (e.g. the temporary avoidance of borderland destinations in Máramaros, the accommodation of refugees).

We compiled a firm-level database from the records of the Romanian tax authority (ANAF), we extracted the annual net turnover and employment of all accommodation-services providers in the Partium region (CAEN 5510, 5520, 5530, 5590) and aggregated these to the settlement level, which enabled us to track the performance of tourism enterprises relative to the pre-crisis level and to calculate changes in labour productivity (turnover per employee). The time-series analysis revealed that the effects of the COVID shock were highly differentiated across the region. In 2020, the tourism indicators of all five Partium counties declined steeply; however, from the second half of 2021, unexpected differences emerged in the rebuilding phase. Paradoxically, in certain parts of the economically less developed northern counties – above all in rural, upland and thermal-tourism segments – we observed a brisk post-COVID revival.

After the lockdowns, these peripheral areas gained appeal as alternatives to crowded urban destinations. In the upland settlements of Máramaros and at some rural spa resorts in Szatmár County, domestic tourism recovered relatively quickly, and in some places, visitor numbers exceeded their 2019 levels. This suggests that, given appropriate conditions, even peripheral areas may display unexpected adaptive capacity, thereby enhancing their resilience. By contrast, destinations chiefly reliant on international transit suffered much more persistent losses: traffic in such places (e.g. Nagyvárad’s transit role, or smaller border towns along motorway corridors) remained below earlier levels even in 2022, signalling the lingering effects of border closures and travel restrictions.

Spatial visualisation of the results yielded further important insights. Settlement-level maps brought into relief the ‘hotspots’ and ‘blind spots’ of resilience (Figure 3). We could clearly identify areas where tourism performance had already bounced back by 2022, as well as zones where the sector was effectively paralysed during the crisis and found little substitute demand. To probe deeper relationships, we again employed gravity modelling, this time in an innovative way: we constructed a gravity map in which the ‘mass’ was not resident population but the tourism turnover of the central settlements. This allowed us to examine the extent of the catchments of the primary tourism nodes (cities, resorts) in the surrounding area on the basis of revenues. As a result, the principal tourism poles of the Partium region emerged: major cities and internationally known spa destinations such as Nagyvárad and nearby Félixfürdő. In their wider environs, the revenues of tourism enterprises regenerated more quickly, pointing to the advantages of network connectivity and diversified product portfolios. At the same time, the gravity map also identified ‘empty’ areas where tourism virtually stalled and no alternative markets or flagship destinations were available nearby.

Taken together, the resilience analysis revealed that the impact of an identical exogenous shock (COVID-19) can vary within the region; therefore, crisis management must be sensitive to the specificities of individual segments and locations. Our findings have practical value, as they can inform local crisis-management strategies and the design of state/EU support programmes. Supporting mountain and rural tourism could stimulate the economies of the northern counties, whereas providers dependent on transit traffic will require longer-term measures to recover. The differentiated analysis of tourism resilience is thus not merely of theoretical interest: it offers concrete guidance to decision-makers for the efficient allocation of resources and the prior identification of vulnerable points.

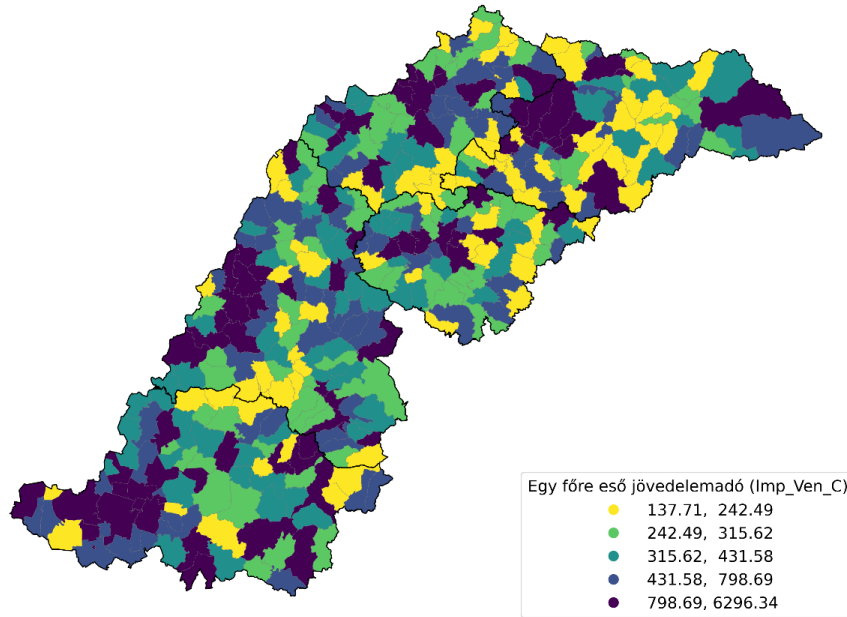


Figure 4: Classification of the municipalities in the Partium region by the per-capita value of the income tax paid within their territory

Source: author's own editing based on 2023 local-government budget-execution (outturn) data (Python)

The fourth, concluding study mapped the spatial patterning of income inequalities in the Partium region, with particular attention to the spatial-organising gravitational effects exerted by borderland cities. The analysis was built on an integrated, settlement-level database that combined multiple sources. First, we collated the 2023 personal income-tax receipts of all local authorities in the Partium region as a proxy for incomes generated locally. Under Romanian budgetary rules, local authorities receive back a fixed share of the personal income tax paid within their territory, which enables a like-for-like comparison of income-generating capacity across settlements. These data were complemented by demographic characteristics (population size, population density), the degree of urbanisation (urban–rural status; DEGURBA), network position (functional catchment, central functions) and road-access indicators (travel time to the nearest county seat and regional centre). On this database, we ran multivariate regression analysis: we first used classical OLS to identify the statistical determinants of income differences, then, to address spatial autocorrelation, estimated spatial-econometric specifications (testing spatial-lag and spatial-error models). The dependent variable was per-capita personal income-tax revenue for the settlements under study, a robust financial proxy for average income levels. Explanatory variables were selected in light of preliminary analyses and the

literature: population size and density, urban or rural status, distance to the nearest county seat, and whether the settlement can be considered part of a larger urban agglomeration.

The results indicate that income levels in the Partium region are primarily shaped by geographical position, population density, and network role. A marked south–north divide is evident: per-capita incomes are substantially higher in the southern counties (Arad, Bihar) and significantly lower in the north (Szatmár, Máramaros, Szilágy). In 2023 the five Partium counties together generated roughly 3 billion lei of personal income tax, more than half of which came from two counties – Bihar (32 per cent) and Arad (25 per cent) – whereas Szatmár (14.5 per cent), Máramaros (20 per cent) and Szilágy (9 per cent) together accounted for only 43 per cent. This indicates an intense territorial concentration of economic performance: southern Partium serves as the region’s growth engine, while a lagging periphery emerges in the north (Figure 4). The OLS estimates also show that proximity to county seats and good accessibility are positively correlated with settlements’ per-capita incomes, whereas residents of small, isolated villages and internal peripheries have markedly lower incomes. This is consistent with a gravitational interpretation: the large borderland cities – especially Nagyvárad and Arad – shape their surroundings such that income levels are higher within their catchments; however, in relative terms, the gap to the adjacent peripheries may widen. In the case of Nagyvárad, although it is the largest economic centre in the Partium region, its regional reach is moderated by the attractive force of Debrecen just across the border, which may siphon off part of the development potential. Arad’s position is comparatively more advantageous: together with nearby Temesvár, a cross-border growth zone is polarising in south-western Partium. A key finding is that, according to the models, surplus income generated in the Partium region diffuses only weakly to peripheral areas; incomes arising in the cores are spatially weakly distributed, thereby reproducing centre-periphery disparities. This accords with the finding of Pardy and Rodríguez-Pose (2025) that integration within the EU Single Market often widens wage disparities to the detriment of peripheral regions with weaker knowledge bases.

Viewed in the context of the literature, the final study confirms a pronounced internal north–south divide within the Partium region. The economic indicators of the southern counties (including incomes) approach Hungarian averages, whereas northern areas display features of a lagging periphery. Proximity to the large borderland cities further reinforces this contrast: around Arad, in conjunction with Temesvár, a dynamic cross-border urban network is taking shape, while in the case of Nagyvárad the presence of Debrecen divides the developmental potential. Structural factors also matter: the region experiences

substantial out-migration (notably of young workers to Western Europe), which weakens the local human capital base. Although infrastructure has improved markedly in recent decades (e.g., motorways built to the frontier; new crossing points), the weakness of knowledge-intensive sectors and the persistent lag of certain internal peripheries (areas comprising small, ageing villages) continue to constrain catch-up. Without external intervention, there is a risk of further internal divergence. As Kocziszky and Szendi (2023) warn, current trends suggest that, if the lag of peripheral areas persists, divergent development paths may emerge within the region. At the same time, the intensifying economic cooperation stemming from Schengen integration and post-COVID recovery funding also opens up opportunities: new cross-border industrial zones and clusters could develop, currently concentrated primarily in the south. However, this will translate into gains for the region as a whole only if development policy deliberately encompasses the catch-up of the peripheries as well.

Viewed as a single whole, the four empirical studies of the dissertation show that the Partium region has become a ‘dual-faced’ East-Central European border region. The Schengen opening and economic dynamism have accelerated integration and growth in some areas, especially in the southern counties, which are dominated by large borderland cities. Elsewhere in the region, particularly in the north and in rural peripheries, historic disadvantages, an adverse migration balance, the proximity to the Ukrainian border, and the weakness of the modern knowledge-based economy continue to produce a persistent lag. The findings also underscore that effective development strategies require a deep understanding of the region’s internal cohesion, economic processes and social dynamics, and should not overlook its fit with neighbouring macro-regions.

4. NEW SCIENTIFIC RESULTS (THESES)

T1. Demonstrating the duality of Partium's spatial structure: Drawing on high-resolution, local-authority time series and combining labour-market, income, and infrastructural indicators, the analysis demonstrates that the Arad–Nagyvárad corridor displays semi-peripheral features with increasing centrality, whereas the Máramaros–Szatmár–Szilágy triangle retains a persistently peripheral character. It can be demonstrated that, following Romania's Schengen accession, economic growth does not proceed homogeneously, but in a fragmented and spatially selective manner: a marked expansion of a southern core contrasts with a persistent peripheral character in the north.

T2. A comprehensive five-dimensional comparison of border sections: Through a five-dimensional benchmarking exercise, introducing the Borderland Population Concentration Index (BPCI), the NUTS-3 units along the Hungarian-Romanian and Hungarian-Croatian borders were compared using infrastructural, border traffic, gravitational, ethnocultural, and demographic indicators. The results indicate that, in all five dimensions, the integration potential of the Hungarian-Romanian border exceeds that of the Hungarian-Croatian section. Taking these factors into account, development policy can be shaped in a way that enables the region to fully benefit from the accession to the Schengen area.

T3. The reintegrative effect of accession to the Schengen area: Evidence shows that the revitalisation of settlements previously located peripherally on either side of the state frontier had already begun before the accession to the Schengen Area, especially in places within the suburban belts of large cities. These processes began following EU accession, and accession to the Schengen area is expected to accelerate the ongoing reintegration.

T4. Gravitational and clustering potential between city pairs: In the Hungarian-Romanian border region, the economic integration capacities of cross-border city pairs substantially exceed the values characteristic of the Hungarian-Croatian border section, especially in the Debrecen-Nagyvárad and Szeged-Arad-Temesvár axes, which show scope for further development (and competition).

T5. Statistical confirmation of the 'buffer-zone effect' in moderating Hungarian–Romanian labour-market indicators: Analysis based on data from the National Institute of Statistics (INSSE) confirms that the labour-market characteristics of border counties fall between the Hungarian and Romanian national averages, thereby attenuating the East-Central European labour-market fault line that runs along the Hungarian-Romanian border.

T6. A labour-market cluster typology for Romanian counties: Using a hierarchical cluster analysis allowed for the identification of three coherent labour market groups. Among the Partium counties, Arad and Bihar were placed in the dynamic ‘industrial-logistics’ cluster, while Szatmár, Szilágy and Máramaros into an intermediate ‘peripheral manufacturing’ cluster. The result confirms that labour-market cohesion within the region is not uniform and closely correlates with economic performance.

T7. Determinants of income inequality identified via spatial regression: Multivariate regression models indicate that population density and accessibility to the county seat account for a significant share of the income-tax variation, with the urbanisation rate also exerting a significant impact. The research indicates that time-based accessibility indicators are stronger predictors than mere distance in kilometres. However, this difference may only become statistically significant as regional infrastructure develops.

T8. A COVID resilience paradox in tourism.

Company-level turnover data for 2019–2023 reveal that the accommodation revenues of Máramaros and Szatmár counties, despite their peripheral location, weaker infrastructure and lower tourism capacity compared to Bihar, quickly exceeded their 2019 levels, whereas performance in the southern counties of the Partium region with a high volume of transit traffic (Bihar, Arad) appears to be more subdued. This finding invites a reappraisal of the received wisdom on the vulnerability of peripheral areas.

5. CONCLUSIONS AND RECOMMENDATIONS

The findings of the four interlinked sub-studies are valuable not only in theoretical terms but also directly applicable in several practical domains. (1) They provide guidance for regional development policy, especially in designing cross-border programmes. (2) They furnish a basis for urban and infrastructure planning by indicating where, and what types of, interventions are needed to mitigate territorial inequalities. (3) In tourism development, the resilience-oriented results support the design of strategies that make the sector more resistant to shocks. (4) Finally, for labour-market programming, the research has identified specific labour-market features of the Partium region, enabling the introduction of targeted employment policies. Below, we outline how the individual findings can be applied in practice and how they may contribute to the sustained development of the Partium region.

Regional development policy and cross-border integration: The analysis of reintegration capacity along the Hungarian-Romanian border reveals that dismantling border impediments alone is insufficient to revitalise the borderland: an adequate infrastructural base and institutional cooperation are also required. The Borderland Population Concentration Index (BPCI) calculated in the dissertation, together with the gravity model outputs, offers concrete guidance to planners of cross-border development programmes. A comparative analysis of BPCI values highlighted the areas within the Partium region where significant reintegration potential is concentrated (e.g., the Nagyvárad-Biharkeresztes, Debrecen-Érmihályfalva, and Arad-Battonya areas).

In these zones, the conditions are favourable for intensive cross-border economic relations and commuting, warranting prioritisation within cooperation programmes. The research identified key areas most likely to benefit from improved permeability after the Schengen opening, notably the already closely connected Arad-Temesvár-Szeged area and the Nagyvárad-Debrecen axis. In policy terms, this implies continuing borderland investments that improve effective local permeability – upgrading roads on lagging stretches and supporting economic and cultural initiatives among partner settlements. Our results support the creation of industrial parks and fostering clustering processes where the borderland population is dense and urban gravitational pull is strong, while on sparsely populated stretches, reintegration should be underpinned above all by improved transportation conditions and the strengthening of human ties. Overall, the research provides a robust, data-driven foundation for borderland development policy.

Urban-network and infrastructure planning: The dissertation reveals a marked north-south gradient in the Partium region, with important implications for spatial planning. The (Temesvár)-Arad-Nagyvárad axis has undergone dynamic development over the past two decades: industrial investments have been launched, logistics networks strengthened and intensive labour flows can be observed. By contrast, the northern part of the Partium region (Máramaros, Szatmár, Szilágy) remains peripheral, with underrepresented knowledge-intensive sectors, weak external capital attraction, and slow structural diversification. These differences are also reflected in infrastructure endowment and accessibility. The indicators of the counties in the south, which are directly connected to EU networks by large-scale infrastructure, already approach Hungarian averages, while further north, a lagging periphery emerges. Infrastructure planning should therefore prioritise the integration of the northern area into the main networks. The results suggest that extending the motorway network towards Szatmárnémeti-Nagybánya and building high-speed links between the frontier and interior are crucial for catching up in the northern counties. At the level of the urban system, the organising power of borderland cities clearly transcends state boundaries. While nearby Debrecen curtails the regional role of Nagyvárad, the case of Arad illustrates that the proximity of Temesvár fosters an increasingly integrated growth pole, which, augmented by Szeged, could serve as the seed for a cross-border urban network in the southern Partium and the southern Great Plain. Planning should deliberately support this process through joint projects, coordinated urban-network strategies, and infrastructure investments that facilitate inter-city connections (e.g., improved rail and road links between Szeged and Temesvár/Arad). The gravity-model maps created in the research indicate which areas of the Partium region fall within the catchments of specific centres; these functional urban areas provide a sound basis for regional planning and resource allocation. In short, interventions must be differentiated and place-specific: build on the strengths of the southern corridor while reducing the isolation of the northern periphery, thereby strengthening existing centres as well as improving the accessibility of outlying areas to narrow the centre–periphery gap.

Tourism development and resilience: COVID-19 exposed tourism as one of the sectors most sensitive to external shocks. Consistent with this, the third study of the dissertation analysed the resilience of Partium’s tourism in detail, yielding several actionable lessons. Rather than uniform crisis-management solutions, differentiated, sector- and place-specific strategies are needed. The highly diverse tourism offer of the Partium region, ranging from transit flows and thermal resorts to upland and urban attractions, enabled us to demonstrate how the same crisis produces different outcomes across sub-regions. The research identified

vulnerabilities: transit-dependent urban accommodation experienced drastic declines, whereas some peripheral areas (northern rural, upland and thermal destinations) exhibited rapid post-pandemic revival. For policymakers, this argues for product diversification and development rooted in local strengths: alongside mass urban tourism, greater emphasis on alternative products (eco-, health- and active tourism), which proved more shock-resistant. The resilience framework also provides a tangible basis for crisis-management protocols, region-specific rescue packages for the hardest-hit areas, programmes to increase the flexibility of firms, such as support for digital transition (Csapó et al., 2023), and campaigns to stimulate domestic tourism. The dissertation also notes that support schemes are more effective where territorial specificities are recognised, confirmed by Hungarian examples as well (Bujdosó et al., 2025).

Labour-market programmes and social convergence: Analysis of the labour market characteristics of the Partium region underscores a dual internal development pattern: employment and economic activity indicators are more favourable in the south, while the north exhibits a persistent lag. Regarding the employment structure, economy in the Partium region is driven by manufacturing and logistics, which exceeds the national average (e.g., the share of manufacturing is 8 per cent higher; relative deviation +38 per cent), whereas several knowledge-intensive sectors are underrepresented. The employment share of the information and communications sector is only about one-third of the Romanian average (relative deviation of –65 per cent); the financial and scientific sectors are also underperforming. These differences provide clear guidance for labour-market programming. In the more dynamic south, where transnational motorway links and, for an extended period, comparatively low wages attracted investment, programmes should raise human capital levels and encourage higher value-added activities. As many young professionals leave the region for Western Europe, labour market and education policies need to offer attractive local prospects to retain or attract them back, including scholarships and traineeships in strategic sectors, as well as local start-up incubators and innovation hubs. In the northern periphery, programmes must focus on convergence and integration, employing employability-enhancing training (re- and upskilling aligned with the needs of emerging sectors) and supporting local enterprise development to create jobs in stagnating areas. The research shows that peripherality need not entail permanent decline: in some northern micro-regions, renewed thermal tourism has revealed latent potential. In summary, targeted measures are needed that simultaneously develop human capital, strengthen the pillars of a knowledge-based economy, and improve the conditions for spatial mobility.

Summary: The results provide decision-makers with actionable insights. Whether designing regional strategies, planning infrastructure, developing tourism or programming labour-market interventions, the research identifies the critical factors and territorial differences that must be taken into account. The region's duality – rapid advances in some areas and persistent lags in others – highlights the need for a deep understanding of Partium's internal cohesion, economic processes, and social dynamics, as well as its fit with neighbouring macro-regions. Only development policies grounded in such knowledge and tailored to the heterogeneity of the region can open the way to sustained convergence and genuine cross-border economic integration. Awareness of the territorial patterns and vulnerabilities identified here enables the design of an integrated regional development approach that simultaneously strengthens cross-border integration, raises economic resilience and ensures that the fruits of growth are shared across the entire region.

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