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Risk Factors of In-Work Poverty in Borsod-Abaúj-Zemplén County, Hungary

ABSTRACT

This study examines the risk factors of in-work poverty in Borsod-Abaúj-Zemplén County, one of the most disadvantaged regions of Hungary. The research aims to identify how educational attainment, household composition, and spatial accessibility influence the per-capita income of the working population as an indicator of in-work poverty. The analysis is based on a household survey conducted between 2024 and 2025, using multiple linear regression analysis. The results indicate that education has a significant positive effect on income, while household size and distance from the county seat have negative relationships with income. The findings highlight the multidimensional nature of poverty, shaped by structural, demographic, and spatial factors. They underline the importance of education, infrastructure development, and targeted regional policies in reducing social inequalities and mitigating persistent poverty in peripheral areas.

Keywords: Borsod-Abaúj-Zemplén County, household composition, education level, regional inequalities, poverty risk factors

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INTRODUCTION

Poverty has long been one of Hungary's most serious socio-economic problems, significantly shaped by the country's transition from socialism to a market economy in the early 1990s. This transformation was characterized by high unemployment, inflation, and growing social inequalities, which led to a substantial increase in poverty (Andorka, 2006; Bank et al., 2003). Since then, numerous studies (Gábos & Szivós, 2002; Darvas & Tausz, 2002; Szoboszlai, 2004) have shown that poverty in Hungary is shaped by a complex set of factors, including educational attainment, labour-market status, regional disparities, demographic characteristics, and ethnic background. Employment has traditionally been regarded as the most important protective factor against poverty; however, in recent decades, the phenomenon of the working poor has received increasing attention. This suggests that employment alone no longer guarantees an adequate standard of living, as an increasing number of people are employed while their household income remains below the poverty threshold (Bruder & Obádovics, 2012; Eurofound, 2017).

Regional disparities have been particularly pronounced for decades: poverty is persistently deeper in Hungary's north-eastern and south-western peripheral regions than in the more developed central regions (Pénzes, 2014). Long-term unemployment, limited economic opportunities, weak educational outcomes, and infrastructural deficiencies all contribute to the persistence of poverty, particularly among marginalized communities (Spéder, 2000; Hegyi-Kéri & Horváth, 2017). These factors not only diminish individual well-being but also reinforce social exclusion and the intergenerational reproduction of disadvantages.

Borsod-Abaúj-Zemplén County, located in Northern Hungary, is particularly well suited to studying these processes. During the socialist era, the region was one of the country's most important industrial and mining centres, where metallurgy, mechanical engineering, and coal mining, alongside large-scale agricultural enterprises and the subsidiary units of agricultural cooperatives, played a significant role in employment. However, during the economic restructuring that followed the regime change, it was not only the rapid decline of heavy industry and mining that caused substantial job losses, but also the transformation of agriculture, the dissolution of agricultural cooperatives, and the closure of their associated subsidiary units, which considerably reduced rural employment opportunities. As a combined result of these processes, many parts of the county experienced persistent economic decline, high unemployment, selective outmigration, and unfavourable social trends (Bakos, 2006; Blažek & Netrdová, 2011). Although attempts have been made over the past decade to revitalise industrial production and attract new investment, the county continues to face significant social and economic challenges. Persistent poverty, structural problems in the labour market, and the social exclusion of disadvantaged groups—particularly the Roma population—remain determining factors of poverty (Varga, 2020; Siposné, 2021). In this context, it is particularly important to understand the determinants of poverty in order to design targeted policy interventions that address not only income disparities but also the structural, economic, and demographic causes of deprivation.

The aim of this study is to explore the determinants of in-work poverty in Borsod-Abaúj-Zemplén County using household-level survey data. Multiple regression analysis is applied to examine the effects of educational attainment, household composition, and spatial accessibility on per-capita income.

LITERATURE REVIEW

The concept of poverty is not uniform in scientific discourse; rather, it comprises several complementary dimensions. One of the most frequently applied definitions is absolute poverty, defined as a state in which an individual or household is unable, over an extended period, to cover the most basic goods and services necessary for subsistence, such as food, drinking water, housing, and clothing. This approach uses a fixed poverty threshold that remains relatively stable over time and space, linked to the minimum resources required for human survival. It is based on access to classical basic needs and does not take into account society's current standard of living or expectations; it is therefore useful in contexts where the focus is on the basic physical conditions of survival (Aijun, 2025; Reddy & Pogge, 2005).

Relative poverty refers to a state in which an individual's or household's material and resource position falls significantly short of the generally accepted norms and average standard of living of the majority of society. In this approach, the poverty threshold is not defined as a fixed minimum but is set relative to the distribution of income or living conditions within the community—for example, as a certain percentage of median income. The definition of relative poverty thus also encompasses deprivation—not only the lack of basic survival needs but also restricted social participation, when those affected are unable to purchase the goods and services that are considered "necessary" according to social norms (Othman et al., 2024).

The subjective poverty approach examines how individuals perceive their own situation in the context of poverty, regardless of whether they live below an objective income threshold. In this interpretation, poverty is based on the extent to which those affected perceive their own well-being, resources, or social position as inferior compared to those of others. Subjective assessment allows poverty to be measured not only on the basis of income or consumption data but also by taking into account individuals' psychosocial and quality-of-life experiences, which is important, for instance, when examining social exclusion or self-evaluation (Siposné Nándori, 2014; Bieńkuńska, 2022).

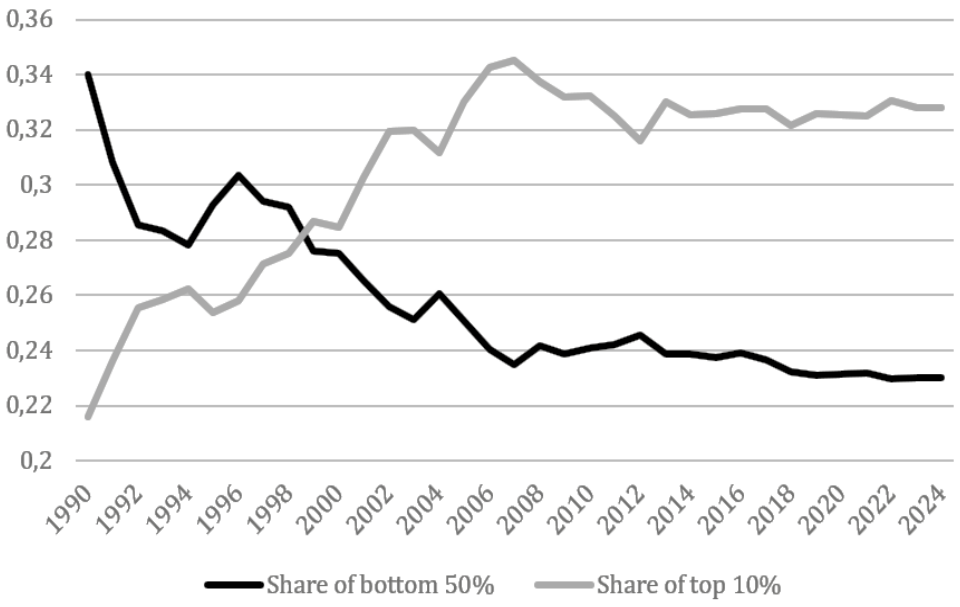
The social-policy definition examines how policy and public institutions interpret, measure, and address poverty as a social problem. From this perspective, poverty is not merely an economic or income-related phenomenon but a structural and institutional issue that interacts with the labour market, education, healthcare, and social justice. In social-policy discourse, the definition and measurement of poverty influence the form of welfare systems, the direction of social transfers, and the instruments of social inclusion. This approach emphasizes the relationship between social exclusion and economic

inequality, making it possible to analyse the structural causes and consequences of poverty within a complex political and social context (Brady & Lane, 2014).

In addition, an important poverty indicator is the At-Risk-of-Poverty or Social Exclusion (AROPE) rate, which jointly takes into account relative income poverty, severe material and social deprivation, and the proportion of households with very low work intensity.

Besides the general at-risk-of-poverty rate, an important indicator is the in-work at-risk-of-poverty rate, which shows the proportion of the employed population aged 18 or over living in a household whose disposable income falls below 60% of the national median income (Lohmann, 2008). This indicator highlights that employment alone does not guarantee protection against poverty, since low wages, part-time or atypical employment, the dependency burden within households, and the limited effectiveness of social benefits can jointly contribute to the emergence of in-work poverty (Tésits & Bokor, 2000, 2005; Tésits, 2005; Tésits et al., 2005; Tésits, 2007a; b; Tésits, 2011; Tésits & Székely, 2007). According to Eurostat data, in 2025 the in-work at-risk-of-poverty rate stood at 8.3% in the European Union and at 8.1% in Hungary (Eurostat, 2025). The phenomenon poses a particularly high risk among low-skilled workers, single-parent households, part-time workers, and large families.

Figure 1. Share of Top 10% and Bottom 50% in Total Income in Hungary, 1990–2024



Source: Own compilation based on the World Inequality Database (https://wid.world/country/hungary/)

Poverty in Hungary increased dramatically during the economic and social transformation associated with the transition to a market economy. The share of the top income decile grew, while the income position of the bottom decile and the middle class deteriorated (Figure 1) (Andorka, 2006).

By the end of the 1990s, the poverty rate had stabilized and did not change significantly until the early 2000s (Branyiczki & Gábos, 2018). Around the turn of the millennium, when examining child poverty, Darvas and Tausz (2002) identified labour-market status, the number of children, housing conditions, settlement type (Budapest, county seat, other town, or village), and Roma origin as the

most important factors increasing poverty risk. Around the same time, Gábos and Szivós (2002) also identified the main factors contributing to poverty risk, including unfavourable labour-market conditions, low educational attainment, disadvantaged territorial characteristics, and demographic factors. Szoboszlai (2004) linked social exclusion to ethnic origin, age, religious discrimination, cultural deficiencies, and rising unemployment rates (Table 1).

Following the 2008 global economic crisis, income poverty and material deprivation worsened, particularly among those with low educational attainment, the unemployed, large families, and residents of sparsely populated areas (Branyiczki & Gábos, 2018). From 2012, however, a positive shift occurred, with income poverty and severe material deprivation rates declining. Győri (2017) pointed out that problems such as the housing crisis, ethnic origin, and family size interact to produce cumulative disadvantages (Table 1).

Examining the effects of the COVID-19 pandemic on poverty, Dávid et al. (2021) found that in 2020, many low-income workers became unemployed because of economic shutdowns and closures. Persistent unemployment and loss of income significantly increased poverty risk, particularly among already vulnerable groups (single-parent families, Roma communities, and elderly people with low pensions). In peripheral, disadvantaged regions, the economic downturn had more severe consequences (Table 1).

Numerous studies (e.g., Gábos & Szivós, 2002; Branyiczki & Gábos, 2018; Dávid et al., 2021) have shown that there are significant regional differences in the extent of poverty in Hungary. The highest levels of poverty are observed primarily in the country's north-eastern and south-western peripheral regions (Pénzes, 2014). The social and economic situation of the population living in these regions is influenced by numerous factors that reinforce one another, making it difficult—and often practically impossible—to break out of poverty. In peripheral settlements, access to public services, healthcare, and quality education is limited.

Table 1. Risk Factors of Poverty Identified by Different Authors

Risk factor of poverty	Darvas – Tausz (2002)	Gábos – Szivós (2002)	Szoboszlai (2004)	Győri (2017)	Branyiczki – Gábos (2018)	Dávid – Szabó – Huszti – Bukovics (2021)
Labor market status	x	x	x		x	x
Number of children	x	x		x	x	
Housing conditions	x			x		
Territorial / settlement characteristics	x	x			x	x
Roma origin	x		x	x		x
Low educational attainment		x			x	
Age			x			x
Religious / cultural factors			x			
Single parenthood		x				x

Source: own compilation based on Siposné Nándori – Lipták – Nagy (2025) p. 65.

Socio-Economic Situation of Borsod-Abaúj-Zemplén County

Borsod-Abaúj-Zemplén County is located in the north-eastern region of Hungary and represents one of the most striking examples of the country's developmental and economic disparities. From the mid-twentieth century onward, the region's economy became heavily industrialized, dominated by metallurgy, mechanical engineering, and the chemical industry, partly building on local natural resources. However, changes in world markets during the 1970s disrupted this dynamic, and the transformation of the manufacturing structure led to stagnation in development. Poor natural conditions for agriculture further limited the possibilities for diversification, particularly for substantial economic expansion in the food and processing industries, and the region's structural tensions therefore emerged at an early stage (Barta & Zsúgyel, 1988).

During the socialist period, alongside metallurgy and mechanical engineering, coal mining also played a defining role in the economy of Borsod-Abaúj-Zemplén County. The coal mines of the Sajó Valley and the Borsod Basin—particularly in the areas of Kazincbarcika, Putnok, Rudabánya, and Lyukóbánya—provided direct livelihoods for tens of thousands of people, while the associated processing industry, energy sector, and transport generated substantial additional employment (Dabasi et al., 2021). Following the regime change, the mines became economically unviable and were gradually closed, resulting in significant job losses that the local labour market was able to compensate for only to a limited extent. The decline of mining and metallurgy caused persistent unemployment and outmigration, particularly in smaller mining settlements and among people with low levels of education. The effects of these unfavourable social processes are still perceptible today (Beluszky, 1999).

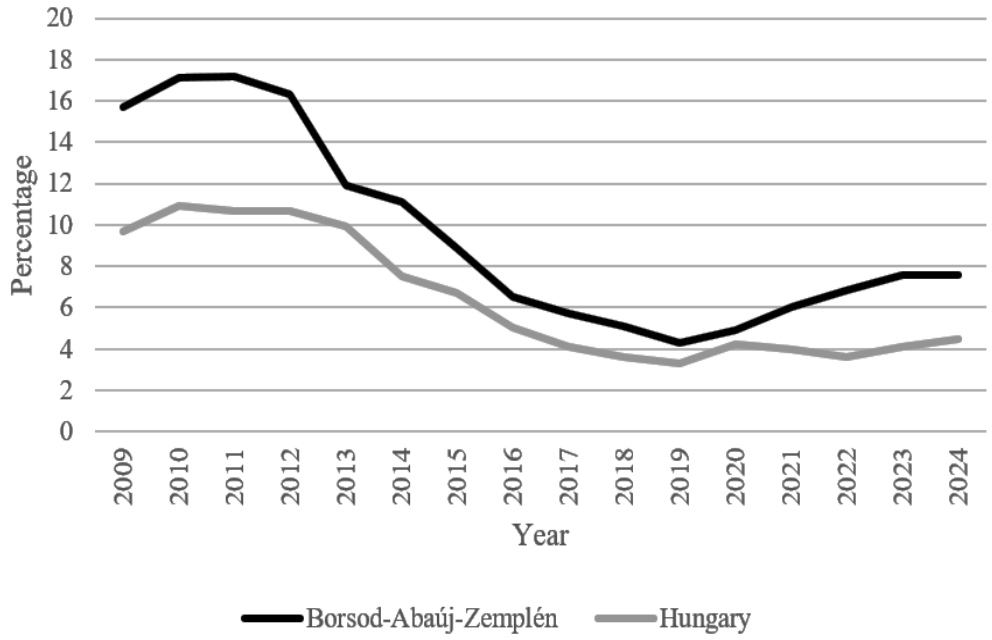
After the regime change, the transition to a market economy did not eliminate the county's industrial character, but its production structure and labour demand were transformed. Although the mechanical engineering and chemical industry sectors remained significant, the transformation led to unemployment and employment-related problems in many areas. Small and medium-sized enterprises now account for more than 60 percent of employment; however, the labour-market participation of lower-skilled and disadvantaged groups is lower, which contributes to structural labour-market problems (Hajdú, 2020).

Demographic trends are unfavourable: the county's resident population is continuously declining, the number of deaths exceeds the number of births, and population loss due to migration is also significant. These processes are accompanied by intensifying population ageing and a weakening labour supply, which, in the long run, limits the region's development potential (Hajdú, 2021).

The labour-market situation continues to pose a challenge, according to statistical data. Among the population aged 15–64, the county-level unemployment rate stood at 7.6 percent at the end of 2024, exceeding the average of most counties (Figure 2). The employment rate stood at around 69.3 percent, while the number of employed people also decreased, particularly in manufacturing, where, for example, employment in machinery manufacturing fell by several thousand people. Meanwhile, some service sectors—such as administrative services and healthcare—showed expansion (HCSO, 2024).

Employment opportunities are further reduced by limited accessibility, as mobility poses serious difficulties for the population. The low level of infrastructural development further deepens territorial disadvantages. Nearly 20% of Hungary's peripheral settlements are located in Borsod-Abaúj-Zemplén County, near the Slovak border (Pénzes, 2018).

Figure 2. Unemployment Rate (%) in Borsod-Abaúj-Zemplén County and in Hungary Among the Population Aged 15–64, 2009–2024



Source: Own compilation based on data from the Hungarian Central Statistical Office

The county's income situation is also unfavourable in a national comparison: the personal income tax base per resident is among the lowest in Hungary, and the most severe poverty is concentrated in the northern parts of the county.

Examining the social situation, the educational structure also partly explains the county's relative backwardness (Hegedüs, 2016). The largest group by educational attainment consists of those with secondary-school (matriculation) qualifications, but the proportion of those with only primary education is also significant, which may have an unfavourable effect on labour-market opportunities and income levels. The high proportion of people with disabilities and disadvantaged groups further increases social risks, particularly among the Roma population, where low incomes, poor housing conditions, and health problems are pronounced (General Assembly of Borsod-Abaúj-Zemplén County, 2025).

Poverty in Borsod-Abaúj-Zemplén County

The socio-economic situation of Borsod-Abaúj-Zemplén County has long been less favourable than the national average, as confirmed by numerous objective poverty and income indicators. Poverty is manifested not only in low incomes but also in limited employment opportunities, unfavourable

demographic processes, territorial peripherality, and inequalities in access to basic services (Káposzta & Lőrincz, 2025).

Based on income indicators, Borsod-Abaúj-Zemplén County has persistently been among the country's most disadvantaged regions. According to data from the Hungarian Central Statistical Office (HCSO), in 2024, the personal income tax base per permanent resident was approximately HUF 4.9 million, significantly below the national average of nearly HUF 7.8 million. This placed the county among the lowest-income regions in Hungary, clearly reflecting low earning levels and an unfavourable employment structure.

Regarding the AROPE indicator, approximately 19% of the national population was affected by some form of this risk in 2024, while the relative income poverty rate was 14.0% and the rate of severe material and social deprivation was 8.5%. Based on these indicators, the Northern Hungary region has for years been among the country's most disadvantaged areas, indicating that, alongside income disadvantages, housing, consumption, and social participation problems are also concentrated there (HCSO, 2024).

The county's settlement structure further reinforces social disadvantages. Poverty is concentrated primarily in areas with small, scattered villages and peripheral regions, particularly in the settlements of Cserehát, Bodrogköz, Abaúj, and Hegyköz. In these areas, low employment, poor transport accessibility, lack of services, low educational attainment, and a high proportion of the Roma population occur simultaneously. The various disadvantages reinforce one another, so poverty is often reproduced across generations, while opportunities to enter the labour market also remain limited (Pénzes, 2014; Pénzes, 2018).

Although improving employment indicators have contributed to a reduction in unemployment over the past decade, these favourable processes have not been accompanied by a substantial reduction in income disparities. The proportion of low-paying jobs in the county remains high, while a significant share of skilled workers take up employment in other regions or abroad. Following the structural transformation of manufacturing, the disappearance of mining, the large-scale decline of metallurgy, and the shrinking of agricultural employment, a substantial proportion of the newly created jobs offer low added value or precarious forms of employment, which increases the risk of in-work poverty. Employment alone, therefore, does not provide automatic protection against poverty, particularly in disadvantaged regions (Gábos & Tóth, 2025).

Social vulnerability is further increased by the unfavourable demographic structure. The continuous decline of the population, ageing, and the outmigration of the young, skilled population all weaken the region's economic potential (Sárkány, 2022). At the same time, many settlements have a high proportion of large families, single-parent households, and the Roma population, which, according to the domestic literature, are among the most important risk groups for poverty (Perpék, 2022). The disadvantaged social situation is further aggravated by unequal access to education, healthcare, and community services. Borsod-Abaúj-Zemplén County not only has a lower income level than the national average but is also in a less favourable position across all major dimensions of poverty—income poverty, social exclusion, material deprivation, and labour-market disadvantages.

METHODS

The aim of our research was to explore the risk factors of in-work poverty in one of Hungary's most disadvantaged regions, Borsod-Abaúj-Zemplén County. We conducted a household-level questionnaire survey to examine whether the risk factors of poverty identified in earlier research (Table 1) continue to have a significant effect on the development of poverty.

The questionnaire was created using Google Forms, and data collection took place between November 2024 and February 2025. The research employed online convenience sampling. The resulting findings cannot be generalized due to sampling bias (Malhotra et al., 2017); nevertheless, convenience sampling can be considered appropriate for exploratory studies. Facebook was used to reach the local population. Facebook has also proven to be an effective data-collection tool during the COVID-19 pandemic (Jaber & Szép, 2024). By 2024, Hungary had more than seven million Facebook users out of a total population of nearly 9.5 million (Facebook Users by Country, 2025), which facilitated access to the target group and enabled rapid data collection. Most towns and settlements have local Facebook groups used for discussing local matters and communication. We shared the questionnaire in numerous such groups. In addition to the online platform, we also contacted representatives of local municipalities and asked them to display our posters, featuring a QR code linking to the questionnaire, on municipal buildings. This also allowed access to the questionnaire for those without a Facebook profile. The questionnaire included demographic questions (sex, age, and place of residence), as well as further closed-ended questions on income, educational attainment, employment status, ethnicity, number of children, and distance from the county seat. A total of 404 people completed the questionnaire, of whom 336 valid responses remained after data checking and cleaning.

Poverty was measured through per-capita net income (INC), calculated from the household's total net income and the number of household members, as reported by respondents. For the question on the household's total net income, respondents could choose from the following categories: below HUF 145,000; HUF 145,000–199,999; HUF 200,000–304,999; HUF 305,000–499,999; HUF 500,000–699,999; HUF 700,000–999,999; HUF 1,000,000–1,499,999; HUF 1,500,000–2,199,999; above HUF 2,200,000. We also asked about labour-market status. The following response options were available: full-time work; part-time work; casual or contract work; running a business or being self-employed; participating in public-works employment; retired; unemployed; dependent; and other. Among these, we considered full-time employees, part-time employees, those performing casual or contract work, business owners/self-employed persons, and participants in public-works employment as employed, and only respondents selecting these categories were included in the further analyses. Therefore, the final sample size was 250. Among the risk factors of in-work poverty, we examined the following:

- number of children living in the household (CHILD);
- distance from the county seat as a territorial/settlement characteristic (DIST): (1: 0–10 km, 2: 10.1–30 km, 3: 30.1–50 km, 4: 50.1–70 km, 5: above 70.1 km);

- educational attainment (EDU): (0: no educational attainment, 1: primary education, 2: secondary education, 3: tertiary education).

We were unable to examine the effect of ethnicity, as only seven respondents in the sample indicated an ethnicity other than Hungarian. The relationship between the dependent variable (monthly per-capita net income) and the explanatory variables was examined using multiple linear regression. We applied the backward elimination procedure, which starts with a model containing all explanatory variables and then removes, step by step, the variables that contribute least to the model until only statistically significant explanatory variables remain in the model (Sajtos & Mitev, 2007).

RESULTS

Descriptive Characteristics of the Sample and Key Variables

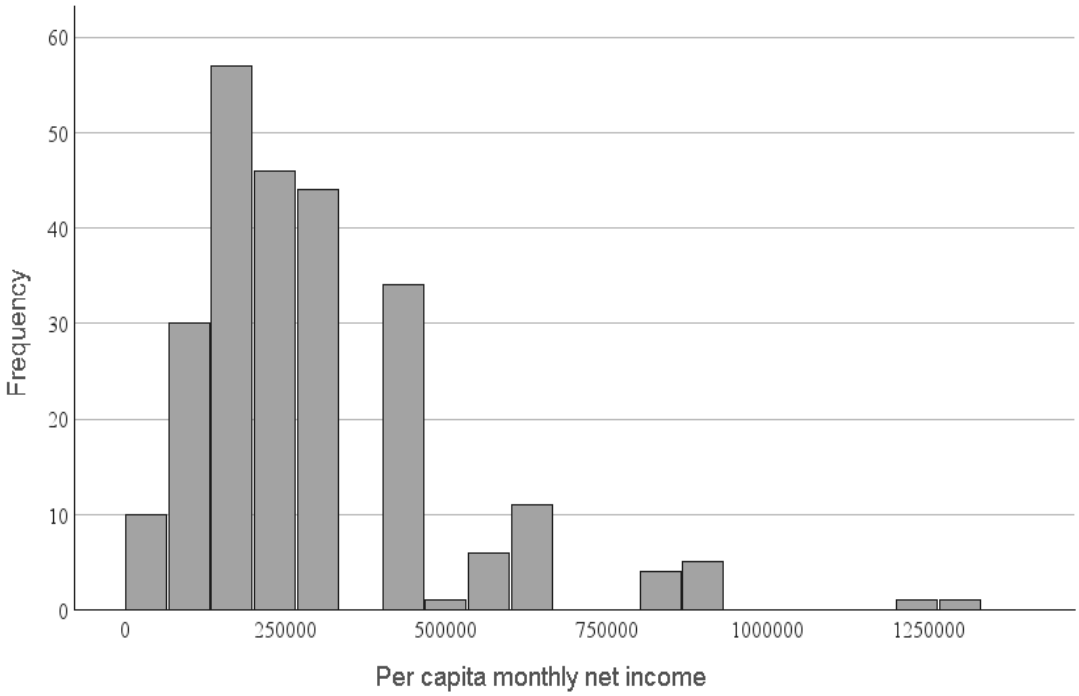
Based on the composition of the sample of 250 individuals included in the analysis, 68.7% of respondents were women and 31.3% were men. The age structure of the sample is relatively balanced (Table 2). The fact that only 0.8% of respondents were over 65 years of age is consistent with the study's focus on the working-age population. In terms of place of residence, 70% of respondents live in urban areas, while 30% live in rural areas (Table 2).

The distribution of the in-work poverty indicator—monthly per-capita net income—is positively skewed (Figure 3). This right-skewed distribution is consistent with the literature, which consistently finds that income distributions tend to be positively skewed. This means that the majority of the population is concentrated at lower or medium income levels, while a relatively small group of high earners forms a long "tail" on the right side of the distribution. Tóth (2009) emphasized that one of the fundamental characteristics of the Hungarian income distribution is its asymmetry, which became particularly pronounced following the regime change. Huszár and Füzér (2023) reached a similar conclusion, showing, through an analysis of household income relationships, that the income distribution does not follow a normal distribution but systematically exhibits positive skewness, which is a structural consequence of income inequality.

Table 2. Composition of the Sample

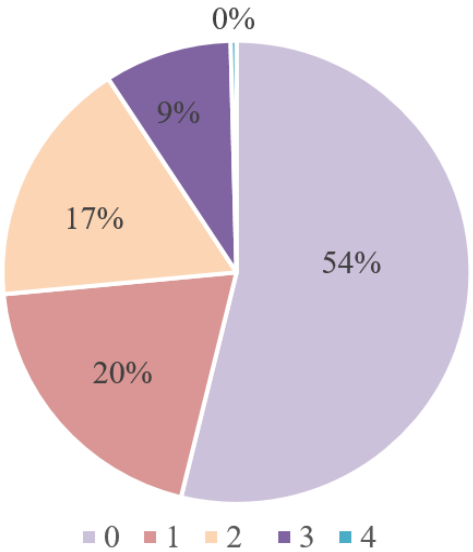
	Variable	Sample decomposition
Gender	Male	31.3%
	Female	68.7%
Age	19–24	15.2%
	25–34	25.2%
	35–44	24.8%
	45–54	22.4%
	55–64	11.6%
	65+	0.8%
Area	Urban	70.0%
	Rural	30.0%

Figure 3. Frequency Distribution of Per-Capita Monthly Net Income of the Informants



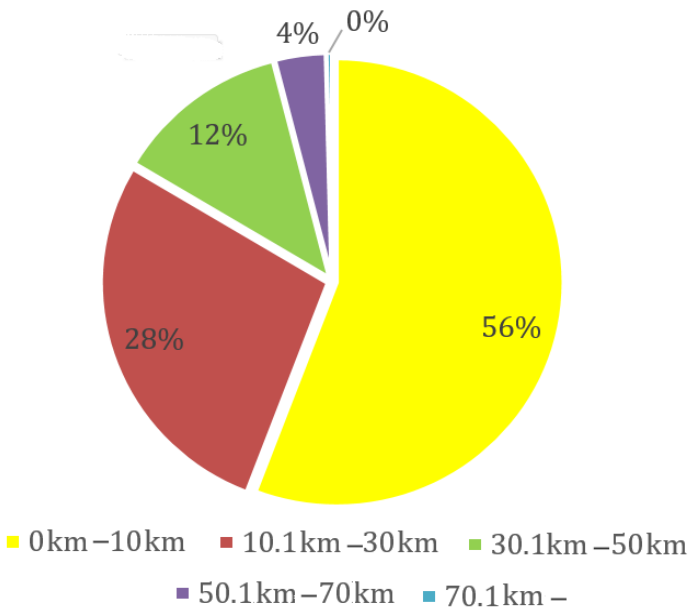
One of the explanatory variables included in the study is the number of children living in the household. Based on the distribution of this variable, more than half of the sample has no children in the household (54%), while 20% of respondents live with one child and 17% with two children. The proportion of households with three or more children is 9% (Figure 4). The distribution thus shows the predominance of smaller households; nevertheless, the presence of households raising three or more children allows for an examination of how an increase in the number of children in the household relates to per-capita income.

Figure 4. Frequency Distribution of the Number of Children in the Sample



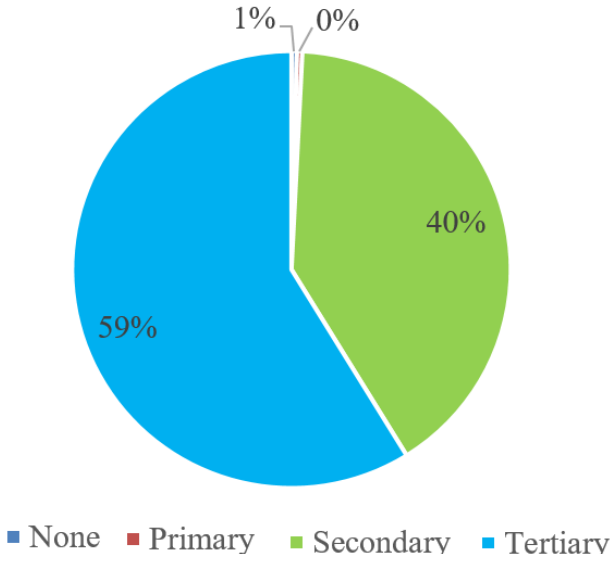
The other explanatory variable examined is distance from the county seat. Based on the territorial location of respondents, a significant proportion of the sample lives relatively close to the county seat (Figure 5): 56% fall into the 0–10 km category, and a further 28% into the 10.1–30 km category. The proportion of those living more than 70 km away is negligible.

Figure 5. Frequency Distribution of the Distance From the County Seat in the Sample



Educational attainment is another explanatory variable included in the study. The sample is strongly concentrated among those with secondary and tertiary education: 40% have secondary education and 59% have tertiary education, while the proportion of respondents with only primary education or no educational attainment is just 1.0% (Figure 6). It should be noted that among the non-employed respondents excluded from the analysis, educational attainment is significantly lower: only 30% of them have tertiary education.

Figure 6. Frequency Distribution of Educational Attainment in the Sample



Determinants of Per-Capita Monthly Net Income

The multiple linear regression model is statistically significant, as confirmed by the results of the ANOVA test ($F = 24.503$; $p < 0.001$). Based on the results of the regression model (Table 3), it can be established that the effects of all the explanatory variables examined are statistically significant.

The multiple regression model has an R^2 value of 0.232 and an adjusted R^2 value of 0.222, meaning that the number of children in the household, distance from the county seat, and educational attainment jointly explain approximately 23% of the variance in monthly per-capita net income. Although the explanatory power of the model cannot be considered comprehensive, it indicates a meaningful relationship in the context of examining a socio-economic phenomenon, especially considering that income status may also be influenced by numerous factors not included in the model, such as ethnicity and other sources of household income.

Testing for multicollinearity confirmed the robustness of the model: all VIF values were around 1.0 (Table 3), indicating that multicollinearity among the explanatory variables does not pose a problem and that correlations among the variables therefore do not bias the results.

Table 3. Results of the Regression Analysis

Predictor	B	SE (B)	Beta	t	Sig.	Tolerance	VIF
Constant	177223.4	64278.0	–	2.8	0.006	–	–
Number of children in the household	–74365.2	11209.9	–0.373	–6.6	0.000	0.995	1.005
Distance from county seat	–38974.0	13436.2	–0.164	–2.9	0.004	0.984	1.017
Level of education	91632.8	21979.1	0.236	4.2	0.000	0.986	1.015

The number of children living in the household shows a significant negative relationship with per-capita income. This indicates that a larger household size divides the available income among more dependents, reducing per-capita income and potentially increasing the risk of poverty. Figure 7 clearly illustrates the negative relationship between the number of children in the household and monthly per-capita net income. For childless households, the median income is higher, whereas the median per-capita income generally decreases as the number of children increases.

Another important explanatory variable, which is likewise inversely related to income level, is distance from the county seat. Overall, a negative relationship is observed between distance from the county seat and monthly per-capita net income. The median income is highest in the 0–10 km category and then gradually decreases as distance from the county seat increases, in the 10.1–30 km, 30.1–50 km, and 50.1–70 km categories (Figure 8). This suggests that people living closer to the county seat have a more favourable income position, while lower per-capita income is characteristic of more distant, peripheral areas. Within each category, however, considerable income dispersion is observed, along with several markedly high income values. The slight increase observed in the category beyond 70 km should be interpreted with caution, as this group comprises only a negligible part of the sample—two individuals.

Figure 7. Box Plot of the Number of Children in the Household and Per-Capita Monthly Net Income

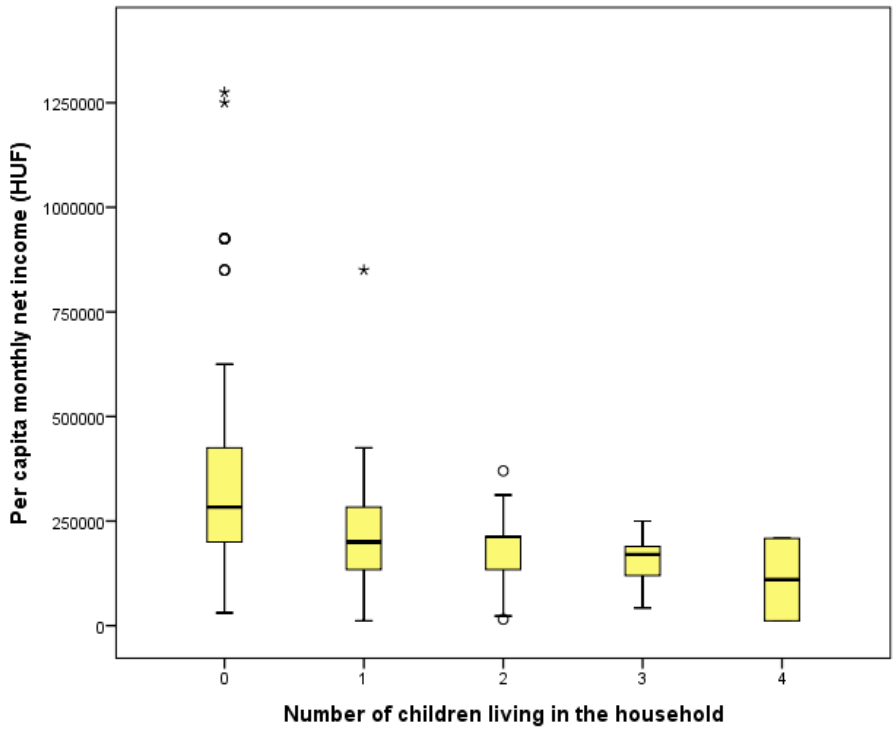
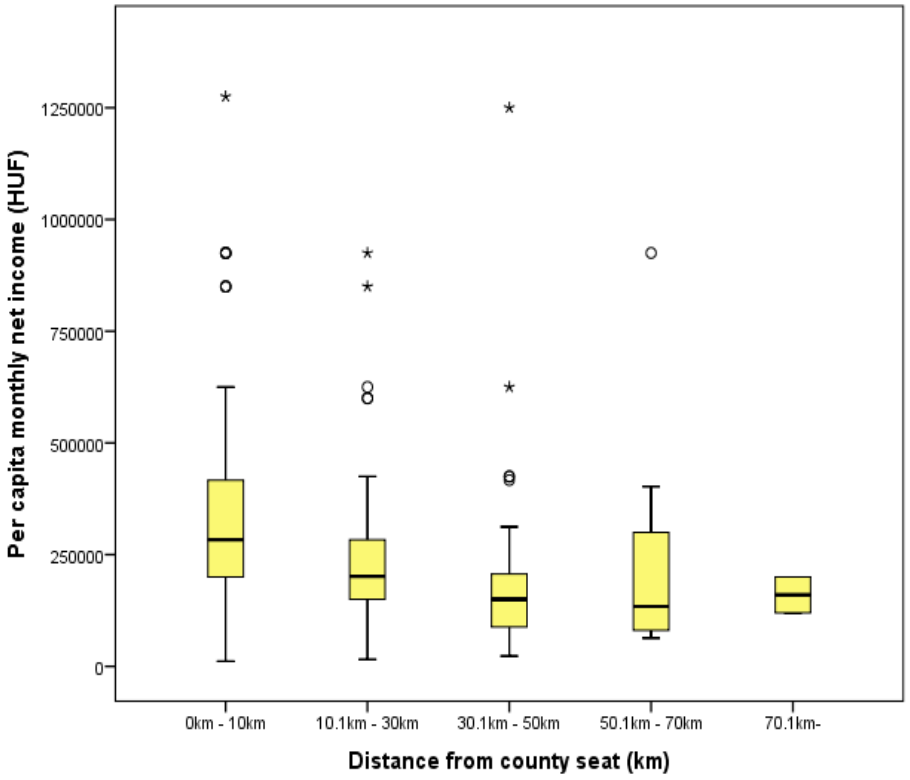


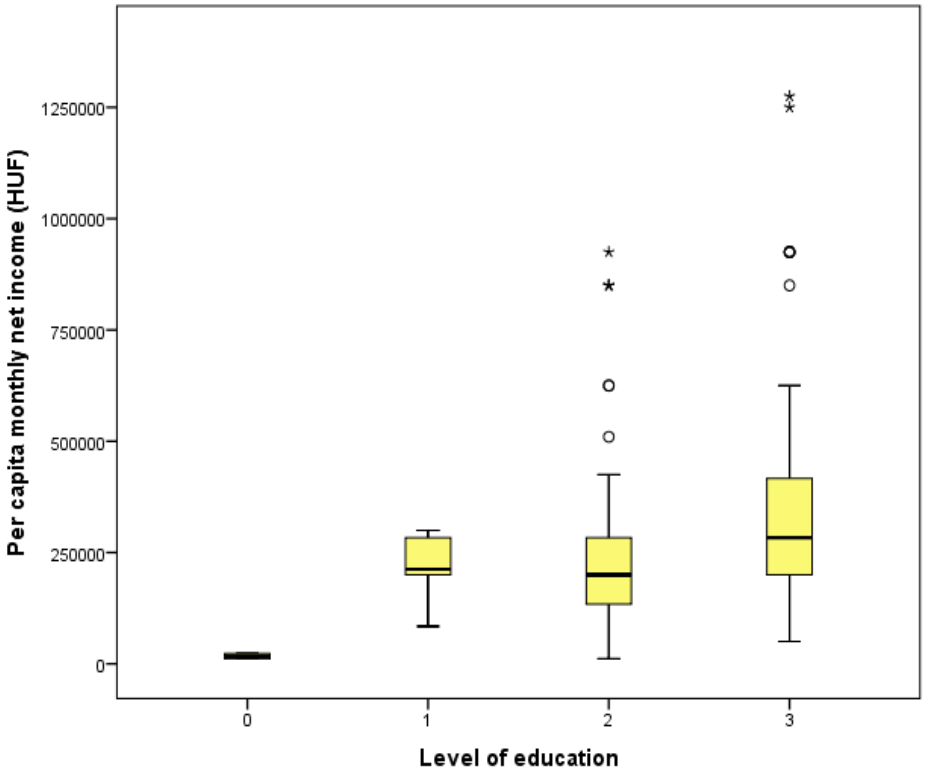
Figure 8. Box Plot of Distance from the County Seat and Per-Capita Monthly Net Income



The level of educational attainment shows a significant positive relationship with income level, meaning that a higher level of education is associated with higher per-capita income. This is clearly

consistent with findings in the literature. As educational attainment increases, the median income also rises: those with tertiary education have a more favourable income position than those with secondary education (Figure 9). In the higher educational categories, however, greater income dispersion and several markedly high values can also be observed, suggesting that tertiary education increases the likelihood of a higher income position but does not, by itself, result in the same income level in every case.

Figure 9. Box Plot of Educational Attainment and Per-Capita Monthly Net Income



CONCLUSIONS

In this study, we examined the factors determining in-work poverty in one of Hungary's most disadvantaged regions, Borsod-Abaúj-Zemplén County. Our starting point was that the economic and social transformation following the regime change contributed significantly to the increase in poverty, particularly in peripheral regions. Based on the literature, the emergence and persistence of poverty among the working population are shaped by a complex set of factors, among which educational attainment, household composition, and territorial and regional disparities play a determining role.

The aim of the research was to explore the extent to which these factors influence per-capita income, as an indicator of poverty, in the studied region. The effects of the explanatory variables were examined using multiple linear regression analysis. Our results show that educational attainment, distance from the county seat, and household size are significantly related to per-capita income.

These findings suggest that regional accessibility and human-capital accumulation are important determinants of income position, while demographic pressure—such as larger household size—can further aggravate economic disadvantages. The regression model had moderate yet meaningful explanatory power, explaining approximately 23% of the variance in per-capita income.

Our results are in line with numerous domestic empirical studies that have confirmed that education plays a decisive role in labour-market success and in the development of earnings differentials. Kertesi and Varga (2005) and Rédei (2007) showed that in Hungary, labour income rises significantly with increasing educational attainment, particularly for secondary and tertiary education. According to the analyses of Tóth (2009), higher education not only improves income position but also acts as a protective factor against poverty, as it reduces the likelihood of persistent low-income status. Gábos and Szivós (2002) emphasized that low educational attainment was one of the strongest structural poverty risk factors in Hungary, while individuals with higher education have a greater chance of obtaining stable, better-paid jobs. The positive effect of education on income is particularly strong in disadvantaged regions, where the lack of education limits labour-market mobility and reinforces territorial inequalities (Spéder, 2000).

The persistence of poverty in the region is also reinforced by structural and spatial inequalities. Limited infrastructure, weak access to services, and unfavourable educational outcomes sustain the reproduction of disadvantages, particularly in peripheral settlements. These results are consistent with earlier studies emphasizing the interrelated roles of education, territorial disparities, and demographic factors in shaping poverty risks in Hungary (Darvas & Tausz, 2002; Spéder, 2000; Branyiczki & Gábos, 2018; Győri, 2017; Gábos & Szivós, 2002).

The analysis highlights the multidimensional nature of poverty, shaped jointly by demographic factors—such as household size and educational attainment—and geographic characteristics, such as proximity to economic centres. This underscores the importance of targeted policy interventions in addressing these factors. Policy responses must therefore go beyond short-term welfare measures and prioritize investment in education, regional development, and infrastructure to break the cycle of poverty reproduction. Supporting disadvantaged communities through inclusive education and targeted local development programmes can contribute to improving social mobility opportunities and reducing regional disparities.

When interpreting the results of the research, however, the limitations of the database used must also be taken into account. The county's income spatial structure is not determined solely by distance from the county seat. Tiszaújváros and Kazincbarcika, as significant economic centres, may also influence the income and labour-market situation of surrounding settlements, while the M3 highway allows for greater commuting distances than before. Commuting to Slovakia, as well as other forms of foreign employment and the associated remittances, may also play a role in shaping income conditions (Balizs & Somogyi, 2024).. However, the database used in this study does not allow for reliable quantification of these factors at the settlement or household level. Therefore, the significant effect of distance from the county seat cannot be interpreted as an independent and exclusive explanation

of the county's overall income spatial structure; rather, the result points to a relationship between territorial accessibility and income position.

Although the study was based on a convenience sample, it offers valuable exploratory insight into the socio-economic processes of one of Hungary's most disadvantaged counties. Future research should therefore consider supplementing the measurement of spatial accessibility with the accessibility of economic centres—such as Miskolc, Tiszaújváros, and Kazincbarcika—as well as with commuting and foreign-employment opportunities. Using representative samples and longitudinal research designs would allow more robust conclusions to be drawn about the territorial and social determinants of in-work poverty. Based on the findings, policies aimed at reducing in-work poverty must address not only income-related but also territorial, demographic, and educational factors in an integrated manner, particularly in peripheral regions.

Declarations

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The authors declare that there are no financial or non-financial competing interests relevant to the content of this article.

Author contributions
Conceptualization: SNE, LK, NZ; Methodology: SNE; Data curation: SNE, LK; Formal analysis: SNE; Investigation: SNE; Visualization: SNE; Writing – original draft: SNE, LK; Writing – review & editing: NZ. All authors have read and approved the final version of the manuscript.

Data availability
The data are available from the corresponding author upon reasonable request.

Ethical approval
Not applicable: this study did not involve human participants, animal experiments, or sensitive personal data requiring ethical approval.

Informed consent
Data were collected through an anonymous online questionnaire. At the beginning of the questionnaire, participants were informed about the purpose of the study and the processing of their data and provided their consent by completing the questionnaire.

Use of AI tools
The author(s) did not use generative artificial intelligence (AI) tools in the preparation of this manuscript.

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