University of Sopron
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THE LONG-TERM RELATIONSHIP BETWEEN RESILIENCE AND COMPETITIVENESS BASED ON TWO REGIONS

Theses of Doctoral (PhD) Dissertation

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1. JUSTIFICATION FOR CHOOSING THE TOPIC

One of the prominent issues in regional science is the examination of the flexibility and competitiveness of regions. Researchers dealing with this topic have investigated how to determine the responses of regions to external environmental impacts and crises. What are the factors and characteristics that facilitate quick and efficient responses and recovery from crises, and what are those that hinder or slow down a rapid recovery? The temporal changes in these characteristics are the focus of the studies.

In addition, the examination of the competitiveness of regions has come to the attention of the researchers. This is primarily based on the propensity for market competition, and secondarily on how individual regions can withstand continuous competition. Since each region has a unique economic and social structure, they are affected differently and respond in various ways. The measurement of competitiveness has become complex, requiring not only a single indicator but also a comprehensive analysis of the characteristics and development status of the examined region. Therefore, regions need to have independently formulated strategies to effectively respond to environmental and economic crises and government interventions they face, as governmental decisions can

significantly influence the life of a region. Their adaptability determines their flexibility and competitiveness.

The author's earlier research inspired them to analyse regional flexibility and competitiveness in a more profound and extended time frame, developing a new methodology for this analysis. According to the author, the flexibility and competitiveness of regions are fundamentally influenced by the long-term, distinctive economic and social processes of the territorial units and the factors determining them, along with their characteristics.

Therefore, to be able to analyse regions, it is necessary to conduct a time-series examination of the territorial units composing them and to uncover the relationships formed between them, exploring the reinforcing and weakening attributes.

2.   THE OBJECTIVES AND HYPOTHESES OF THE THESIS

The aim of the thesis is to conduct resilience studies based on counties in Hungary and to search for the necessary data for a long-term analysis spanning a 60-year time interval. A crucial objective is to examine the resilience and competitiveness at the county level within the region, conduct related comparative analyses, and develop a unique research methodology. This

methodology will enable the performance of competitiveness analyses at both the county and regional levels using the created database.

THE AUTHOR FORMULATED THE FOLLOWING HYPOTHESES:

H1. Sufficient regional and county-level data for long-term analyses in Hungary can be researched, from which a new methodology can be developed. This methodology would enable the creation of complex regional indicators from county-level resilience metrics.

H2. It is possible to determine a set of indicators beyond economic metrics that influence the resilience and competitiveness of regions.

H3. The resilience and competitiveness of counties can be determined, along with their relationship to regions. Furthermore, the relationship between resilience and competitiveness can be examined.

H4. The stability of regional systems and the conditions for regional balance can be more accurately examined through long-term, complex analyses than through short-term crisis analyses.

H5. When examining the resilience and competitiveness of regions, it is necessary and not sufficient, to conduct a complex analysis of the counties that comprise them.

3. CONTENT AND METHODOLOGY OF THE RESEARCH

The thesis presents the analysis of two NUTS 2 regions in Hungary: the Western Transdanubia region and the Southern Transdanubia region. Each of the examined regional development regions consists of 3 counties, and due to their unique characteristics, they shape the economic, social, and cultural situation, human capital, political thinking, and settlement structure in a distinct way. The research can be further divided into two major parts for each region: the analysis of regional resilience and regional competitiveness.

The author conducted data collection at the county level spanning 60 years, from 1960 to 2020. The selected county-level statistical data from the 1960s are structured in a way that aligns with the current data collection structure and can be analysed over time. These data are valid and sourced from the Central Statistical Office (KSH), with extensions and units of measurement that can be corresponded over time. *The data collection was significantly hindered by the limited availability of digital databases for the first 30 years. These data had to be individually digitised from the annual county and territorial statistical yearbooks.*

Over the course of the examined 60 years, specific data amenable to comparative analysis were derived from collected county and national-level datasets. Additionally, data were formulated as percentages relative to the national average. The percentage data, contextualised against the national mean, effectively delineate the individual counties' significance and fluctuations in importance within the country over the six-decade period. The author placed considerable emphasis on data continuity, deeming it crucial for facilitating analyses across disparate temporal spans and periodic breakdowns. The entirety of the available 65 indicators was categorically organised by the author into seven distinct factor groups: demographic factors (comprising 13 indicators), labour market factors (comprising 10 indicators), economic and industrial factors (comprising 3 indicators), agricultural factors (comprising 15 indicators), infrastructure and utility factors (comprising 11 indicators), healthcare factors (comprising 8 indicators), and educational factors (comprising 5 indicators).

In the methodology of regional resilience, the thesis explores the methodology for Resilience Factors (RF) and Resilience Index (RI) for all counties, as well as the methodology for Region Resilience Factors (RRF) and Region Resilience Index (RRI) for the Southern Transdanubia and Western Transdanubia regions.

After delineating the methodology for resilience examinations, the author devised the methodology for regional competitiveness, adapting it to the database created during the research based on the available literature. The author determined the analytical methodology for factor groups, which included correlation analysis, principal component analysis, and cluster analysis. The research methodology thus formulated provides the opportunity for the application of resilience measurements at multiple levels and across a broad spectrum. It also facilitates the analysis of competitiveness using the same database.

4. RESULTS OF THE RESEARCH

The results of the resilience analysis for the Southern Transdanubia region

Significant disparities are evident in the adaptive capacities among the counties within the Southern Transdanubia region, each characterised by distinct dominant factors. Over the examined 60-year period, efforts to stem population decline and emigration have proven ineffective in each county. The negative demographic indicators project continued population decrease. Infrastructure deficiencies, particularly notable in Tolna County, persist. The region's heterogeneity has intensified, especially in the domains of the labour market, economy and industry, and infrastructure. This trend suggests a

failure of the counties to leverage the opportunities inherent in territorial relationships and regional structures. Furthermore, they have not succeeded in developing their respective county-level economic and social structures sufficiently to enhance their adaptive capacities.

Examining the Region Resilience Factors, it can be stated that significant regional weaknesses are evident in the demographic domain, and the region has not achieved any job-creating structural changes. There has been no substantial economic and industrial breakthrough, and the agricultural factor cannot be considered dominant.

Health indicators notably contribute to defining the region's adaptability, yet in the realm of education, substantial disparities are discernible, particularly in Somogy and Tolna counties. The degree of lag in comparison to Baranya county is so pronounced that the factors in Baranya cannot offset it. This imparts a marked heterogeneity to the region, significantly impeding its adaptability.

The results of the competitiveness analysis for the Southern Transdanubia region

In the principal component analysis of the Southern Transdanubia region, it can be observed that there is a close relationship between demographic, healthcare, and economic-

industrial factors, which is crucial for the competitiveness of the region. Competitiveness in the region is also determined by factors such as skilled labour, the educational level of the population, and the employment relationship system.

The cluster analysis revealed that between 1960 and 2020, the dispersion characteristic of the main components of the counties presents a rather heterogeneous picture in terms of the values of larger clusters.

In the competitiveness indices of the counties comprising the region, Baranya County stands out with a high positive composite index value, contrasting with the lagging negative values of Tolna and Somogy counties. However, this was not sufficient to render the overall regional competitiveness index positive. Overall, the competitiveness of the Southern Transdanubia region can be considered as lagging.

The results of the resilience analysis for the Western Transdanubia region

The region mostly leveraged its geographical advantage stemming from its proximity to the border, which not only offset the post-transition decline in economic and industrial factors but also initiated a distinct and dynamic development in labour market, infrastructure, and agricultural factors. This

allowed for a resurgence of positive growth in these factors following the 2008 economic crisis.

During the examination of the Western Transdanubia region, a high degree of heterogeneity is observed among the counties constituting the region in several factors. Győr-Moson-Sopron County significantly outpaces the other two counties in demographic, economic and industrial, agricultural, and educational factors, with their lag persisting substantially and durably in these areas. Győr-Moson-Sopron County is the least resilient in the region, indicating that, on a per capita basis, it has not kept pace with the other two counties in infrastructure development.

Overall, it can be concluded that in the Western Transdanubia region, demographic differences are so significant that this factor negatively impacts the region despite the attractive force of Győr-Moson-Sopron County. The region's economy and industry experience periodic, occasional growth, while agricultural values contribute positively to the region's resilience in the second cycle of the examined period. Healthcare serves as a stable foundation for the region's resilience for most years, especially in the period between 2010 and 2015. In contrast, the field of education consistently exhibits a deep negative trend throughout, distinctly impairing

the region's resilience despite high labour market and healthcare values.

The results of the competitiveness analysis for the Western Transdanubia region

During the principal component analysis of the Western Transdanubia region, it can be observed that demographic, economic and industrial, agricultural, and educational factors appeared with positive factor loadings, while the healthcare factor exhibited a negative factor loading, indicating a strong relationship among them. In the second principal component, the labour market factor stood out as a significant determinant of competitiveness. The cluster analysis revealed the formation of two distinct clusters, reflecting the bipolar structure of the region, which negatively affects its competitiveness, as the counties in the region are unable to reinforce each other.

The competitiveness indices of the counties comprising the region revealed that the outstanding competitiveness values of Győr-Moson-Sopron County are not sufficient to make the entire region competitive due to the lagging performance of the other two counties.

5. THESES OF THE DISSERTATION

T1. For long-term, representative analyses in Hungary, sufficient regional and county-level data is available, from which a new methodology can be developed to create complex regional indicators from county resilience metrics. The author proved that a sufficient quantity of data can be explored, and long-term Hungarian databases can be established for conducting county and regional resilience and competitiveness analyses.

The author conducted a comprehensive search for a total of 65 indicators spanning the period from 1960 to 2020, resulting in 3,628 raw data points per county. A collective dataset of 51,004 raw and standardised data points was utilized for principal component analyses, cluster analyses, correlation calculations, the determination of competitiveness indices, and for conducting comparative analyses. Additionally, the author generated an extra set of 21,768 data points for the analysis of national ratio figures.

T2. The set of indicators that influence the resilience and competitiveness of regions can be identified beyond economic metrics.
Through the examination of principal components derived from correlation-based principal component analyses, the author

confirmed that, beyond economic indicators, it is possible to identify social metrics that play a crucial role in the realms of resilience and competitiveness. The most significant factors, based on the examined areas, include labour market, educational, agricultural, demographic, and infrastructural factors.

T3. The resilience and competitiveness of counties can be determined, along with their relationship to regions. Furthermore, the relationship between resilience and competitiveness can be examined.

The relationship between resilience and competitiveness indices was established through the weighting of principal components. During the examination of individual factors, different elements played crucial roles in assessing the region's resilience, primarily indicating differences relative to the region and their temporal changes. On the other hand, during principal component analysis, the strength of relationships between factors indicative of competitiveness determined the most significant elements, showcasing the region's strength. The detected correlations between resilience factors and competitiveness further enable the exploration of their additional impact on the region.

T4. Long-term, comprehensive analyses allow for a more precise examination of the stability of regional systems and the conditions for the balance of the region compared to short-term crisis analyses.

Over the 60-year study period, it has been demonstrated that significant socio-economic changes can generally induce lasting alterations in the resilience of the examined regions, bringing about concurrent changes in multiple factors. Therefore, through the long-term examination of individual areas—rather than in 7-14 year intervals or within the budgetary cycles of the EU—the changes in socio-economic processes and the resilience of areas can be better understood and determined. This understanding can serve as the basis for developing regional development strategies.

The results of long-term time series analysis are suitable for examining certain impacts in both the medium and long term. A good example of this is the long-term impact of automotive industry investments in Győr-Moson-Sopron County. Long-term analyses are also suitable for the short and medium-term examination of individual factors, such as the rapid changes in labor market factors.

According to the author, the speed of resilience change depends spatially and temporally on significant impacts occurring in a given society, as well as on the responses from

local governments and the central government, and the interrelationships among them.

T5. When examining the resilience and competitiveness of regions, it is necessary, and not sufficient, to conduct a comprehensive analysis of the individual counties comprising them.

The research has confirmed that when examining the resilience and competitiveness of regions, it is not sufficient to analyse the regions as unified wholes. The counties are the relevant territorial units that significantly influence the resilience and competitiveness of the regions.

The results of resilience and competitiveness examinations of counties can significantly differ from each other; the heterogeneity of the examined regions varies, with both leading and lagging areas present within a single region. It is also observed that urban spaces develop in competitiveness, while regions lacking urban areas experience a decline in resilience and competitiveness. The complex resilience index of regions is composed of numerous factors, which may not necessarily reflect the internal resilience structure of the region and, on its own, does not facilitate the formulation of the region's development strategy. To determine developmental disparities within the region, the examination of territorial units

forming the region, such as counties, sub-regions/districts, cities, and city-regions, is strongly recommended in the future.

6. CONCLUSIONS AND RECOMMENDATIONS

In the context of long-term resilience analyses, it has become evident that over the course of 60 years, there has been an increase in heterogeneity within the examined regions, accompanied by growing disparities in county-level resilience. This suggests that, over time, counties with initially similar resilience profiles have experienced divergent trajectories, with some advancing to the forefront while others have fallen behind. These changes can be linked to significant interventions, such as industrial restructuring, major investments, and European Union development support, which have substantially altered the resilience of the counties. Counties that did not experience substantial job-creating investments gradually lagged behind the leading ones.

These results also demonstrate that when the NUTS 2 regions were originally geographically designated, socially and economically heterogeneous areas were formed, and over time, differences within the regions emerged that, without significant interventions, have become insurmountable. These internal disparities significantly hinder the achievements of prominently developing areas at the NUTS 2 level. The relationships among

territorial units within the region do not reinforce but rather weaken each other. They are unable to leverage each other's comparative and competitive advantages for mutual benefit. Instead, over time, these advantages diminish, leading to the lagging behind of less competitive counties. It might be worthwhile to reconsider the structural support for lagging regions and the development of lagging factors.

The author suggests designating the so-called **'convergence space'** (space not defined by administrative boundaries) within the region. Here, the resilience and competitiveness disadvantages of a specific geographic area are much more evident. It is more recommendable at this level to implement directed and well-targeted territorial development interventions. However, administrative and development policy control is still proposed at the county and regional levels.

7. FURTHER RESEARCH DIRECTIONS

According to the author, the resilience and competitiveness of regions depend on the adaptability and competitiveness of the territorial units that make them up. Therefore, solely examining regions and relying on region-based development policies are no longer sufficiently effective, and they do not identify support for areas where resources can be used most efficiently. Consequently, it is essential to study **the resilience structure**

of each region, focusing on areas with significantly different adaptability within the region, such as counties, districts, cities, and urban catchment areas. This approach allows for the identification of leading areas, their catchment areas, and their impact on the surrounding space, as well as the determination of lagging or **convergence areas**. By analysing the resilience and competitiveness factors specific to each area, it becomes possible to designate development and targeted intervention directions, ensuring that targeted development occurs in leading areas while simultaneously achieving focused development in real convergence areas.

The author suggests further research directions, proposing the enhancement of the developed resilience and competitiveness index methodology. This enhancement would involve additional factors and sub-factors, enabling shorter-term (5-10 years) examinations of smaller areas.

8. PUBLICATIONS RELATED TO THE TOPIC OF
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Link to the author's full and actual publication list:

https://m2.mtmt.hu/gui2/?type=authors&mode=browse&sel=authors10055503