Changes in the social and economic situation in the affected settlements following the handover of the M85 and M86 expressways

Az érintett települések társadalmi és gazdasági helyzetének változásai az M85 és M86 gyorsforgalmi utak átadása után

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ABSTRACT: This study examines the socio-economic impacts of the M85 and M86 expressways in Northwest Hungary, with particular attention to the development trajectories of rural settlements and changes in commuting patterns. The research is based on the assumption that transport infrastructure investments improve accessibility, increase labour mobility, and contribute to regional development. The analysis focuses on settlements located in Győr-Moson-Sopron and Vas counties and relies on census data from 2011 and 2022, complemented by Spatial Information System (TEIR) and Hungarian Central Statistical Office (KSH) databases. To assess the effects of expressway development, correlation analysis and a difference-in-differences (DiD) approach were applied, enabling comparisons between the affected and the control areas.

The findings indicate that proximity to expressways is associated with more favourable demographic and income indicators, whereas the independent effect of accessibility improvement is relatively limited. In rural settlements affected by the new roads, population decline slowed, housing stock expansion remained stronger, and job growth exceeded that observed in control areas. However, these changes did not substantially alter the overall development trajectory. The most notable impacts emerged in labour mobility and commuting systems. Out-commuting increased, labour market catchment areas expanded, and cross-border daily mobility intensified. The Austrian labour market became an increasingly important destination, particularly in the Sopron area and along the M85 corridor. Nevertheless, the results do not confirm a significant strengthening of polycentric relations between the regional centres of Győr, Sopron, and Szombathely. The study concludes that the expansion of the expressway network primarily reinforced existing spatial and labour market structures rather than generating new regional development axes. Transport infrastructure, therefore, appears to be a necessary but insufficient condition for territorial convergence and polycentric regional development.



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KULCSSZAVAK: gyorsforgalmi út; ingázás; támogató infrastruktúra; regionális fejlődés; határ menti munkaerőpiac

ABSZTRAKT: A tanulmány az M85 és M86 gyorsforgalmi utak átadásának társadalmi-gazdasági hatásait vizsgálja Északnyugat-Magyarországon, különös tekintettel a rurális települések fejlődésére és az ingázási kapcsolatok átalakulására. A kutatás alapfeltevése szerint a közlekedési infrastruktúra fejlesztése javítja az elérhetőséget, növeli a munkaerő mobilitását és kedvező fejlődési pályára állíthatja az érintett településeket. Az elemzés Győr-Moson-Sopron és Vas megye településeire terjed ki, és 2011., illetve 2022. évi népszámlálási adatokra, továbbá a TEIR és KSH adatbázisaira épül. A gyorsforgalmi úthálózat hatásának vizsgálata korrelációelemzéssel és difference-in-differences megközelítéssel történt, amelyek lehetővé tették az érintett (kezelt) és kontrollterületek összehasonlítását.

Az eredmények szerint az autópálya közelsége összefüggést mutat a kedvezőbb demográfiai és jövedelmi mutatókkal, ugyanakkor az elérhetőség javulásának önálló hatása korlátozott. A vizsgált rurális településeken a népességcsökkenés üteme mérséklődött, a lakásállomány bővülése és a munkahelyek számának növekedése pedig meghaladta a kontrollterületeken mért értékeket. Mindezek ellenére nem figyelhető meg olyan mértékű gazdasági felzárkózás, amely új fejlődési pályát eredményezett volna. A legjelentősebb változások az ingázási rendszerekben jelentkeztek: nőtt az elingázók száma, bővült a munkaerőpiaci vonzáskörzet, valamint erősödött a határon átnyúló napi mobilitás. Különösen Sopron térségében és az M85 folyosó mentén vált meghatározóvá az ausztriai munkavállalás szerepe. Az eredmények ugyanakkor nem igazolják, hogy az új utak jelentősen erősítették volna a Győr, Sopron és Szombathely közötti policentrikus kapcsolatokat. A kutatás arra a következtetésre jut, hogy a gyorsforgalmi úthálózat bővülése elsősorban a meglévő térszerkezeti és munkaerőpiaci folyamatokat erősítette fel, miközben önmagában nem teremtett új regionális fejlődési tengelyeket.

Introduction

Connecting large urban core areas with high-capacity transportation corridors is typically treated as an infrastructure issue. The road networks of Hungary and Central Europe have undergone significant expansion in recent decades, which, coupled with a dramatic increase in the number of cars, has brought about fundamental changes in the region's life. Expressways not only transform long-distance transportation but also reshape the commuter catchment areas of urban centres, making metropolitan regions accessible even to peripheral, rural areas. At the intersection of transportation science and regional development, it is essential to distinguish between major corridors and highways that facilitate international transit traffic and the primary roads connecting cities and regions (Fleischer 2009). In Hungary, planning and public discourse tend to conflate these categories, describing the development of the expressway network as having made county seats more accessible (via expressways) from Budapest. In Hungary, this

means that larger cities are easily accessible from Budapest, as the transport network remains radically monocentric (radial). Fewer studies examine the impacts of these developments on rural (non-metropolitan) areas (Hardi, Szörényiné Kukorelli 2014; Tóth, Nagy 2014). The most common approach suggests that improved accessibility can enhance investment opportunities, making rural areas more attractive to investors. However, expressways also lead to increased out-commuting, particularly among the skilled workforce, which represents a drain on resources for smaller communities.

Commuter flow data offer an excellent opportunity to examine these issues, as they enable long-term assessment of the spatial impact of a new or improved transportation corridor. Conducting many such local and regional studies allows us to estimate, ex ante, during transportation network planning, the impact of developments, changing capacities, and various patterns of the development of localities and regions.

One might ask whether the M85 and M86 motorways providing connection between the larger cities of Northwest Hungary, have contributed to the development of rural areas, and how they have influenced commuting patterns. Conventional wisdom, both general and sometimes even academic, attributes a regional and local development impact to the construction of motorways. These views can also serve as the hypotheses for our study:

- New motorways increase the intensity of commuting between settlements.
- New motorways expand labour market catchment areas.
- Rural settlements located near expressways exhibit more favourable demographic and economic development trajectories.
- The impact of transport infrastructure is more pronounced in mobility patterns than in local economic development.
- In the polycentric region under study, the new roads strengthen the links between cities and towns.

Literature review

At a theoretical level, the relationship between transport infrastructure and regional development is often interpreted within the conceptual framework of spatial concentration effects. According to Paul Krugman's fundamental thesis, a centralised system essentially promotes the growth of the centre, whilst the growth rate of the peripheries lags behind and their economic diversity declines (Krugman 1999). In addition to the construction of motorways, reference is often made to the phenomenon of induced traffic: empirical studies suggest that there is a nearly proportional relationship between capacity expansion and the number of vehicle kilometres travelled. The spatial concentration effects of the expressway network are vividly illustrated in other article of Paul Krugman (2000) as well.

Our study examines the extent to which the impact of expressways on a rural region can be demonstrated using commuting data. We selected Northwest Hungary as case study because it represents a unique area within the Hungarian territorial system, as its accessibility conditions have shaped a region somewhat distinct from the rest of Hungary (Berta, Török 2010). The region's unique spatial characteristics were further accentuated by the completion of two new expressways, the M85 and M86, over the past decade, which connect medium-sized cities and agglomerations. These roads were built between Győr, Sopron, and Szombathely. The selection of the research area was motivated by the desire to find a rural area where the dominant pull effect of the Hungarian capital is less pronounced; ultimately, higher-quality connectivity was achieved within a polycentric region (Hardi 2025). At the same time, the results may be instructive for countries and regions where development is currently underway.

According to the transportation science approach, the primary purpose of expressways (highways and motorways) built alongside main roads connecting settlements is to facilitate long-distance, high-speed travel and to reduce traffic passing through settlements. These roads are typically built with grade-separated interchanges, multiple lanes, and limited access, making travel safer and faster compared to traditional main roads. Additionally, they strengthen economic ties and improve regional accessibility.

Numerous studies confirm that expanding the road network not only accommodates existing traffic but also generates new trips (phenomenon of induced traffic). An empirical study has shown that there is a nearly proportional relationship between road capacity and vehicle kilometres travelled (Duranton, Turner 2011). Expressways influence commuting patterns, particularly the spatial extent of workplace catchment areas. Better transportation infrastructure increases commuting distances (Glaeser, Kahn 2004). Due to the relative constancy of travel time (Marchetti's constant), faster transportation results in longer trips (Levinson 1998). It means that commuters primarily consider travel time and, to a lesser extent, geographic distance. For most people, a one-hour commute represents a psychological threshold beyond which daily commuting becomes intolerable. (Of course, various life circumstances can alter this.) At the same time, this travel time can vary widely depending on the quality and layout of transportation routes, as well as the need to switch modes of transport.

Understanding modern spatial structures and commuting patterns requires a thorough analysis of the socio-economic impacts of transport infrastructure. Theoretical frameworks highlight how structural connectivity shapes regional development, accessibility, and spatial cohesion (Spiekermann, Wegener 2000; Vickerman 2021). The socio-spatial outcomes of these networks – particularly with regard to spatial equity and individual mobility opportunities – are critical to understanding localised labour market dynamics (Geurs, van Wee 2004; Parthasarathi, Levinson, Hochmair 2013; Rodrigue 2020). When these global

models are applied to the domestic context, the latest empirical evidence shows how local commuting zones and administrative frameworks reshape domestic employment patterns (Szalkai 2025). Furthermore, these structural conditions strongly influence labour market integration, particularly in peripheral and cross-border regions, where transnational labour mobility depends on physical and institutional links (Lőcsei et al. 2025).

In recent years, the international literature has been examining these effects using increasingly sophisticated methods. Rocha and his co-authors (2024) demonstrated, with regard to Portuguese motorways, that expressways significantly increase both inbound and outbound commuter numbers, whilst also having a positive impact on local economic indicators (such as business turnover and gross value added). In contrast, Fretz, Parchet and Robert-Nicoud (2022), in examining the impact of the Swiss motorway network, drew attention to the phenomenon of 'spatial sorting': improved accessibility makes settlements more attractive to higher-income and better-educated groups, which in the long term may lead to the displacement of lower-income groups and an increase in urban sprawl.

In Central Europe, Franc and Litzman (2024) used the Czech example to demonstrate that, paradoxically, new motorways can slow down the rate of business start-ups in peripheral settlements, as the gravitational pull of major urban centres draws economic activity away from their surrounding regions. With regard to Hungary, Buckwalter (2003) pointed out as early as the beginning of the 2000s that there is a strong correlation between motorway accessibility and regional development indicators; however, during the transition period, this effect was primarily manifested through access to motorway junctions.

It is important to distinguish between the effects of proximity as a state characteristic and those of improved accessibility as a change characteristic. Whilst the former reflects existing conditions (stock effect), the latter indicates dynamic changes (flow effect). Building on these theoretical foundations, this study examines whether proximity or the degree of change has a stronger influence on the development trajectory of the region under study.

The study area

The study area covers the two northwestern counties of Hungary: Győr-Moson-Sopron and Vas (Figure 1). In terms of economic development, Győr-Moson-Sopron county is the most developed administrative unit in the country after Budapest and the Central Hungary region (comprising Budapest and Pest county), and has consistently ranked first among the counties in GDP per capita. Only Budapest, Central Hungary and Győr-Moson-Sopron county exceeded the national average in 2022; all other counties remained well below the average. Vas

county ranked 4th among the counties in 2011 but slipped to 5th by 2022, as Pest county – which is essentially the Budapest agglomeration – grew at a much faster rate. In terms of GDP growth, the two counties examined lagged well behind the average, as between 2011 and 2022, Hungary's less developed but more industrialised counties recorded faster growth, whilst the traditionally more developed areas, starting from a higher base, showed lower growth.

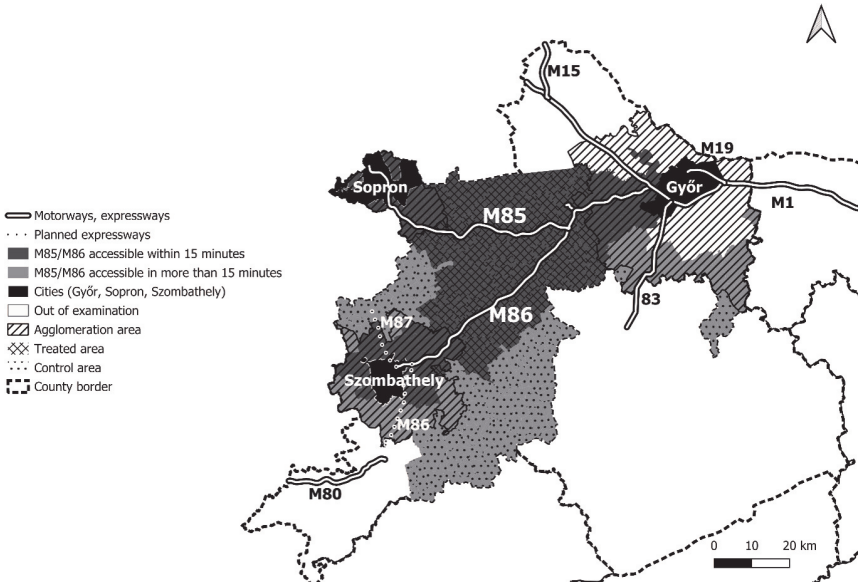
In terms of transport links, Győr-Moson-Sopron county is the western gateway to Hungary; it is crossed by the most important motorways and the railway lines, which connect Budapest with Vienna, Bratislava and, consequently, with Western and Northern Europe. If we add to this the M19 motorway, the newly completed M85 and M86 motorways, and main road No. 83 – which, despite its official classification, meets motorway standards – we can say that the county has the best transport links in the country after the central region. The M85 connects the county seat (Győr) with Sopron, the county's other city with county-level status[1]. Thus, the county can be divided into two parts: the northeastern part comprises the Győr agglomeration[2] and the area around the M1 motorway and railway line No. 1, which is the county's traditionally more developed part and enjoys an excellent transport location. The other area, the Győr–Csorna–Sopron corridor, had poorer transport conditions prior to the construction of the M85 expressway. Within this southwestern area, the Sopron region already had good transport links even before the construction of the M85, if we also take into account the nearby Austrian transport network. Csorna and its surrounding area is an important junction where roads 86 and 85 intersect. The town suffered greatly from through freight traffic until the expressway was built. At the same time, this area was considered one of the least developed parts of the county. Stretching southwards from Csorna town, towards Lake Balaton and the northern part of Zala county, lies the so-called 'inner periphery' of Transdanubia, which is remote from the larger cities and lags behind the region's more developed areas in various development indicators.

It was only with the opening of the M86 expressway that Vas county gained a well-developed road infrastructure. This road links Szombathely (county seat) with Győr and the M1 motorway, thereby integrating the county seat into the national expressway network. The county seat's transport links will continue to improve, and it will become a uniquely important transport hub at the national level with the further development of the M86 southwards and the completion of the M87 motorway, which is currently under construction.

A sort of north–south development gradient can also be observed in this county. The eastern half of the northern part is connected to the aforementioned inner periphery of Transdanubia, whilst the western half is more urbanised; the county seat and the Kőszeg district can be considered particularly well-developed, with strong links to Austria. The southern part of Vas county shows lower levels of development and is less urbanised. The M80 expressway runs through the county:

the Körmend–Szentgotthárd–national border section was opened in 2021 and 2024, whilst the remaining sections are still under construction. In fact, it is a 2 × 1-lane road without a hard shoulder, which may be upgraded to an expressway at a later date. It connects to the Austrian network via the S70 expressway, but is not yet linked to the Hungarian network. Consequently, although it is officially classified as an expressway, it can still be regarded as having unfulfilled potential from a regional development perspective.

Figure 1: The study area, the expressway network and the sample area categories in Győr-Moson-Sopron and Vas counties
A vizsgált terület, a gyorsforgalmi úthálózat és a mintaterület-kategóriák Győr-Moson-Sopron és Vas megyékben



Source: authors' compilation

Both counties are characterised by their location alongside the Austrian border. Typically, the northern section borders Austria's most developed region, the Vienna agglomeration, whilst further south, on the Austrian side, we find poorer areas. Of the Hungarian motorways, only the M1 and the M80 connect directly to the Austrian motorway network; the M85 merely approaches it, whilst the end of the M86 is still a long way from the nearest Austrian motorway. It should be noted that the M80 may gain significance in the future by providing a good link to Graz, Austria's rapidly developing transport hub.

Methodology

The aim of this study is to examine the socio-economic impact of new motorways on the localities affected by these roads. We determined the extent to which each locality was affected based on whether the nearest motorway junction could be reached from that locality within 15 minutes. To this end, we used the data from the Spatial Information System (TEIR) database titled 'Travel time to the nearest expressway junction via the fastest route by road (minutes)'. The change between two points in time (2011 and 2022) indicated whether a given settlement was affected by the completion of a new road. We relied on the TEIR database (KSH STADAT datasets) and the census data of the Hungarian Central Statistical Office (KSH) for 2011 and 2022. We can distinguish between the following two groups as dependent variables.

Firstly, to characterise overall development, we examine resident population data aggregated from the settlement level, the personal income tax base per taxpayer, the housing stock, and the number of passenger cars per 1,000 inhabitants, as well as changes in these figures between 2011 and 2022. As a second group, to analyse population flows, we use the census commuting data sets – specifically, their complete settlement matrix. From these, we calculate the out-commuting and in-commuting figures (calculated at settlement level; thus, both out-commuters and in-commuters may move both within and outside the examined territory). We determine the number of cross-border commuters and their proportion of outbound commuters; we also calculate the number of employed persons from the number of outbound commuters and the number of residents finding work locally, and the number of jobs from the number of inbound commuters and the number of locally employed residents. Obviously, these figures do not correspond to the numbers of employees and jobs estimated by labour force surveys, but they are suitable for analysing spatial and temporal variations.

The impact of motorways may differ across different types of areas. In metropolitan agglomerations, where multiple modes of transport and transport routes typically converge, their combined effects come into play. In rural areas between urban centres, the impact of development is debated, and the so-called 'tunnel effect' may emerge (Erdősi 2002). For this reason, when designing our spatial samples, we had to distinguish between large cities, medium-sized cities, their agglomerations, and rural areas. In our study, we therefore compare data from rural areas affected by new expressways with data from areas not affected by these roads, as well as with agglomeration-level and national data. First, we carried out a correlation analysis on a national sample to determine whether a general correlation could be identified between proximity to motorways, improved accessibility, and development indicators; we then examined the M85 and M86 – as newly constructed expressways – in detail, comparing the changes.

Evaluation of the correlation analysis based on a national sample

The aim of the analysis, carried out using SPSS program, was to investigate whether the accessibility of motorway junctions, and improvements therein, are correlated with trends in the demographic, labour market, housing stock, motorisation, and income indicators of localities. The analysis was based on data from 1,356 settlements where the travel time to the nearest motorway junction decreased between 2011 and 2022. Furthermore, data for Budapest, county-status cities and their agglomerations/urban regions were excluded. This ensured that the results were relevant and comparable with the data from our sample area.

Quantitative analysis of the M85 and M86 expressways' impact on urban development

To isolate the causal effect of infrastructure development, we apply the difference-in-differences (DiD) method, a quasi-experimental design. The fundamental aim of applying this model is to distinguish the extent to which the socio-economic changes under investigation can be attributed to transport infrastructure development, and the extent to which they result from general national or regional trends. The method employs 'treated' and 'control' samples (in our study, groups of settlements and areas). In this study, we divide the treated sample into further functional subsamples (agglomeration subsamples and rural subsamples along the M85 and M86, and junction subsamples at the M85–M86 intersection), and we extend the analysis to include other comparative areas (national average and other newly constructed roads in other parts of the country). These comparisons will provide a better understanding of the regional structure of the study area and its level of development within the country. This approach allows us to filter out individual settlement characteristics that remain constant over time, as well as general trends over time, thereby estimating the additional development generated by the opening of expressways. One of the fundamental conditions of the difference-in-differences approach is that the treated and control areas should have followed similar development trajectories prior to the intervention. To ensure this, the control group was drawn from the same geographical region – specifically, rural settlements in Győr-Moson-Sopron and Vas counties – which were not within a 15-minute travel zone of the M85 and M86 expressways. During the sample selection process, we excluded settlements in the northwest of Győr-Moson-Sopron county, as well as those in southwestern Vas county affected by the M80 expressway.

The aim of this approach was to ensure that the treated and control settlements were situated in institutional, regulatory and regional economic environments that were as similar as possible. Although the development indicators for the two groups are not identical, data from the 2011 base year

indicate that both represent fundamentally rural areas with similar settlement structures. We interpret the results not as strict causal estimates, but as quasi-experimental comparisons. When designing the sample, we created three clearly distinguishable groups of settlements based on road accessibility to motorways (Figure 1):

1. Rural treated group: Settlements that are within a 15-minute journey from the junctions, but are located outside urban agglomerations and are predominantly rural in character. This group comprises 96 settlements (a mix of villages and small towns), which we have divided into three subgroups: in 25 cases, the M85 is accessible; in 53 cases, the M86 is accessible; whilst in 18 cases, both motorways (M85/M86) can be reached within a maximum of 15 minutes.
2. Agglomeration-based treated groups: Settlements that are within a 15-minute isochronic distance from the M85 or M86 junctions and belong to the functional urban area (agglomeration) of Győr, Sopron, or Szombathely. It is justified to distinguish these subgroups, as the dynamics of large cities and commuting patterns can fundamentally distort the results for rural areas. In the three agglomerations, excluding the central cities, 19, 11 and 28 settlements meet these proximity criteria (in the case of Sopron, this includes all settlements within the agglomeration).
3. Control area: Rural settlements in the two counties that lie outside the 15-minute accessibility zone. In the case of Vas county, the southern areas situated near the M80 motorway were excluded. Consequently, 88 settlements from the two counties were included.

In order to interpret the results of the sample, we considered it necessary to examine the values of further groups within the study area:

4. We present the values for the three county-status cities (Győr, Sopron, Szombathely) separately.
5. The 'core' area of the Győr agglomeration comprises those settlements, which have had good transport links to the M1 motorway for decades, but are located more than 15 minutes' drive from the M85 road.
6. The peripheral group of the Győr agglomeration comprises those agglomeration settlements situated outside the 15-minute isochron line.
7. The peripheral group of the Szombathely agglomeration comprises those agglomeration settlements situated outside the 15-minute isochron line.

In order to gain a better understanding of the structural characteristics of development in the study area, we will also compare the results observed in the sample areas with other nationally aggregated data.

8. For the purposes of these comparisons, we will use national average values.
9. As well as aggregated data for settlements located within a maximum distance of 15 minutes' travel from other new motorways or motorway

sections opened during the period under review (M25, M3, M35, M44, M4) will be examined. In the case of the 'New roads' group formed from this, the county seats (Szolnok, Békéscsaba, Eger) were excluded from the group, ensuring that areas of a similarly rural nature are compared with the 'rural treated' and 'control' areas. It should be noted that none of these county seats has agglomerations as developed as those in the study area; therefore, it is not necessary to exclude agglomeration settlements from the group.

The research did not attempt to explicitly isolate or model these factors. Consequently, the changes presented cannot be regarded as being solely attributable to the impact of the M85 and M86 roads. Whilst the difference-in-differences methodology can partially filter out nationwide temporal trends, regionally varying processes such as cross-border employment, commuting from abroad, or the development of industrial centres in western Hungary may still influence the results. For this reason, we interpret the findings as reflecting a relationship between the motorway network and regional development processes, rather than as an exclusive causal effect.

Results

Impact of motorways' proximity

One of the most important questions is how motorway accessibility in 2022 relates to the socio-economic indicators examined. Based on Pearson's correlations, although most significant relationships are weak, their directions are consistent and interpretable.

A negative relationship is observed between changes in the resident population and journey time to the motorway slip road ($r = -0.127$; $p < 0.001$), indicating that settlements with better motorway accessibility generally experience a more moderate population decline or are more likely to show population growth. Spearman's rank correlation indicates a slightly stronger relationship ($\rho = -0.198$).

The proportion of commuters in 2022 also correlates negatively with motorway access time ($r = -0.153$; $p < 0.001$); in other words, the proportion of employed people who commute is higher in settlements located closer to the motorway. This is consistent with expectations in transport geography: better accessibility increases labour market mobility and broadens the range of available jobs.

However, no significant correlation is observed with the proportion of commuters ($r = -0.031$; $p = 0.250$); therefore, proximity to the motorway does not, in itself, clearly make settlements more attractive as employment centres.

Stronger correlations are observed for economic development indicators. There is a negative correlation between the personal income tax base per taxpayer and

motorway access time ($r = -0.196$; $p < 0.001$), whilst a negative relationship is also observed for car ownership ($r = -0.071$; $p < 0.01$). In other words, settlements closer to motorways generally have higher incomes and higher levels of car ownership.

A similar correlation is evident for income growth ($r = -0.142$; $p < 0.001$): settlements with better accessibility experienced greater income growth between 2011 and 2022.

Impact of improved accessibility

The second key question was whether the extent of the improvement in accessibility between 2011 and 2022 was correlated with the development of the settlements.

Based on the results, correlations here are generally even weaker. A weak but significant negative correlation was found with population change ($r = -0.062$; $p = 0.022$). Given that the variable indicates a reduction in journey time with negative values, this suggests that greater improvements in accessibility may have been accompanied by a moderate population gain. However, the correlation is extremely weak, and therefore its practical significance is limited.

No correlation can be demonstrated between the proportion of commuters and improvements in accessibility ($r = -0.010$), nor is there a significant correlation with changes in the commuting rate ($r = -0.006$). This suggests that motorway developments alone have not resulted in any noticeable change in daily commuting patterns. The proportion of cyclists and changes in this figure also show no correlation with improvements in accessibility.

With regard to the availability of jobs, however, a weak positive correlation can be observed between the 2022 figure and the change in accessibility ($r = 0.037$; not significant according to Pearson, but $\rho = 0.105$ according to Spearman; $p < 0.05$), whilst a slightly stronger positive correlation is evident in the case of changes in the number of jobs ($r = 0.114$; $p < 0.001$). This may suggest that improvement in motorway connectivity has, to some extent, contributed to the expansion of local employment capacity.

A similar trend can be observed in the housing stock. The change in the number of dwellings per 1,000 inhabitants is positively correlated with improvements in accessibility ($r = 0.082$; $p < 0.01$), which may suggest that better transport links have stimulated housing construction and the expansion of the housing stock.

A more significant correlation is evident with changes in the number of private cars ($r = -0.013$ (Pearson), but Spearman's $\rho = -0.265$ in relation to changes in the housing stock; the direct correlation with the motorway variable is weak). Overall, the results do not support the view that improved accessibility alone would have significantly increased car ownership.

No clear effect can be observed for income indicators either. Neither the 2022 income level (r = -0.020) nor the growth in income (r = -0.005) shows a significant correlation with the extent of improvement in motorway accessibility.

Overall development in the study area

In terms of population change, the region continues to follow the national demographic trends, as it is characterised by an overall population decline (Table 1). At the same time, the dynamics of these processes differ significantly from the national pattern. Whilst at the national level the rate of population decline has accelerated (from -2.4% to -3.3%), in the rural areas of the M85–M86 region the rate of decline has slowed substantially (from -4.3% to -1.4%). This improvement is particularly evident in settlements along the M86, where the rate of population loss fell by nearly five percentage points. Improved accessibility may have slowed demographic decline in peripheral regions; however, it has not reversed the trend toward growth.

In the control area, a slowdown in population decline is also evident, though the extent is considerably more modest than in the treated area. The findings therefore suggest that the demographic situation in the treated area has improved relative to the national and control area trends. It is particularly noteworthy that the region's indicators are more favourable than the demographic trends generally observed along the newly constructed motorways in Hungary.

At the same time, urban centres and agglomerations follow different development trajectories. The most dynamic growth is observed in the Győr and, in particular, the Sopron agglomerations, where population growth is outstanding even by national standards. In contrast, Szombathely's growth is concentrated in the city itself, whilst the population dynamics of the agglomeration stagnated between 2011 and 2022 and even turned negative in some settlements.

Based on the personal income tax base per taxpayer, the rural area under study was in a more favourable position than the control area in both 2011 and 2022. At the same time, the pace of development in the two areas is almost identical; in both cases, a catch-up of around 5.7 percentage points relative to the national average is observed. Although these rural areas still lag behind the national average, their performance exceeds that of many other rural areas in Hungary. This is clearly illustrated by the fact that the national 'new roads' group lags behind both the examined and control areas in terms of both income levels and growth dynamics.

The most favourable income indicators continue to be recorded in major urban centres and their agglomerations. The Győr agglomeration stands out in particular, where the tax base per taxpayer already exceeds the national average, whilst the pace of catching up is also outstanding. The data for the Sopron region, however, appear to reflect a paradoxical situation. Income indicators here

remain below the national average, whilst the region's economic performance and labour market attractiveness are significant even by national standards. The primary reason for this phenomenon is that a significant proportion of the population works in Austria, and their income does not appear in Hungarian tax base statistics because regulations prevent double taxation. Consequently, average income figures based on the number of taxpayers and total taxable income underestimate the region's actual income levels.

Changes in the housing stock largely reflect demographic trends. Although the rate of growth in the housing stock generally slowed during the second period, the decline in the treated area was significantly smaller than in the control area or at the national level. In the rural sample under study, the growth rate fell by just 1.1 percentage points, whilst a decline of 3.7 percentage points was observed in the control area. This relatively favourable performance is primarily explained by the results from settlements along the M86 motorway, where the rate of growth in the housing stock remained virtually stable. At the same time, urban agglomerations show a significantly greater rate of expansion, particularly in the Győr and Sopron agglomerations, where housing construction activity is several times higher than in the rural sample areas.

Changes in the number of private cars show a more complex spatial pattern than other indicators of development. The results suggest that the increase in car ownership is driven primarily by commuting needs, and only secondarily by income levels. The strongest growth is observed in agglomerations, where both the expansion of the passenger car fleet and the number of cars per thousand inhabitants are notably higher than the national average. The Sopron and Szombathely agglomerations are characterised by particularly high figures, closely linked to the high level of employment in Austria and daily cross-border commuting.

Table 1: Changes in the main social and economic indicators (population, personal income tax base per taxpayer, housing stock, and the number of passenger cars per 1,000 inhabitants)
A fő társadalmi és gazdasági indikátorok (lakónépesség, egy adófizetőre jutó SZJA alapot képező jövedelem, lakásállomány és személygépkocsik száma ezer lakosra) változásai

Regions	*Change in population (%)*			*Personal income tax base per taxpayer national average = 100%*			*Change in housing stock (%)*			*Passenger cars per 1,000 inhabitants (units)*	
	2001-2011	*2011-2022*	*Change (percentage points)*	*2011*	*2022*	*Change (percentage points)*	*2001-2011*	*2011-2022*	*Change (percentage points)*	*2022*	*Change compared to 2011 (units)*
Rural treated area	-4.3	-1.4	2.9	85.7	91.5	5.7	5.6	4.5	-1.1	481.4	153.4
M85	-1.5	0.2	1.7	83.7	87.6	3.9	8.2	6.0	-2.2	499.4	166.1
M85/M86	-4.6	-5.1	-0.5	88.4	95.0	6.5	4.0	1.2	-2.8	475.5	154.3
M86	-6.1	-1.2	4.9	86.1	92.8	6.7	4.4	4.7	0.3	470.0	143.3
Control area	-6.7	-5.1	1.6	82.7	88.4	5.7	4.2	0.5	-3.7	486.7	179.7
City of Győr	-0.8	1.4	2.2	116.4	119.4	2.9	13.0	10.9	-2.1	445.1	122.1
Treated area within the Győr agglomeration	1.9	8.1	6.2	96.0	106.3	10.3	10.7	7.6	-3.1	475.8	159.4
Core of the Győr agglomeration	7.3	18.3	11	105.2	116.4	11.2	17.4	19.1	1.7	465.5	150.7
Periphery of the Győr agglomeration	-3.9	1.8	5.7	91.7	100.2	8.5	3.1	2.6	-0.5	458.2	177.0

Regions	*Change in population (%)*			*Personal income tax base per taxpayer national average = 100%*			*Change in housing stock (%)*			*Passenger cars per 1,000 inhabitants (units)*	
	2001-2011	*2011-2022*	*Change (percentage points)*	*2011*	*2022*	*Change (percentage points)*	*2001-2011*	*2011-2022*	*Change (percentage points)*	*2022*	*Change compared to 2011 (units)*
City of Sopron	7.0	3.6	-3.4	92.3	87.9	-4.3	20.1	10.3	-9.8	456.2	79.8
Treated area within the Sopron agglomeration	7.9	20.9	13	80.7	78.1	-2.6	18.2	24.8	6.6	522.3	166.8
City of Szombathely	-5.2	1.1	6.3	104.9	106.4	1.5	9.8	6.4	-3.4	455.6	101.6
Treated area within the Szombathely agglomeration	2.9	-1.4	-4.3	93.6	99.1	5.5	12.4	4.6	-7.8	517.1	179.1
Periphery of the Szombathely agglomeration	-0.1	-2.4	-2.3	88.3	92.7	4.4	8.9	2.6	-6.3	494.3	187.3
New roads in Hungary	-3.8	-5.8	-2.0	77.1	80.8	3.6	4.2	0.3	-3.9	380.0	134.3
National data	-2.4	-3.3	-0.9	100.0	100.0	0.0	7.8	4.4	-3.4	426.5	127.7

Source: authors' calculation based on TEIR and KSH data

Analysis of commuting data

Outbound commuting

Based on an analysis of out-commuting patterns, only limited differences are evident between the rural treated and control areas. The number and proportion of outbound commuters have risen in both areas; however, in the control area, the proportion of outbound commuters amongst the employed is slightly higher, and the rate of increase is somewhat more pronounced.

The spatial differences are far more pronounced than the variations between the rural treated and control areas. The lowest outbound commuting rates are observed in cities, whilst the highest figures are characteristic of agglomeration settlements, where commuting has become a fundamental mechanism of labour market integration. Particularly dynamic trends are evident in the Sopron region, where the number of outbound commuters has nearly doubled.

The role of working abroad is of exceptional significance even when compared to the national average. The proportion of cross-border commuters is particularly high in Sopron and its surrounding area, and it exceeds the national average throughout the western Hungarian region under study. In the rural treated area, both the proportion of cross-border commuters and the rate of growth are higher than in the control area, suggesting that improved accessibility via the new transport infrastructure may have increased labour mobility across the border.

Changes in the number and proportion of locally employed residents can be interpreted as reflecting commuting patterns. In rural areas, their numbers fell or stagnated, whilst in agglomerations increased. Overall, changes in employed population show a close correlation with changes in resident population, suggesting that demographic dynamics remained one of the most important determinants of labour market processes during the period under review.

Based on commuting data, the spatial mobility of the workforce in the region under study has continued to increase in parallel with the development of the new motorway network; however, the nature of these changes is better characterised by a reorganisation of existing regional links rather than the emergence of new commuting patterns. The results suggest that the impact of the M85 and M86 motorways was primarily manifested in a deepening of labour market integration that had already existed previously.

No significant difference is observed between the treated rural area and the control area with respect to the out-commuting indicators. In the treated rural sample, the number of outbound commuters increased by 30.2% between 2011 and 2022, which exceeds the 28.3% increase recorded in the control area (Table 2). At the same time, the proportion of those who have moved away from the area amongst the employed is higher in the control area (65.6%) than in the treated area (61.6%), and the rate of increase was also faster (+7.8 and +7.5

percentage points respectively). Both types of regions significantly exceed the national average, where the proportion of cross-border commuters is only 41.0%, whilst the growth rate was 5.6 percentage points. This suggests that the labour market in the border region of western Hungary is much more integrated than the national average, and that the spatial separation between place of residence and place of work is considerably more pronounced.

Within the rural study area, the differing characteristics of the individual road sections are clearly evident. Along the M85, the proportion of commuters rose to 67.4%, which is the highest rural figure in the entire sample. In contrast, a rate of 56.5% is observed in settlements along the M86, suggesting that local employment opportunities have remained somewhat more significant here.

Differing labour market positions of cities and agglomerations

The most striking differences are evident at the level of the settlement hierarchy. In cities, the commuting rate is significantly lower than in agglomerations. In Győr, only 17.1% of the workforce worked in another settlement in 2022; in Szombathely, 22.3%; and in Sopron, 33.7%. This reflects the role of these cities as centres of employment.

In contrast, the agglomerations fulfil a classic residential function. In the Győr agglomeration, the proportion of commuters was 77–78%; in the Sopron agglomeration, 80.7%; and in the Szombathely agglomeration, 82.6% in 2022. This means that four-fifths of the employed population in these settlements do not work in their place of residence.

The strongest agglomeration integration is observed in the Győr region. In the core area, the proportion of commuters stands at 77.1%, whilst their number has increased by nearly 47%. At the same time, the number of people in employment rose by 41.1%, which clearly reflects the combined effect of suburbanisation and economic growth.

Cross-border commuting

One of the most significant characteristics of the study area is the significant proportion of people working abroad. At the national level, 6.3% of commuters work abroad, whilst in the rural sample under study, this proportion is 18.7% and in the control area it is 14.4%.

The Sopron region is characterised by particularly high figures. In the city of Sopron, nearly three-quarters (74.7%) of commuters work abroad, whilst in the Sopron agglomeration the figure is 39.2%. These proportions can be considered unique even on a national scale.

The trend in cross-border commuting is also significant. Within the group of commuters in the intervention area, the proportion travelling abroad rose by 5.6

percentage points, whilst in the control area it rose by only 3.9 percentage points. A particularly strong increase was observed in the M85 area (+7.5 percentage points), suggesting that improvements to transport infrastructure may have improved access to the Austrian labour market. Cross-border commuting also increased along the M86 (+5.1 percentage points) but it remains less significant than in areas closer to Sopron. This clearly demonstrates that transport infrastructure alone is not sufficient for the development of cross-border labour market links; their intensity is determined primarily by geographical location and proximity to the Austrian labour market.

Changes in local workforce and employment

As outbound commuting increased, the number of residents working locally in rural areas fell. In the rural treated area, this decline was 4.5%, whilst in the control area it was nearly 8%. In other words, the local labour market in the treated area was less severely affected.

In contrast, an increase can be observed in urban agglomerations. In the core area of the Győr agglomeration, the number of people working locally rose by 25.5%, whilst in the Sopron agglomeration it rose by 21.5%. This suggests that population growth and economic development have simultaneously increased both the number of locally employed residents and the number of outbound commuters.

Changes in the number of people employed are closely linked to demographic trends. The greatest increase occurred in dynamically growing agglomerations, particularly in the core area of the Győr agglomeration (+41.1%) and in the Sopron agglomeration (+42.4%). In contrast, a much more modest employment increase can be observed in rural areas experiencing population decline.

Table 2: Change in the number and proportion of outbound commuting and employment-related data between 2011 and 2022
Az elingázók számának és arányának, illetve egyéb, foglalkoztatással összefüggő adatok változása a mintaterületen, 2011 és 2022 között

Regions	*Outbound commuters*				*Cross-border commuters*				*Residents working locally*	*Employed resident*
	Change in number (%)	*Percentage of the working population %*		*Change in the proportion, in percentage points*	*Change in number (%)*	*Percentage of the commuters %*		*Change in the proportion, in percentage points*	*Change in number (%)*	*Change in number (%)*
		2011	*2022*			*2011*	*2022*			
Rural treated area	30.2	54.1	61.6	7.5	85.5	13.1	18.7	5.6	-4.5	14.2
M85	29.6	60.8	67.4	6.6	81.1	18.8	26.2	7.5	-2.9	16.9
M85/M86	25.7	56.5	63.5	7.0	59.2	10.8	13.7	2.9	-6.1	11.8
M86	32.8	48.2	56.5	8.3	109.5	8.8	13.9	5.1	-4.9	13.3
Control area	28.3	57.8	65.6	7.8	76.0	10.5	14.4	3.9	-7.9	13.0
City of Győr	54.0	13.3	17.1	3.8	73.9	19.2	21.7	2.5	14.3	19.6
Treated area within the Győr agglomeration	31.7	74.2	77.4	3.1	80.5	5.5	7.6	2.1	11.0	26.4
Core of the Győr agglomeration	46.6	74.3	77.1	2.8	96.8	4.5	6.0	1.5	25.5	41.1
Periphery of the Győr agglomeration	33.4	71.0	76.2	5.1	23.5	3.8	3.5	-0.3	2.4	24.4

Regions	Outbound commuters				Cross-border commuters				Residents working locally	Employed resident
	Change in number (%)	Percentage of the working population %		Change in the proportion, in percentage points	Change in number (%)	Percentage of the commuters %		Change in the proportion, in percentage points	Change in number (%)	Change in number (%)
		2011	2022			2011	2022			
City of Sopron	87.9	20.8	33.7	12.9	97.5	71.0	74.7	3.6	-2.9	16.0
Treated area within the Sopron agglomeration	48.5	77.4	80.7	3.3	127.7	25.6	39.2	13.7	21.5	42.4
City of Szombathely	57.6	16.1	22.3	6.2	93.2	28.9	35.4	6.5	5.7	14.1
Treated area within the Szombathely agglomeration	18.7	80.7	82.6	1.9	102.6	7.4	12.6	5.2	4.5	16.0
Periphery of the Szombathely agglomeration	23.0	78.3	81.3	3.0	80.0	7.0	10.3	3.3	2.1	18.4
New roads in Hungary	46.8	42.8	50.6	7.7	46.6	4.1	4.1	0.0	6.2	24.3
National data	38.4	35.4	41.0	5.6	46.2	6.0	6.3	0.3	9.4	19.7

Source: authors' calculation based on TEIR and KSH data

Reorganisation of commuting destinations

An analysis of commuting destinations suggests that new roads have not fundamentally altered the region's labour market orientation (Table 3). The key employment centres remain Győr, Sopron, and Szombathely; in the case of Győr, the agglomeration also emerges as a distinct employment hub.

The strongest labour-attracting effect is evident in the Győr region. Of the outbound commuters in the M85/M86 subsample, 22.8% work in Győr, the highest proportion among the destinations examined. This clearly reflects Győr's role as the leading economic centre of the Western Transdanubia region.

At the same time, intra-regional links weakened in several instances during the period 2011–2022. The proportion of commuters travelling from the rural study area to Győr, Sopron, and other regional centres stagnated or declined. In particular, a 1.2 percentage point decline in the number of commuters travelling towards Győr was observed in the M85/M86 subgroup.

The pull of Budapest and its agglomeration increased, albeit from a low base. Within the study area, the proportion of commuters travelling to Budapest rose by 1.9 percentage points, suggesting that improved transport links have, in part, facilitated a broader geographical spread of the capital's labour market. Nevertheless, the role of the Budapest-oriented labour market remains limited. The proportion of commuters travelling from the rural treated area to Budapest is only 2.5%, whilst the figures for Sopron and Győr are 10.3% and 8.2% respectively. The region's domestic labour market network has therefore remained essentially regional and has not become Budapest-centred.

This is particularly striking when compared with the country's other new motorways. In the national sample of 'new roads', the proportion of commuters to Budapest is 16.2%, whilst in the region under study it is only 2–3%. This shows that the development of the western Hungarian region is determined primarily by its own regional economic centres and the Austrian labour market, rather than by the pull of the capital city.

To enable a nationwide comparison, we also examined the proportion and changes in destinations for the other new motorways. In each case, we took into account Budapest and the county seats accessible via the motorway in question. Of those commuting from these areas, 16.2% travel to Budapest – a figure that has risen by 3.3 percentage points compared with 2011 – whilst the proportion commuting to county seats stands at 26.5%, having remained virtually unchanged following the opening of the new roads. It can be seen that, amongst commuters from the areas served by the M85 and M86, the proportion of commuting to the capital is significantly lower; whilst the increase in this proportion is similar to that seen with the other new roads; the situation is similar for the county-status cities concerned.

Table 3: The share of different commuting destinations in work-related commuting in 2022 (%) and change compared to 2011 in percentage points
A különböző ingázási irányok részesedése a munkavállalási célú ingázásban 2022-ben (%) és a 2011-hez viszonyított változás mértéke százalékpontokban kifejezve

Place of residence	Destination							
	Budapest agglomeration		*City of Budapest*		*Győr agglomeration*		*City of Győr*	
	2022	*Change (2011-2022)*	*2022*	*Change (2011-2022)*	*2022*	*Change (2011-2022)*	*2022*	*Change (2011-2022)*
Rural treated area	0.5	0.4	2.5	1.9	1.9	0.2	8.2	0.0
M85	0.3	0.2	2.1	1.6	1.1	0.3	5.4	0.0
M85/M86	0.6	0.5	2.9	2.1	5.9	0.4	22.8	-1.2
M86	0.6	0.5	2.8	2.1	0.8	0.2	4.3	0.8
Control area	0.5	0.4	2.7	2.0	0.8	0.2	3.0	0.8
City of Sopron	0.6	0.4	5.6	3.1	0.4	0.2	1.8	0.0
City of Szombathely	1.3	0.9	10.1	7.3	0.1	0.1	2.1	1.3
Core of the Győr agglomeration	0.7	0.5	3.2	2.0	11.8	0.9	68.3	-0.5
Treated area within the Sopron agglomeration	0.2	0.2	1.7	1.3	0.2	0.0	1.6	0.4
Periphery of the Szombathely agglomeration	0.4	0.3	1.9	1.6	0.1	0.1	0.6	0.5
City of Győr	2.3	0.9	17.7	8.9	27.1	0.5		
Treated area within the Győr agglomeration	0.5	0.3	2.5	2.0	12.8	0.4	62.7	-1.6
Periphery of the Győr agglomeration	0.4	0.2	2.0	1.2	16.6	1.7	67.9	1.1
Treated area within the Szombathely agglomeration	0.3	0.2	2.2	1.8	0.1	0.1	0.5	0.4

Place of residence	Destination							
	Budapest agglomeration		*City of Budapest*		*Győr agglomeration*		*City of Győr*	
	2022	*Change (2011-2022)*	*2022*	*Change (2011-2022)*	*2022*	*Change (2011-2022)*	*2022*	*Change (2011-2022)*
Rural treated area	0.8	0.2	6.3	1.4	1.3	-0.1	10.3	-0.3
M85	0.0	0.0	0.5	0.2	2.7	-0.2	19.6	-0.6
M85/M86	0.0	0.0	0.3	0.1	0.3	0.1	4.2	-0.3
M86	1.9	0.3	14.2	2.9	0.4	0.1	4.5	0.0
Control area	3.7	0.0	21.4	4.4	0.2	0.1	2.5	0.4
City of Sopron	0.1	0.1	0.9	0.3	5.2	-2.0		
City of Szombathely	18.4	-2.4			0.0	0.0	2.0	0.7
Core of the Győr agglomeration	0.0	0.0	0.1	0.1	0.0	0.0	0.3	0.1
Treated area within the Sopron agglomeration	0.0	0.0	0.4	0.3	3.5	-0.4	46.0	-11.2
Periphery of the Szombathely agglomeration	8.4	0.0	61.6	-2.5	0.1	0.1	0.3	0.2
City of Győr	0.1	0.1	0.6	0.4	0.1	0.1	1.4	0.3
Treated area within the Győr agglomeration	0.0	0.0	0.2	0.1	0.0	0.0	0.6	-0.1
Periphery of the Győr agglomeration	0.0	0.0	0.1	0.1	0.1	0.0	0.3	0.3
Treated area within the Szombathely agglomeration	8.1	-0.9	65.1	-4.3	0.1	0.1	0.4	0.1

Source: authors' calculation based on TEIR and KSH data

Inbound commuting and settlements attractiveness

The most significant differences emerge when examining inbound commuting (Table 4). This follows from the nature of the data itself: inbound commuting affects fewer settlements than outbound commuting and is a more concentrated phenomenon, so the disparity between settlements of different types will be greater. In this respect, the figures and dynamics in the treated rural area far exceed those in the control area. In the treated rural area, the number of inbound commuters increased by 29.8%, whilst in the control area it rose by only 15.8%. The number of jobs rose by 11.6% in the managed rural area, and by a mere 1.5% in the control area. If we compare groups located along other new roads in the country with the area under study, it can be seen that, whilst the absolute figures in other parts of the country are lower than in the rural treated area or the control area, the rate of growth is significantly higher.

This suggests that the M85–M86 region is not only a source of labour but is also increasingly acting as a destination for labour. Particularly noteworthy is the M85/M86 subgroup in the Csorna area, where the number of in-commuters increased by 55%, whilst the number of jobs rose by 21.4%. This is an outstanding figure within the overall rural sample.

Nevertheless, the region's development dynamics lag behind the national average. Nationally, the number of jobs increased by 28.3%, and by 27.6% along the new roads, whilst in the area under study it rose by only 13.2%. On this basis, road network developments did not in themselves generate exceptional job creation, but they did contribute to the better integration of existing economic centres and to strengthening the region's ability to attract labour.

Overall, the results show that the most significant impact of the M85 and M86 motorways was not a radical transformation of the employment structure, but rather a denser network of regional labour market links, a further increase in cross-border employment, and the increasing integration of certain key hubs – above all the regions of Győr and Csorna – into the Western Transdanubian economic area.

Table 4: Inbound commuting and job trends between 2011 and 2022
Beingázás és munkahelyeket érintő trendek 2011 és 2022 között

	Number per 1,000 inhabitants				*Number per 1,000 inhabitants*			
	Change in number (%)	*Number per 1,000 inhabitants*			*Change in number (%)*	*Number per 1,000 inhabitants*		
		2011	*2022*	*Change in percentage points*		*2011*	*2022*	*Change in percentage points*
Rural treated area	29.8	46.8	54.4	7.7	11.6	377.4	427.2	13.2
M85	29.9	51.2	58.3	7.2	13.9	350.5	398.5	13.7
M85/M86	55.0	34.8	46.9	12.0	15.2	289.7	351.6	21.4
M86	24.7	47.4	54.1	6.8	9.2	433.3	478.5	10.4
Control area	15.8	39.7	45.3	5.6	1.5	292.7	313.1	7.0
City of Győr	56.0	37.9	45.5	7.5	30.1	622.6	798.7	28.3
Treated area within the Győr agglomeration	40.4	48.7	54.6	5.9	25.3	224.4	260.2	15.9
Core of the Győr agglomeration	88.6	35.8	45.6	9.8	48.1	177.1	221.8	25.2
Periphery of the Győr agglomeration	14.3	39.4	42.1	2.7	7.1	198.6	209.0	5.2
City of Sopron	45.7	23.6	31.6	8.1	8.6	467.7	490.2	4.8
Treated area within the Sopron agglomeration	41.1	40.3	44.0	3.6	29.4	167.8	179.6	7.0
City of Szombathely	38.3	35.1	41.5	6.3	17.2	587.3	680.7	15.9
Treated area within the Szombathely agglomeration	31.2	51.2	56.9	5.6	18.2	178.7	214.1	19.8
Periphery of the Szombathely agglomeration	55.0	43.8	54.2	10.4	25.3	166.6	213.7	28.3
New roads in Hungary	59.0	26.3	34.9	8.5	20.1	258.2	329.5	27.6
National data	56.2	31.3	39.4	8.1	24.0	373.1	478.8	28.3

Source: authors' calculation based on TEIR and KSH data

Discussion

The results suggest that the socio-economic impacts of the expansion of the motorway network are more complex than a linear relationship between accessibility and development would suggest. Although settlements located closer to motorways have more favourable demographic and economic indicators, the extent of improved accessibility alone shows only a limited correlation with the development indicators examined. Based on the results of the correlation analysis, population change, income levels, and commuting patterns are more strongly linked to proximity to motorways than to the extent to which a settlement has moved closer through the expressway network between 2011 and 2022. This suggests that transport infrastructure does not in itself shape development processes but is primarily capable of having a significant impact in areas that already possess favourable economic and social resources.

Our findings are consistent in several respects with those of core–periphery models and new economic geography. According to these, reduction in transport costs does not necessarily lead to the catching up of peripheral regions but often reinforces the competitive advantage of existing centres. Whilst demographic and economic indicators have improved in many rural settlements in the region, the most dynamic development continues to be observed in cities and their agglomerations. In particular, Győr and Sopron agglomerations have shown outstanding growth in population and housing stock, suggesting that the new infrastructure has primarily reinforced existing urbanisation processes. It is evident that M85–M86 junction around Csorna has seen significant improvement and is becoming integrated into the Győr agglomeration.

An analysis of commuting data also provides important insights. The new expressways have increased labour mobility but have not brought about any fundamental structural transformation in the region's labour market network. The proportion of commuters has risen, yet the main patterns of the regional division of labour have not changed significantly. No marked strengthening of links between Győr, Sopron and Szombathely can be observed, even though this would be expected in the case of a polycentric development pattern. Indeed, in several cases, the relative proportion of commuting from the areas under study towards the traditional regional centres has declined. One of the negative findings of the research is that the M85 and M86 motorways have not strengthened the mutual labour exchange between the three regional centres (Győr, Sopron and Szombathely). Although physical connectivity has improved, the intensity of commuting between the cities has stagnated or increased only marginally. The data highlight the asymmetry of these commuting patterns. The proportion of commuters travelling to Sopron from settlements along the M85 corridor was 19.6 per cent in 2022, representing a slight decrease (-0.6 percentage points) compared with 2011. In contrast, only 5.4 per cent of people

from the same region commuted to Győr, and this proportion has remained completely unchanged (0.0) since the road was built. Similarly, 14.2 per cent of those living along the M86 section linked to Szombathely work in the county seat (+2.9 percentage points), but only 4.3 per cent (+0.8) commuted towards Győr. The most telling data comes from the group located at the junction of M85 and M86 roads (M85/M86): here, Győr's dominance is unquestionable (22.8 per cent of commuters), whilst Szombathely's appeal is negligible (0.3 per cent). These data confirm that cities in this polycentric region continue to have independent, relatively isolated catchment areas, and that road development has not created an integrated regional labour market. This suggests that the new roads have primarily made existing labour market links more efficient but have not created new processes of regional integration.

One of the most important findings of the research is the exploration of the Austrian labour market's role. Whilst most of Hungary's new motorways show an increase in the pull of the capital's city centre, a different pattern emerges in the region under study. The proportion of cross-border commuters significantly exceeds the national average across all examined subgroups, particularly in the Sopron region. This suggests that the effects of the M85 and M86 motorways can only be partially understood within the context of the Hungarian urban network. One of the most significant consequences of these infrastructure developments may well have been that they improved access to the Austrian labour market, thereby intensifying cross-border daily mobility patterns. The development of this region should therefore be interpreted not solely in a national context, but within a functional cross-border regional framework.

Based on difference-in-differences comparisons, the treated localities showed a more favourable trajectory than those in the control area across several indicators. However, the magnitude of the differences generally remained moderate and, in many cases, did not represent a qualitative shift in development trends. The rate of population decline slowed, the number of jobs increased, and car usage rose above the control area's figures; however, these changes were not sufficient on their own to chart a new course of development for the region. The results suggest that the expressways acted as catalysts for existing development processes.

Overall, the research suggests that the expansion of the motorway network can primarily be interpreted as infrastructure designed to increase capacity, and does not fundamentally represent a new, structural change in the network connections of cities and regions concerned. We could verify this by comparing our findings with a motorway that did not follow the route of pre-existing main roads but instead represented a new structural element within Hungary's territorial structure. However, as we do not have such a motorway, our findings remain speculative. This can only be examined once the planned roads in Szombathely are completed and a network connection is established that does

not run towards Budapest. The new roads have improved mobility, increased commuting distances, and contributed to the spatial expansion of labour markets. However, they have not created a new settlement hierarchy or new regional development axes. The impact of these developments was felt through the existing economic structure, the position within the urban network, and labour market linkages.

Our findings therefore confirm that transport infrastructure is a necessary but not, in itself, a sufficient condition for regional development: convergence and polycentric development can only be expected if transport investments are implemented in conjunction with economic development, institutional and labour market interventions.

Conclusion

The study examined the impact of the M85 and M86 expressways on the development and commuting connections of rural settlements in Northwestern Hungary. Our results show that motorway proximity is significantly associated with several development indicators, while the independent impact of improved accessibility is limited. The most significant changes occurred in commuting systems: labour mobility increased, and the geographical extent of commuting connections expanded. However, only moderate additional effects can be demonstrated for local economic and demographic indicators.

The study did not clearly demonstrate that the new expressways strengthened the region's polycentric structure. Functional relations between cities developed only to a limited extent, while the role of the Austrian labour market continued to strengthen. The lack of polycentric cohesion warns that physical infrastructure alone cannot bridge the functional distance between cities. For Győr, Sopron, and Szombathely to form a real region, not only asphalt roads but also institutional and economic cooperation would be needed. As it stands, the new roads tend to drain the labour force from rural areas to the centres (or Austria), which could lead to the long-term demographic and economic erosion of rural areas.

Our research concludes that the impact of expressway infrastructure investments is fundamentally embedded in the existing economic and social structure, so they primarily strengthen existing spatial structural processes.

Notes

1 There are 19 counties in Hungary. With the exception of Pest county, whose centre is Budapest, 18 counties have county seats and there are also further 7 county-status cities. Thus, in our study area there are 2 county seats (Győr, Szombathely) and 1 county-status city (Sopron).

2 According to the nomenclature of the Hungarian Central Statistical Office (KSH), agglomerations, agglomerating areas or metropolitan settlement clusters are formed around Hungarian medium-sized cities depending on the level of integration of their urban areas. In our study area, there is an agglomeration around Győr, an agglomerating area around Szombathely, and a metropolitan settlement cluster around Sopron. For simplicity, we use the word agglomeration in all cases.

References

Berta, T., Török, Á. (2010): Travel Time Reduction due to Infrastructure Development in Hungary. *Promet – Traffic & Transportation,* 1., 23–27. https://doi.org/10.7307/ptt.v22i1.161

Buckwalter, D. W. (2003): Highways and Regional Realignment in an Economic Frontier: The Case of Hungary. *Eurasian Geography and Economics*, 2., 121–143. https://doi.org/10.2747/1538-7216.44.2.121

Duranton, G., Turner, M. A. (2011): The fundamental law of road congestion. *American Economic Review,* 6., 2616–2652. https://doi.org/10.1257/aer.101.6.2616

Erdősi F. (2002): Gondolatok a közlekedés szerepéről a régiók/városok versenyképességének alakulásában. *Tér és Társadalom,* 1., 135–159. https://doi.org/10.17649/TET.16.1.840

Fleischer T. (2009): A közlekedés szerepe a policentrikus városhálózat fejlesztésében. *Tér és Társadalom,* 1., 19–42. https://doi.org/10.17649/TET.23.1.1214

Franc, A., Litzman, M. (2024): Are new highways beneficial for regional economic development? *Proceedings of the 17th International Scientific Conference INPROFORUM,* 335–340. https://doi.org/10.32725/978-80-7694-053-6.51

Fretz, S., Parchet, R., Robert-Nicoud, F. (2022): Highways, Market Access and Spatial Sorting, *The Economic Journal,* 643., 1011–1036. https://doi.org/10.1093/ej/ueab070

Geurs, K. T., van Wee, B. (2004): Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport Geography,* 2., 127–140. https://doi.org/10.1016/j.jtrangeo.2003.10.005

Glaeser, E. L., Kahn, M. E. (2004): Sprawl and urban growth. In: Henderson, J. V., Thisse, J. F. (eds.): *Handbook of Regional and Urban Economics. Volume 4: Cities and Geography.* Elsevier, 2481–2527. . https://doi.org/10.3386/w9733

Hardi, T., Szörényiné Kukorelli, I. (2014): Complex gravity zones and the extension of labour catchment areas in North Transdanubia. *Dela - Oddelek za Geografijo Filozofske Fakultete v Ljubljani,* 42., 95–114. https://doi.org/10.4312/dela.42.95-114

Hardi T. (2025): A magyar középvárosok városhálózati/térszerkezeti pozíciójának alakulása az ingázó adatok fényében (2001–2022). *Területfejlesztés és Innováció,* 2-3., 51–70. https://doi.org/10.15170/terinno.2025.18.02-03.03

Krugman, P. (1999): The role of geography in development. *International Regional Science Review,* 2., 142–161. https://doi.org/10.1177/016001799761012307

Krugman P. (2000): A földrajz szerepe a fejlődésben. *Tér és Társadalom.* 4., 1–21. https://doi.org/10.17649/TET.14.4.604

KSH népszámlálások adatai (2011, 2022). https://www.ksh.gov.hu/nepszamlalasok (Letöltés: 2026. 04. 02.)

Levinson, D. M. (1998): Accessibility and the journey to work. *Journal of Transport Geography,* 1., 11–21. https://doi.org/10.1016/S0966-6923(97)00036-7

Lőcsei H., Bogdán G., Csizovszky A., Igari A., Labáth Á., Varga B. (2025): Munkavállalási célú ingázás a magyar határokon [Commuting for employment purposes across the Hungarian borders]. In: Hermann Z., Czaller L. (eds.): *Munkaerőpiaci tükör 2025: a munkaerőpiac területi egyenlőtlenségei.* ELTE Közgazdaság- és Regionális Tudományi Kutatóközpont, Budapest, 136–143.

Parthasarathi, P., Levinson, D., Hochmair, H. (2013): Network Structure and Travel Time Perception. *PLoS ONE,* 10., e77718. https://doi.org/10.1371/journal.pone.0077718

Rocha, B. T., Melo, P. C., Afonso, N., de Abreu e Silva, J. (2024): Motorways, local economic activity and commuting. *Regional Studies,* 1., 164–177. https://doi.org/10.1080/00343404.2023.2187768

Rodrigue, J-P. (2020): *The Geography of Transport Systems.* Routledge, New York

Spiekermann, K., Wegener, M. (2000): Freedom from the Tyranny of Zones: Towards New GIS-based Spatial Models. In: Fotheringham, A. S., Wegener, M. (eds.): *Spatial Models and GIS: New Potential and New Models. GISDATA 7.* Taylor & Francis, London, 45–61.

Szalkai G. (2025): Az ingázás tendenciáinak változása Magyarországon 2011 és 2022 között [Changes in commuting trends in Hungary between 2011 and 2022]. In: Hermann, Z., Czaller, L. (eds.): *Munkaerőpiaci tükör 2025: a munkaerőpiac területi egyenlőtlenségei.* ELTE Közgazdaság- és Regionális Tudományi Kutatóközpont, Budapest, 120–126.

Tóth, G., Nagy, Z. (2014): Same or Different Development Paths? A Comparative Study of the Large Cities and Regions in Hungary. *Regional Statistics,* 1., 100–119. https://doi.org/10.15196/RS04107

Vickerman, R. (2021): Will Covid-19 put the public back in public transport? A UK perspective. *Transport Policy,* 103., 95–102. https://doi.org/10.1016/j.tranpol.2021.01.005