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New Transport Infrastructure and Regional Development of Central and Eastern Europe

Tomasz Komornicki * and Sławomir Goliszek

Institute of Geography and Spatial Organization Polish Academy of Sciences, 00-818 Warsaw, Poland
* Correspondence: t.komorn@twarda.pan.pl

Abstract: The discussion about the impact of the construction of new transport infrastructure on economic growth has been going on in scientific journals for decades. The objective of the article is to assess the importance of the development of transport infrastructure for regional development in Central and Eastern European countries (CEEC). The analysis mainly concerns investments made with the support of European Union structural funds. Particular attention was paid to transport relations between the major metropolises. It is assumed that they perform the functions of growth poles and generate the diffusion of development processes also into the peripheral area. In addition, a study of changes in potential accessibility in road transport was carried out. The temporal scope of the study covers a period of 12 years, when the scale of new investment was greatest. The results thus obtained are set against a backdrop of economic development indices (changes in GDP over the period under study). The study confirmed that the impact on economic development mainly takes place at the beginning of the development of the transport infrastructure. On this basis, a dynamic spatial sequence proposal was formulated regarding the dependence between investments in infrastructure and the development of regions and metropolises.

Keywords: infrastructure development; gdp growth; central-eastern Europe; roads; rail; accessibility

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1. Introduction

The discussion about the impact of the construction of new transport infrastructure on economic growth has been going on in scientific journals for decades. Many authors emphasise that the potential impact of the growth of transport infrastructure can differ from one region to another and depends on the presence or absence of other drivers of economic growth [1]. Reliable research on this issue requires a broad temporal and spatial perspective. It should also comprise major infrastructural programmes rather than individual investment projects. A time perspective can only be gained by reference to long-term economic history research. Currently, large-scale infrastructure endeavours are primarily being pursued in China, and on a smaller scale also in India or Iran. As a consequence, many of the analyses that have been published concern those countries (in recent years, e.g., Yu et al. [2]; and Maparu and Mazumder [3]). In Europe, in former decades, substantial research efforts focused on Spain, whose infrastructure programmes were extremely ambitious [4]. With the 2004 enlargement of the European Union, the centre of gravity of transport infrastructure efforts shifted to Central and Eastern Europe, where it covered an extensive area extending from Estonia to Bulgaria [5,6]. A substantial portion of the investments was co-funded by the EU's Cohesion Policy [7]. They have not been evaluated in a comprehensive manner to date. The analyses have been country-specific [8] and have generally focused on individual modes of transport. In addition, many studies that have formulated conclusions regarding the effect of European transport investments on GDP dynamics have been based on research carried out in Western Europe. Following this, the results have been extrapolated to the entire continent. Therefore, it seems essential that the studies be reviewed, this time with account taken of the effects of investments in Central and Eastern Europe [5].

The objective of the article is to assess the importance of the extension of transport infrastructure, seen on a macro-scale, for regional development in the new EU member states. In the thematic sense, the new infrastructure, built up with extensive support of EU funds under the cohesion policy, is the primary subject of the analysis. For that reason, the paper focuses, in the first place, on the assessment of the impact of the considerable linear investments (roads and railways) on the development of regions classified as NUTS3 units. The NUTS classification was formally introduced in Poland on 26 November 2005, at the time of the entry into the force of the Regulation of the European Parliament and of the Council amending the Regulation on the establishment of a common classification of territorial units for statistics (NUTS) due to the accession of Czechia, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia to the European Union. Special attention is paid to transport relations between the most important metropolises in the area considered, which function as development poles and generate diffusion of economic growth throughout a wider area. The analysis is supplemented with an assessment of changes in potential accessibility by road, which, although unable to accurately capture the actual contribution of the investments to regional development, provides an insight into the development opportunities created by the new infrastructure.

In this context, it can be assumed that the overarching objectives of carrying out large transport investment projects are as follows:

1. Providing support for the development of main metropolises, including their position in the network structure, and development of their range of interaction (labour market), including the elimination of bottlenecks on the routes between metropolises;
2. Improvement in the accessibility of peripheral areas as a necessary precondition (though not a sufficient one) for the activation of economic development, as well as for enhancing better linkages for these areas with metropolitan centres.

For the aforementioned reasons, an assessment was made of large transport investment projects that were carried out in Central and Eastern European countries (CEEC) over a period of 10–12 years. The CEE countries are the EU accession countries (those being EU members that joined in 2004 and 2007), apart from Cyprus and Malta, which are located at a geographical distance from the primary area of research [9]. The results thus obtained are set against a backdrop of economic development indices (changes in GDP over the period under study). The study made it possible to relate the investment process in transport to the rapid changes taking place in Central and Eastern Europe as a result of the transformation and subsequent accession to the European Union. It complements a number of earlier studies carried out mainly under conditions of already-developed Western European infrastructure.

The study utilises the results of the project EU FP7 GRINCOH (Growth-Innovation-Competitiveness: Fostering Cohesion in Central and Eastern Europe). It comprises investments completed by the end of 2015 when the EU's 2007–2013 financial perspective actually came to an end (the n + 2 rule). Thus, the study spans the years 2004–2015. The discussion of the changes in accessibility relies on the outcomes of the RECIPA (Relativity and effectiveness of changes in potential accessibility and the costs of building modern transport infrastructure systems) project of the Polish National Science Centre, which gives a picture of the changes in accessibility indicators over the years 2007–2015.

The article is structured as follows. The first chapter refers to previous research on the impact of the development of transport infrastructure on economic growth. Particular emphasis is placed on the relatively few previous studies on infrastructure projects completed in the 'new' EU member states. The second chapter presents an overview of the research method employed and the data sources relied on. The chapters that follow (3–4) are devoted to the spatial distribution and scale of road and rail transport projects. The fifth chapter presents the findings of an analysis of changes in the potential accessibility of road transport. The sixth chapter is an attempt to establish the relationship between

EU expenditure on infrastructure (under the Cohesion Policy) and GDP, which includes a proposal for a regional typology. Chapter Seven, which is a summary, presents the conclusions and proposes a sequential model for measuring the effects of road transport infrastructure investments on development.

2. Results of Previous Research

Issues associated with the impacts of transport investments on the socio-economic development of adjacent areas are widely analysed in the scientific literature. The role of infrastructure as a factor behind economic growth is often questioned. At the same time, studies corroborating that proposition are frequently conducted in countries with a dense road and/or rail network. Numerous other studies point out that the development of infrastructure is not a sufficient condition for economic development but that, undoubtedly, it is a necessary precondition for activating growth processes. When perceived from a macroeconomic global perspective, the impact of infrastructure development on the economy is of undisputed importance. Recent studies have proved the classical conjecture that regional differences at an economic level are associated with mutual relations between the economy of scale and the cost of transport [10,11]. The problem becomes more complex when lesser spatial structures, as well as particular modes of transport, are subject to analysis. This applies in a particular manner to highly developed countries that have a well-established transport network and where the developmental role of new investments is often put into question [12,13]. This does not mean, however, that transport in these countries has ceased to be an essential factor in development. It only proves that the impact of transport on development is of a complex nature (an indirect factor) and that it cannot be analysed by means of simple models [14]. A critique is levelled at the validity of further development of road infrastructure based on the limited effectiveness of such developments and considerable external costs generated by road transport. The research studies corroborating this critique, however, are primarily conducted in urban areas (cf. Szarata [15]). As a consequence, such studies have limited spatial scope with the scale making it impossible for the transport factor to be identified accurately [16], including urban mobility studies [17–19]

However, some modern studies [1] have confirmed that a statistical relationship between economic development and the length of railway lines and motorways also exists in areas located within the EU's economic core, such as Belgium.

In the literature on the subject, one finds simultaneous studies that confirm and negate the existence of the interdependence between investments in transport infrastructure and economic development. The conclusions from the individual analyses depend upon the case studies that were made use of, the quality of the data, as well as the geographical scale of the study. The estimates of Kemmerling and Stephan [20] confirm that for three out of the four European countries investigated (Germany, France, Italy and Spain), regional investment in road infrastructure has contributed to regional production. The few investigations concerning the problem carried out in the context of Central and Eastern Europe include the report by Cieślik and Rokicki [21], which refers to the setting of the Polish provinces and metropolitan areas. These authors demonstrated that there exists a statistical interrelationship between the development of metropolises (their economic potential) and the state of the higher-level road infrastructure (i.e., only at the national highways level). At the same time, such an interrelationship does not exist for lower-level roads. These results confirm the correctness of concentrating the investment effort on the most important transport corridors, whose extension appears to be the most effective from the point of view of cohesion at the European level. The conclusions of Crescenzi and Rodriguez-Pose [22] go in the opposite direction. Following the earlier studies of Vickerman [12], these authors see the resolution of the problems of peripheral areas more in the development of their internal infrastructure than in their linkage with the main growth poles. The very same authors state, though, that ultimately endowment with good infrastructure is a precondition for economic development. In their opinion, regions with adequate initial motorway networks tend to perform better than regions lacking this type of basic infrastructure. At the same time, further extension of infrastructure in regions already well endowed from this point of view does not have an influence that would add to economic development. In the later studies [23], these authors question the effectiveness of transport-related investment projects supported by the European Union, indicating instead, that investments in the R&D sector and migration have a decisive impact upon the development of regions. The investigations upon which they founded such a conclusion, however, were conducted in only eleven countries from among the "old member states", where the road networks (the analysis being concentrated on the length of motorways) are already well developed (and thus, conforming to the earlier conclusions of these authors, where further investments cease to be effective). Crescenzi and Rodriguez-Pose [23] also emphasise the important fact that the negative results obtained by them from the econometric model might be the effect of the politically conditioned choice of projects for implementation by the decision makers. This is confirmation of the proposition that the assessment of the analyses questioning the role of transport infrastructure must also account for the indicators applied. Many new studies also consider and model the economic effects of transport investments in the context of environmental impacts [24].

A comparison of the results obtained by various authors (see Table 1) proves that most of them find the impact of new infrastructure on development to be conditional upon additional factors. Furthermore, they identify different levels of impact depending on the type of spatial unit. It emerges from a review of the literature that the scale of the impact decreases with existing general economic development.

Table 1. Impact of infrastructure investments on development—examples of research findings.

Authors	Developed Countries (Western Europe)	Non-European Emerging Markets	Central-East Europe
Confirmation of the effect of the development of transport infrastructure on socio-economic development	Kemmerling and Stephan, [20] Meersman and Nazemzedeh, [1]	Yu et al. [2] Maparu and Mazumder, [3] Olsson [25] Muvawala et al. [26] Kadyraliev et al. [27] Alam et al. [28]	Cieślik and Rokicki, [21] Komornicki et al. [29] Skorobogatova and Kuzmina-Merlino, [8]
Effect on development depending on external factors and/or occurring only in some units (regions)	Crescenzi and Rodriguez-Pose [22] Vickerman [12] Muller et al. [30]	Saidi and Hammami, [24] Matushkina et al. [31] Japarov et al. [32] Zhao et al. [33] Lu et al. [34]	Rosik and Szuster [35] Domańska [36] Urlicki [37] 5th EU Cohesion Report [38] Rokicki and Stępniak, [39]
No effect on development	Crescenzi and Rodriguez-Pose [23] Psenka [13] Gorzelak [40]		Szarata [15]

Source: own analysis.

As shown by other studies, the impact of infrastructural investment projects can be different in different geographical macro-regions. This concerns, in particular, the macro-regions of Central and Eastern Europe. This thesis is further corroborated by the results of the IASON project. To a significant extent, it was also confirmed during the study of possible improvements to the transport accessibility index in Europe, carried out within the Fifth EU Cohesion Report [38]. The EU Territorial Agenda 2020 [41] highlights the same problem, just like its base document, the Territorial and State Perspective. The Fifth Cohesion Report of the European Commission provides theoretical estimates of further improvement in transport accessibility. In Western European countries, these values vary between 10 and 20%, whereas, in the new accession countries, they exceed 100%. At the same time, the scale of the road network underdevelopment to date, combined with ever-growing transit traffic (especially heavy goods traffic over the route from Russia through the Baltic states to Germany and Czechia), mean that external costs (environmental and those associated with traffic safety) are tending to decline due to the completion of new investment projects along the route comprised of motorways and dual carriageways known as expressways.

In relative terms, there have been fewer research studies in the very new EU member states that examine the direct impact of new developments in road infrastructure on economic growth. To some degree, this follows from the objective fact that we are dealing, thus far, with a relatively short period of large-scale investment in transport. Among the previous studies concerning these issues, one can mention the studies by Potrykowski [42], who analysed mutual correlations between the density of the road network and the level of economic development within Poland. This phenomenon was also analysed by Rosik and Szuster [35], who asserted that the earlier extension of the motorway network (prior to 2006) only contributed to an improvement in the accessibility of those regions that already enjoyed good accessibility, and that subsequent investments led to an increase in spatial polarisation. A study carried out by Domańska [36] was devoted solely to a particular investment project where the effects of the construction of new sections of the route of the Polish A4 motorway were investigated. Further development of research studies related to the above-mentioned issues took place after the enlargement of the EU, linked with a significant intensification of investment activity in the transport network. The effects of road investments became the subject of research within the ESPON projects (e.g., such projects as [43–46]), and in the course of time, these issues were taken up by EU Cohesion Reports [47]. At the same time, changes occurred in the indicators that were used. Measures of spatial accessibility were more widely used, the first ones dealing with the time aspect and the second ones based on the potential accessibility indicator [47]. The impact of road investments on development was comprehensively analysed in several formal evaluation studies, including two large projects on a national scale. Their conclusions pointed, in particular, to significant regional differentiation of investment effects. On a local scale, this observation was supported by the analysis of Urlicki [37], dealing with the effects of the northern section of the A1 Polish motorway on accessibility and mobility. The effect of infrastructure projects on development is conclusively demonstrated by research completed in the Baltic States (Latvia, Skorobogatova and Kuzmina-Merlino [8])

A separate problem is constituted by the general interdependence between the allocation of European funds and the level of economic development of the new accession countries [48]. Conforming to the various economic reports (e.g., Hapenciuc et al. [49]), the very fact of directing the funds to Central-Eastern Europe does not guarantee the economic success of this area. Given the very high position of transport-related projects in the entire value of structural funds (in the years 1983–1987, it already constituted as much as 43% of expenditure on infrastructure originating from the European Regional Development Fund and spent in the countries of the Community; during the same period 47% of funds from the ERDF spent in Spain were devoted specifically to transport; Banister et al. [50]) it should be admitted that such statements refer, as well, to the effectiveness of infrastructural investments. The factors that condition the effective absorption are: the macroeconomic situation, the institutional capacity and the co-financing capacity.

The conclusions that can be drawn from the literature on the subject imply a very careful interpretation of the materials at hand relating to the effects of the current allocation of European Union funds to transport infrastructure in the CEE countries. Care must be taken in view of:

(a) The short time period of the study;
(b) The varying states of development of infrastructure in particular countries;
(c) The varying economic situations of the CEE countries and their different absorption capacities (the institutional factor as well as the possibilities of co-financing the projects);
(d) The varying effectiveness of investment projects undertaken on different geographical scales;

(e) The shortcomings of some of the base indicators.

Taking into account the above aspects, it appears that attempts at formulating the initial conclusions concerning the effectiveness of investments in transport infrastructure (in the sense of general development) must be related to the spatial analysis of the geographical distribution of the respective projects. In these conditions, studies based on econometric models are less useful in view of their high vulnerability to imprecision in the input data (depending upon the quality of these data and the assumptions adopted, it is possible to obtain quite contradictory results). By contrast, better research value is offered by studies of the reduction in travel costs and of accessibility understood as an indicator of development opportunities (transport as a necessary, but not sufficient, condition for development). It is only against their backdrop that it is possible to compare the amount of outlay on infrastructure (e.g., from cohesion policy funding) and indicators of regional economic development. Importantly, such a comparison should not assume a direct one-way effect of investments on development since the relationship may be two-directional.

3. Data Sources and Methodology

At the onset of the study, it was assumed that analysis would deal with all the linear investment projects (roads and railways) that meet at least one of the two requirements: (a) a length exceeding 20 km, (b) projects exceeding EUR 30 million in investment. For each of the investment projects, the following data were successfully obtained (retrieved from databases in the individual member states and provided by partners of the FP7 GRINCOCH project): (a) the course of new or modernised roads (described by initial and final nodes); (b) length in km; (c) source of financing (including, in particular, the EU contribution); (d) cost (EU contribution); (e) character of investment project (brief description, in case of roads—with particular reference to the following categories: modernisation, construction of dual carriageways (expressways), construction of motorways; in the case of railways: extent of modernisation); (f) year of completion of a given investment project.

At the same time, statistical data were collected. These were primarily those pertaining to GDP and its change over the period under study at the level of NUTS3 (Eurostat) and to changes in accessibility (based on the findings of the RECIPA project).

A selection was made from among the most important metropolitan centres in the CEEC area under investigation, with the inclusion of the immediate surroundings of the centres. In total, 50 cities were selected whose mutual transport interrelations became the subject of comprehensive analysis. The selection was based on the following criteria:

(a) Mega's according to ESPON 1.1.1.: Tallinn, Riga, Vilnius, Warsaw, Gdansk, Poznan, Szczecin, Wroclaw, Lodz, Katowice, Cracow, Prague, Bratislava, Budapest, Ljubljana, Bucharest, Sofia, Timișoara.
(b) Cities that are supplementary to the network, selected due to their location (e.g., within a border zone and/or functioning as transport nodes): Tartu, Klaipėda, Białystok, Lublin, Brno, Ostrava, Košice, Debrecen, Szeged, Cluj-Napoca, Constanța and Varna.
(c) Cities in neighbouring countries that belong to the EU: Helsinki, Stockholm, Malmö, Copenhagen, Berlin, Munich, Salzburg, Vienna, Venice, Thessaloniki.
(d) Cities in neighbouring countries outside the EU (by membership at the beginning of 2013): Zagreb, Belgrade, Skopje, Istanbul, Kishinev, Lviv, Kiev, Minsk, Saint Petersburg.

In addition to the thus-defined network of cities, road and railway corridors linking these cities into one system were separately selected [51]. Two simultaneous databases were established, each of these containing ca. 80 line sections (see Figures 1 and 2). Each line section was initially assessed for its length, the size of EU financial input in investment projects in the period under study and also for the travel-time savings in road and rail transport. Travel-time savings were estimated on the basis of data stemming from Poland. To that end, a model of traffic speed, designed at the Institute of Geography and Spatial Organization PAS, was utilised indirectly (with the assumption that travel times are analogous to those generated by the model in Poland). Measures of changes in travel time were used, including totals and the change equivalent to 100 km of route.

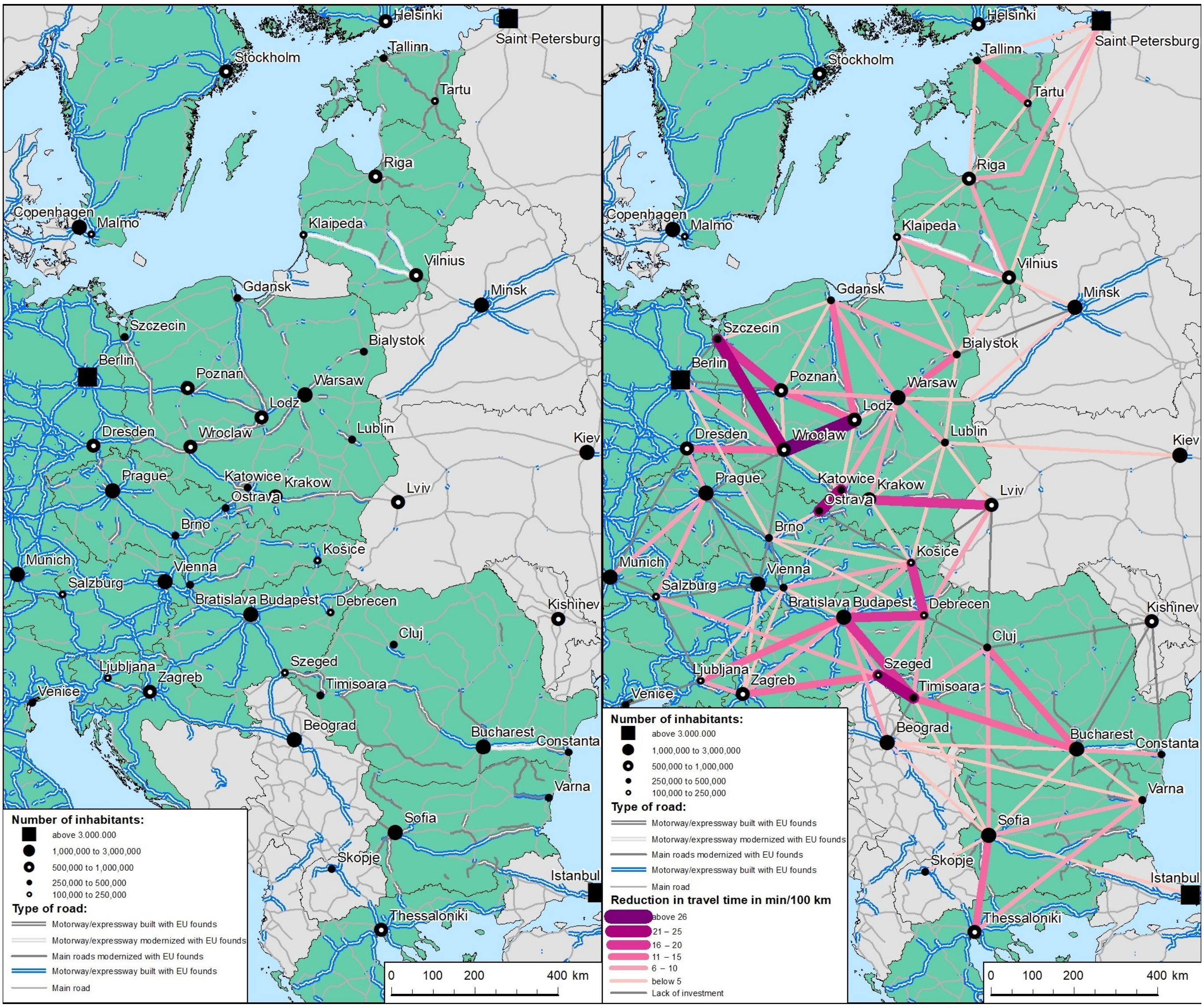

Figure 1. Road investment and change in travel time (roads) per 100 km.

In addition, the volume of investment in road and rail transport was estimated at the NUTS3 level, which allowed it to be compared with the changes in GDP per capita. Investments were presented both as totals and per 100 km of route. In this way, a cautious assessment of the effectiveness of linear transport investments was made. In order to analyse the relationship between EU spending on transport infrastructure and the growth of regions, simple correlation and regression analyses were employed (see Section 6).

In addition, the position of particular regions was subject to analysis at the NUTS3 level in terms of changes in potential road accessibility (employing the data obtained from the RECIPA project). Both absolute and relative changes in the road accessibility index were calculated.

The potential accessibility method, considered an objective measure of the state of development of infrastructure in the Central Europe region, is among the most important. Potential accessibility is based on the negative exponential distance–decay function. The closer the opportunity (mass of each other region), the more it contributes to accessibility. The larger the opportunity, the more it influences accessibility. The travel time between any pair of transport zones was calculated by applying the shortest travel routes according to Dijkstra's algorithm [52–54].

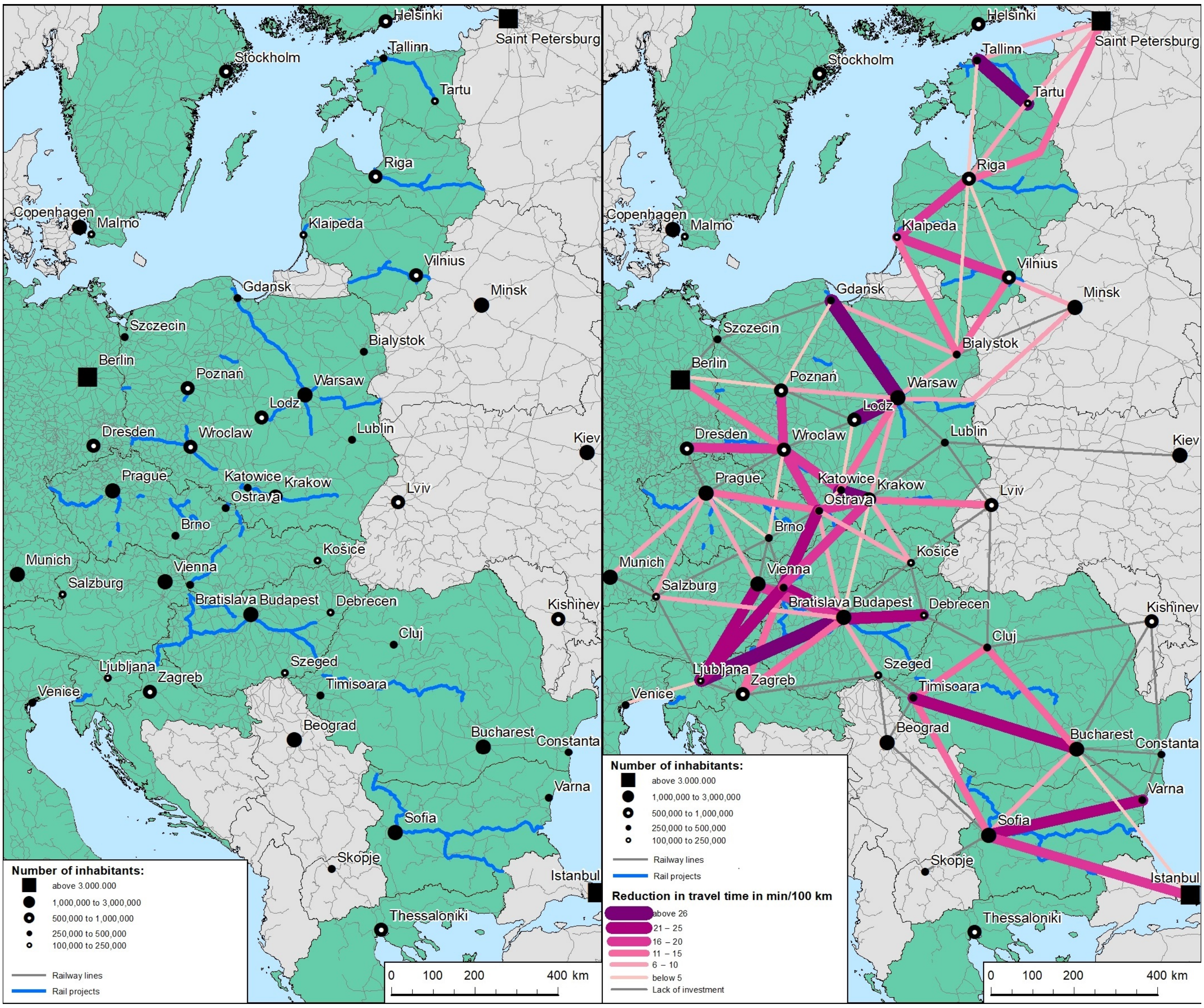

Figure 2. Rail investment and change in rail travel time per 100 km.

The basic feature of potential accessibility is the fact that the attractiveness of a destination increases with its size (f_1) and decreases with increases in physical, time and economic distance (f_2):

$$A_i = \sum_j f_1(M_j) f_2(c_{ij}) \tag{1}$$

where:

A_i—transport accessibility of a unit (transport district) *i;*

M_j—masses available in unit (transport district) *j;*

f_1—function of the distance between pairs of regions;

c_{ij}—total time distance associated with travel/transportation services from transport district *i* to transport district *j* [55,56].

The value of the potential accessibility index thus depends on the location of the territorial unit in relation to other cities, on the size of these cities and on the cost (time) of travel needed to reach them. Defined in this way, accessibility can be understood as a measure of the opportunities for spatial interaction of an economic or social nature.

4. The Scale and Effects of Investment in Main Transport Corridors

4.1. Development of the Road Infrastructure

On the eve of accession to the European Union, the network of fast-traffic roads (motorways and expressways) was very unevenly developed in the countries of Central and Eastern Europe. It was definitely the most extensively developed in Slovenia, this country being followed by Czechia and Hungary. The three countries had already started the construction of motorways before the year 1989 and—in contrast to the remaining countries considered—they also continued the construction during the pre-accession transformation period. Owing to this fact, the road networks of the three countries were connected with the networks of the western European countries (e.g., the routes Ljubljana–Vienna, Ljubljana–Venice, Budapest–Vienna, as well as Prague–Nuremberg). There was also the connection between Prague and Bratislava, which had already been built before the break up of Czechoslovakia. The Czech and Hungarian networks appeared in classical fashion by extension of radial segments of the network going out from the capital cities. Considering the surface area of the country, the road infrastructure of Lithuania was also relatively well developed. There were connections between the most important national centres, Vilnius, Kaunas and Klaipeda. In Poland, Slovakia, Romania and Bulgaria, only the beginnings of the respective motorway/expressway networks existed, while in Latvia and Estonia, there were, practically, no such networks at all. In Poland, a large proportion of the existing motorways were the remnants of German projects from before and during World War II. The common feature for the countries listed here was also the idle period, in terms of new investments, during the 1990s. The state that existed prior to the year 1989 remained "frozen" until the first European pre-accession funds (ISPA) appeared. A plan for constructing motorways under a concessionary system (so-called BOT) was set in motion in Poland, but later on, it was restricted and abandoned to the advantage of road construction with the use of European funds. Yet, despite this, two stretches of concessionary motorway had already been completed by the year 2004—one of them connecting the city of Poznan with the German border and Berlin.

The above description of the differences in the initial state of affairs determined the strategy for using Union funds in successive financing periods. Countries such as Hungary, Czechia and Slovenia aimed at the completion of the construction of their respective base networks, which often meant investing in segments linking their own networks with those of neighbouring countries. They also tried to eliminate the bottlenecks in their road systems. In this sense, the objectives of their road development policies were to conform to the aims of European transport policies (outlined, for instance, in the White Paper [57] and in the documents that formed the basis for the development of the TEN-T network). The situation of the other countries was quite different. Delays in the realisation of investments were so significant there that these countries tended to make maximum use of European funds for the construction of the basic segments linking the main urban centres or accommodating mass transit. In view of the larger spatial scale of some countries (especially Poland and Romania), this also implied a dispersion of the investment outlays. This dispersion was also magnified by the fact that the respective projects were constructed—as a rule—with the use of resources from the Cohesion Fund and the ERDF. In addition, not all of the investment projects were well prepared (environmental decisions, local conflicts related to the route finally chosen), which resulted—especially in the first period after accession (2004–2006 financing period)—in construction being initiated in those fragments where the preparatory process had been already completed. In the case of Romania and Bulgaria, the projects could only be started in the following financing period (earlier if resources from the ISPA programme were used), and so analogous problems were delayed with respect to, for instance, Poland.

The greatest spatial extent of road investments supported with funds from the European Union occurred in Poland, followed in this sense by Bulgaria and Czechia. The respective projects in Poland were significantly dispersed. They were unconnected with the capital of the country, but, at the same time, resulted in the creation of a second transboundary connection with the German motorway network, and a second connection with the Czech network (continued on the other side of the border). It also became possible to construct a motorway up to the border with Ukraine. In Czechia, the works were more spatially concentrated in the area of Prague and Ostrava. Connections were also completed in the direction of Austria (Linz) and Germany (Dresden). In Bulgaria, work was continued on the already-started projects in an East–West direction, as well as on the route towards Greece. A situation similar to that in Czechia was observed in Slovenia, where investments were concentrated on the extension of pre-existing routes and their linking with their counterparts on the Hungarian and Croatian sides of their borders. In Slovakia, construction was continued on the main motorway, constituting the principal transport axis of the country, while in Romania, construction work was started on the main connection between Bucharest and the Hungarian border [58]. The scale of investments in the Baltic countries was limited. Thus, in Lithuania, initially, all the existing routes that had not been sufficiently fulfilling the criteria for motorways were modernised. In Latvia and Estonia (and to a lesser extent also in Bulgaria), main roads were modernised, although they were not brought up to the standard of motorways/expressways. An interesting example is provided by Hungary, where—contrary to the other countries considered—in parallel with the investments financed from EU funds, projects were continued and financed from national resources and in the framework of a public–private partnership (PPP).

When assessing the geographical distribution of the EU's co-financed investments (Figure 1), one should state that:

(a) They were more heavily concentrated in the western part of CEE countries (Slovenia, Czechia, western Poland and western Slovakia);
(b) Their distribution was conditioned by how advanced the previous activity on the road infrastructure was;
(c) The investments considered resulted in the base road networks of Czechia, Slovenia and Hungary nearing closure;
(d) Owing to these investments, the degree of integration of the motorway/expressway network of the CEE countries with those of the old member countries improved (new connections appearing between Poland and Germany, and between Czechia and Germany, construction of the Czech–Austrian and Bulgarian–Greek connections is well advanced);
(e) There has also been an improvement in the integration of the networks between some of the CEE countries (first of all between Poland and Czechia, Hungary and Slovenia, as well as Hungary and Romania), and with Croatia, having become an EU member in 2013 (from Slovenia);
(f) The investments in question did not contribute significantly to the improvement of the cohesion of the motorway/expressway network across the Baltic countries (*Via Baltica*), nor between Bulgaria and Romania, Hungary and Slovakia or Slovakia and Poland;
(g) Linkages across the outer boundary of the European Union improved in only a few places, first of all in the direction of Ukraine (from Poland and Hungary), and, to a lesser degree—Turkey (from Bulgaria) and Belarus (modernisation of the regular main roads in Lithuania);
(h) The map of the region still shows significant areas deprived not only of EU-supported road investment projects, but also, in general, of motorways and expressways (first of all, northern Romania, northwestern Poland, as well as Latvia and Estonia).

The effectiveness of the investment projects undertaken can be assessed by comparing the shortening of travel times between the most important metropolises of the region (and the metropolises of the surroundings). The changes expressed in absolute terms also depend, naturally, upon geographic distance. That is why the comparison has additionally been expressed in relative terms, with time-wise advantage calculated per 100 km of route constructed (Figure 1). From among the domestic connections analysed, the biggest advantages were observed in Poland, first of all for travel between Wroclaw and Lodz and Wroclaw and Szczecin, these being followed by Poznan and Szczecin, Lodz and Gdansk, as well as Warsaw and Bialystok. In other countries, significant changes were registered in Romania (Bucharest–Timisoara and Budapest–Cluj) and Estonia (Tallinn–Tartu). Regarding the connections with the metropolises in the old member states, the biggest advantage was observed for travel between Wroclaw and Dresden and between Sofia and Thessaloniki. Concerning the routes between the CEE countries, one should, first of all, mention the shortening of the travel time between Katowice and Ostrava, Kosice and Debrecen, Budapest and Ljubljana, as well as between Timisoara on the one hand and Budapest and Szeged on the other. Of the directions which cross the outer boundary of the Union, highly significant improvement took place, above all, on the alignment Cracow–Lviv.

Altogether, considering the support from European funds for the development of the motorway/expressway network in the CEE countries, it may be noted that from the point of view of internal cohesion of the primary centres in the individual countries, this support was most effective in Poland, Czechia and Bulgaria. At the same time, in the setting of the external relations within the Union, advantages were observed in all the countries analysed except for the Baltic States. Owing to their own internal as well as Hungarian investment projects, marginally located Romania, without doubt, became a beneficiary in these terms. Quite visible advantages are also evident regarding the Polish–German connections. Investments in the road infrastructure made during the period 2004–2013 were also beneficial for Croatia and prepared them for EU membership. Of the countries not belonging to the Community, which benefited from developments in the CEE countries analysed here, one should note Turkey and Ukraine [59].

4.2. Development of the Rail Infrastructure

The spatial scale of the investment projects related to railways that were supported by the funds of the European Union was smaller than in the case of the road projects. At the same time, many of the rail projects were very costly, and it is really hard to compare the scope of the necessary investments. One deals, as a rule, with modernisation works that are mainly designed to adapt the network to higher train speeds. Virtually no new lines were built (the sole exceptions, in practical terms, being the Latvian projects to connect to the new seaport and convert to dual-track operation). In the majority of countries, modernisation encompassed one or several longer railway routes, most frequently along the alignment of the TEN-T corridors (see Figure 2). A large proportion of the modernised lines served domestic connections in particular CEE countries. This was the case with all the projects in Lithuania, Estonia and Slovakia and with the majority of the Polish ones as well. Regarding the connections to the old member states of the EU, a significant role was played by the reconstruction of the routes from Poland and Czechia to Germany and from Hungary to Austria. On the other hand, connections between the CEE countries concerned were improved due to the projects involving Hungary and Slovenia, Hungary and Romania, as well as Bulgarian investments in the connections to Romania. A number of lines leading towards areas outside of the territory of the European Union were also refurbished—the ones towards Russia (in Latvia), Belarus (in Poland) and Turkey (in Bulgaria). The longest railway routes (corridors) on which important sections were modernised were the corridor crossing southern Poland (from the border with Germany through Cracow to the border with Ukraine) and the route from Vienna through Budapest towards Bucharest. There were also long lines inside Bulgaria (from Sofia to the Black Sea coast and towards the Turkish border) and inside Poland (from Warsaw to Gdansk).

In terms of reductions in travel time (Figure 2) per 100 km of railway line, the most effective were three Polish projects (Warsaw–Lodz, Warsaw–Gdansk, and Cracow–Katowice) along with the Estonian line Tallinn–Tartu. In all these cases, the estimated reduction of travel time per 100 km of line exceeded 25 min. Considering the connections between the metropolises inside the particular countries, significant travel time reductions were also observed for the lines Sofia–Varna, Bucharest–Timisoara, Budapest–Debrecen, Wroclaw–

Katowice, Wroclaw–Poznan and Vilnius–Klaipeda. As far as the connections with the metropolises of the old member states were concerned, there was a distinct reduction in travel time between Wroclaw and Dresden, Budapest and Vienna, as well as Ljubljana and Vienna. Concerning the internal connections within the CEE region, the situation improved on the following routes: Klaipeda–Riga, Cracow–Ostrava, Wroclaw–Ostrava, Cracow–Bratislava, Budapest–Bratislava and Ljubljana–Budapest. Of the connections reaching outside the Union, the primary beneficiaries were those towards Ukraine (Cracow–Lviv) and Turkey (Sofia–Istanbul; [59]).

Summing up the analysis of the spatial distribution of the railway projects supported by the European Union and their effectiveness in the sense of shortening travel times between the metropolises, one should note the following:

(a) The projects undertaken had virtually exclusively the character of modernisation, and none of the CEE countries decided to finance a significant new railway line (including a high-speed line) from EU funds;
(b) The scale of the modernisations undertaken varied greatly, as did the initial technical state of the individual routes that were modernised, this having had an influence on the ultimate effect on the improvement of accessibility over specific routes;
(c) Railway projects featured a higher degree of concentration on a couple of routes in each country—which ought to be assessed positively;
(d) Railway projects were undertaken by all the CEE countries, and their geographical pattern was relatively proportional;
(e) Domestic investment projects dominated, but many of these at the same time contributed to a significant shortening of travel times between metropolises in neighbouring countries;
(f) An improvement was noted in the mutual railway accessibility of the metropolises of the Vysehrad Group countries (meaning here southern Poland, Czechia, Slovakia and Hungary) and also of Slovenia; at the same time, the railway systems of the Baltic states and of Bulgaria and Romania remained isolated from the rest of the countries of the region, and thus also from the entire European Union.

5. Road Accessibility Changes

The potential accessibility index is another measure that well illustrates the changes in transport linkages between centres. For years, research into such accessibility has been conducted on a Europe-wide scale, mainly by German research centres [60] and for the purposes of ESPON projects [43,44,46]. In addition, some countries (including Poland and Czechia) have pursued such studies on their own territories. This study analyses changes in potential road accessibility that resulted from road investments in Central and Eastern Europe (2007–2015). The changes are presented in absolute (Figure 3) and relative values (Figure 4), each time on a European scale (with destinations across the continent included in the analysis) and for the macro-region (where only destinations in the countries surveyed are taken into account).

In 2007, almost the entire area of the CEE countries had relatively low potential road accessibility indices. There was also a sharp increase in indicator values at some of the area's western borders, which should be attributed to a discontinuity with the faster-traffic infrastructure routes (e.g., on the Polish–German and Hungarian–Austrian border). Higher values (more than 120% of the ESPON average) were mainly observable in some major cities (concentration of population) and along the few more modern road routes [59,61].

In terms of pan-European accessibility, favourable absolute changes in the level of road accessibility (Figure 3a) were noted across the region of the study area (NUTS3). They were definitely the strongest in the compact area that stretched from central and southern Poland to eastern Czechia and western Slovakia. In addition, substantial changes were observed in western Romania and eastern Poland. The improvements along the western border of Czechia and Hungary were less pronounced, which can be explained by the motorways that were already in place there. The least noticeable absolute changes took place in eastern Romania and Estonia.

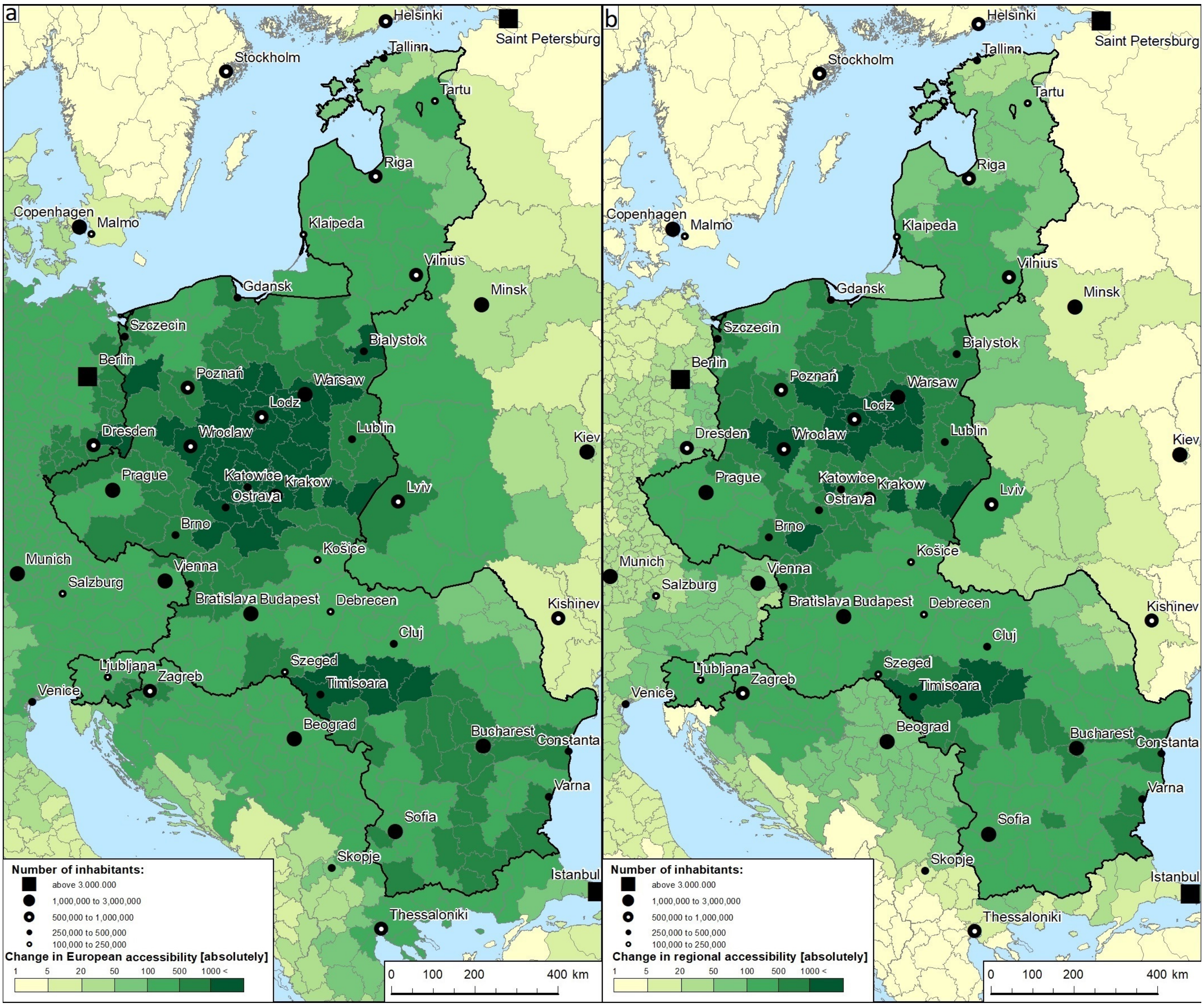

Figure 3. Absolute changes in potential road accessibility in the period 2007–2015. (**a**) Pan-European perspective; (**b**) macro-regional/CEE perspective.

In relative terms, the distribution (Figure 4a) looks different. It highlights some peripheral areas where the pre-2004 level of accessibility was very low and was improved considerably by subsequent investment projects. The areas include southeastern Poland, central and western Romania and southern Bulgaria (improvement of more than 15%). By contrast, some other peripheral areas, such as the Baltic states and eastern Romania, turn out not to have benefited much from the development of road infrastructure. Relatively minor changes were also seen in regions where the infrastructure had already been developed (northern Hungary, Czechia; below 5%). The relative growth in the vicinity of some major cities proves that the scale of investments that connected them to the European network was exceptionally large. The major beneficiaries include Wrocław, Timisoara, Bialystok, Burgas and Constanta. Among the capitals, Warsaw was definitely the city that improved its position within the European road system to the greatest extent. By contrast, Prague and Budapest benefited very little.

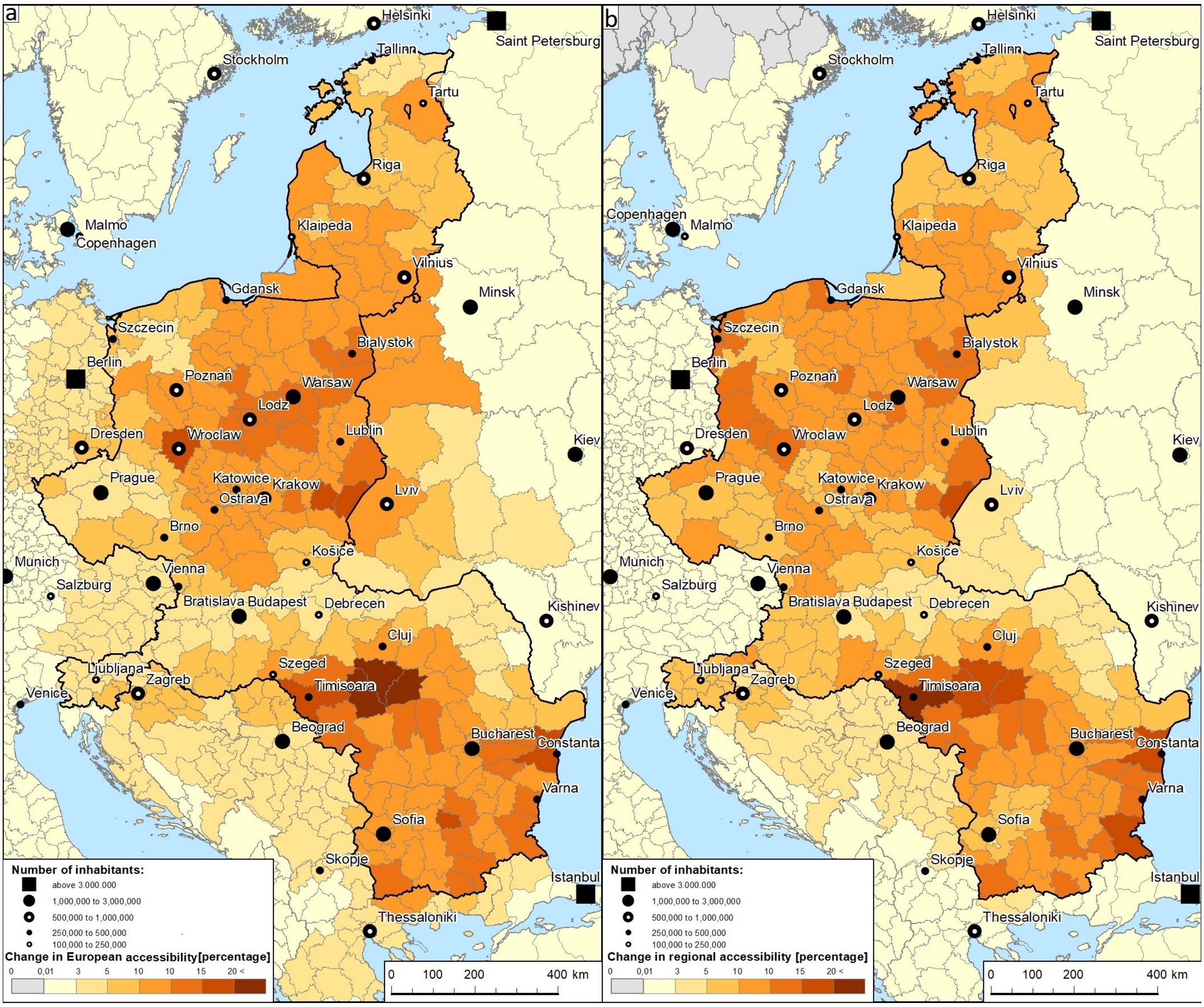

Figure 4. Relative changes in potential road accessibility over the period 2007–2015. (**a**) Pan-European perspective; (**b**) macro-regional/CEE perspective.

The findings of the study also imply a growing polarisation in terms of Europe-wide potential road accessibility in the CEE area and between the countries. Some transport corridors that received sizeable co-funding from the European Union stand out in this respect. This pertains, in particular, to the two latitudinal corridors running in Poland (from Warsaw to Berlin and from Dresden to Cracow and further on to Ukraine), the Via Baltica corridor, and the corridor connecting Budapest and Bucharest.

The results also show that road investments in the 10 EU member states under study also improved accessibility in some of the old member states, as well as in non-EU countries. The beneficiaries in the former case were mainly the eastern Länder of Germany (especially Saxony), as well as Austria and northern Greece (Thessaloniki). The non-EU countries that had their accessibility improved considerably included Ukraine (Lviv Oblast), Belarus, Serbia and Bosnia and Herzegovina.

A similar analysis limited to destinations in the nine countries surveyed reveals the extent to which Central and Eastern Europe had its accessibility integrated internally in terms of road infrastructure. The picture that emerges resembles that described above, especially with regard to the eastern borders of the study area, except that, in spatial terms, the absolute (Figure 3b) and relative (Figure 4b) changes concentrate, to a greater extent, in the vicinity of large centres. Differences occur in areas close to the borders with ‘old’ EU countries whose accessibility clearly benefited more as a result of the road investments than Europe as a whole. This proves that the relatively good baseline accessibility of these regions stemmed exclusively from the proximity of the infrastructure of Germany or Austria. Within the borders of the individual new member states, the borderlands were peripheral areas that were in need of improved connections with domestic metropolises.

6. The Investments and Economic Growth

The costs of the individual projects varied greatly. This applies in a specific way to the extension of the road network. In this case, the key factors were:

(a) The technical scope of the project (new or modernised routes);
(b) Its location with respect to the core areas (higher investment costs within and in the vicinity of the metropolises);
(c) The segment length (the shorter spans of routes were relatively more expensive),
(d) Its location with respect to elements of the geographical environment (especially regarding mountain ranges, which increase investment costs);
(e) The time period ‘when the project was carried out: costs were higher immediately after the extension of the EU and were lower later on during the economic crisis.

The costs of railway transport projects showed less variation.

The costs considered were solely those which were classed as a contribution from European Union funds. The background shows the per cent changes in GDP at the level of NUTS3 units in the period 2003–2010 (Figure 5).

From among the road projects, the most expensive in relative terms seem to be the Hungarian projects, along with some of the Slovak, Czech and Bulgarian ones (in each case concerning rather short segments of route). Against this background, the contribution of the European Union to the projects in Poland would turn out—despite their quite significant overall scale—relatively cheaper. This might be associated with the fact that a high-intensity investment took place in the second part of the 2007–2013 financing period when prices had already somewhat reduced. On top of this, it should be remembered that the true cost of many of the projects in Poland was higher (in particular—given the changes resulting from the bankruptcy of construction companies), which, though, was not reflected in the scale of support from EU funds, weighing rather on the national budget (the Road Fund). Relatively less costly were all the investment projects undertaken in the Baltic states (except for those concerning the road nodes of Riga and Tallinn), this being the consequence of these projects being solely of a modernisation character. Some of the road projects in Bulgaria and Romania had a similar character.

Among the railway projects that were relatively more costly (from the point of view of the EU) were those carried out in Poland and also—again—in Hungary and Slovakia, as well as in western Czechia. The modernisation projects carried out in the Baltic States and Bulgaria turned out to be less costly.

In order to attempt an assessment of the dependence between the level of co-financing of large transport-related investment projects from the funds of the European Union and economic growth, the combined value of the road and railway project support was disaggregated according to NUTS3 statistical units. The summary results are presented in Figure 6 (with cartographic reference to the increase in GDP in the period 2003–2010). The distribution of the scale of support from the EU in road and railway transport is biased by the issue of a different scale of units of reference in individual countries. As a consequence, there is a statistical effect in the form of lower spatial concentration in Poland, Slovenia and Bulgaria. This, however, does not change the general image, showing a distinct concentration of support from the EU in a couple of zones featuring geographical continuity. These zones are as follows:

(a) Western Czechia;
(b) The northeastern part of Czechia (Czech Silesia), together with southern Poland and western Slovakia;

(c) Central Poland;
(d) Western Hungary, together with eastern Slovenia;
(e) Eastern Hungary, together with western Romania;
(f) Southern Bulgaria.

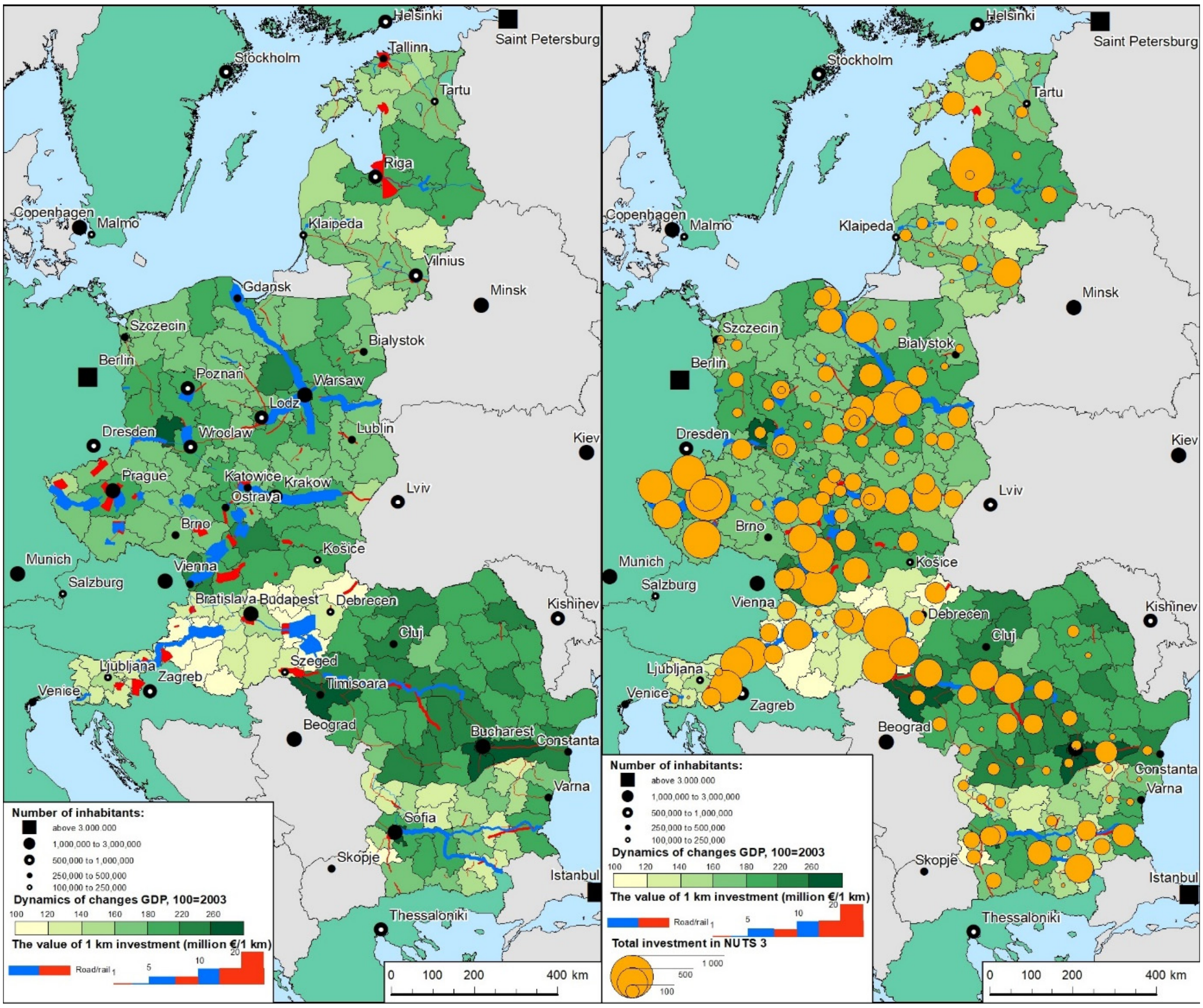

Figure 5. The cost of 1 km of the road and rail infrastructure versus change in GDP.

Within the remaining areas, the projects in question were more dispersed, and in the Baltic States, they were concentrated in the units containing the capital cities of the respective countries (especially in the neighbourhood of Riga).

The attempt to identify a statistical dependence between the level of investment outlay and the change in the value of GDP (related to the respective national averages) did not bring measurable results (see Figure 6). The attempts to identify the interdependence with the absolute (not relative) changes in the value of GDP would even indicate a weak reverse dependence. The regression value of R^2 was 0.072, which means that 93 per cent of the data on the variation of GDP growth 2004–2010 national level is not due to the variation of the sum of projects. The F-statistic significance test parameters were 16.22 on 1 and 209 DF, and the *p*-value was 7.883. The *p*-value was smaller than the F-statistic, meaning that the sample data provided sufficient evidence to conclude that the regression model fits the data better than a model without independent variables. The lack of unambiguous results is understandable in view of:

(a) The significant delay of the potential growth effects with respect to the date of termination of the project;
(b) The fact that, simultaneously with the processes considered here, the global economic crisis took place, causing a significant influence of macroeconomic factors on the economic situation of the regions making it difficult or even impossible to assess the net effect of the investments in transport infrastructure treated alone;
(c) The bilateral character of the potential dependencies (such as the carrying out of road projects in areas featuring strong increases in the intensity of HGV traffic, this being the consequence of regional economic activity).

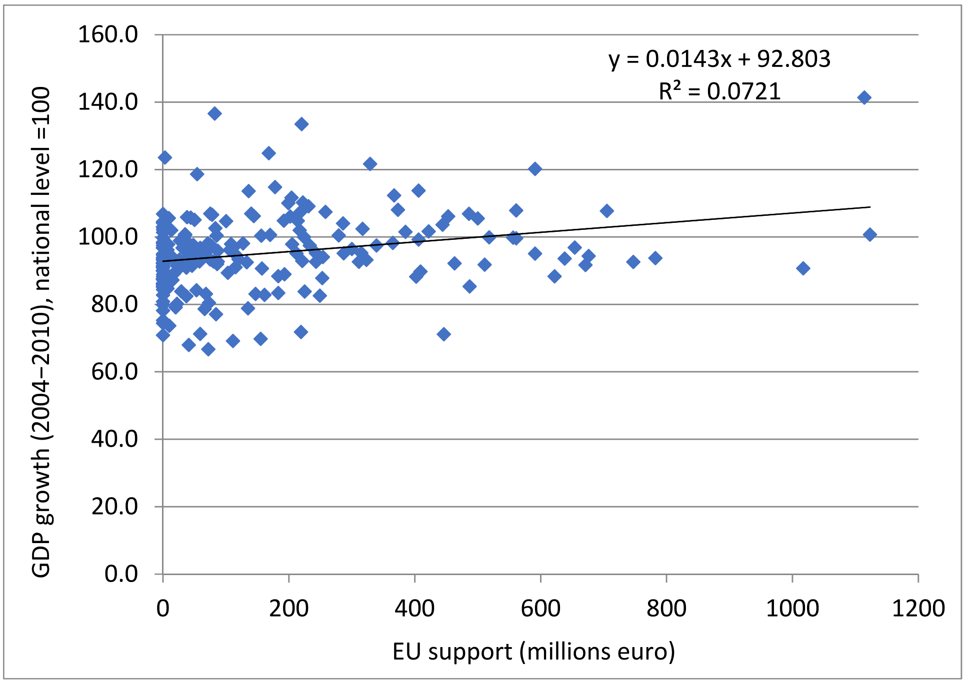

Figure 6. Dependence between the level of EU support in railway and road transport infrastructure and the growth in the value of GDP (relative to the national average).

The results obtained were influenced in a particular manner by the scale of the projects in Hungary, where, at the same time, the lowest GDP dynamics among the CEE countries were noted. Under such circumstances, it was only possible to compare the cartographic images of the two variables so as to try to perceive the potential co-appearance of the respective features within the particular countries. The interpretation of such perceptions must, though, be very carefully handled and should be limited to the statement where large-scale investment took place in areas with high economic dynamics and in areas with clearly lower economic dynamic indicator values.

The changes in the value of GDP in the period 2003–2010 were decidedly greatest in the metropolitan centres, first of all in the capital regions (in Poland and a couple of other regions, e.g., Wroclaw or Cracow), and in some regions with strong industrial functions, such as, for instance, the Plock subregion in Poland (the HQ of the PKN Orlen oil corporation), the Legnica subregion in Poland (copper basin) and western Slovakia (concentration of automotive industries). Relatively high growth was also observed in western Romania. All of the areas mentioned accounted for a significant proportion of the investments supported by European Union funds. However, such investments were also located in other places (in areas with distinctly worse economic indicators). In these cases, the general pattern remained strongly determined by the differing economic situation of the particular countries as a whole (distinctly lower dynamics in Hungary, Slovenia and Bulgaria). It can only be stated, therefore, that one can hardly indicate regions featuring very high growth dynamics where transport-related projects would not be realised (to a certain extent, Bucharest constitutes an exception). This confirms the earlier suppositions that some of the projects could rather constitute a response to the growing demand from the already existing traffic (especially road traffic), which is concentrated in areas featuring high GDP growth. Thus, at least partly, the support from the EU funds for transport infrastructure would have a reactive, and not proactive, character. Yet, it cannot be excluded that other projects, carried out in less dynamic regions, would not bring the expected economic effects. Their potential appearance would, however, certainly be more delayed in time.

Comparison of the value of investments and the changes in GDP weighted by national averages indicates (Figures 7 and 8) that the areas of co-appearance of strong relative growth rates and support from the EU for railway and road transport (type "A") are associated with some of the metropolises and/or their surroundings (first of all Warsaw, Prague, Vilnius, Riga, Lodz, Wroclaw and Cracow). At the same time, other cities of this rank are characterised by simultaneous relatively high dynamics of GDP growth and lower level of investments (e.g., Budapest, Sofia or Poznan; type "C"). When interpreting these results, one should remember that the analysis solely considered investments in linear connections (railway and road infrastructure), while some metropolises were significant beneficiaries of support in the domain of air transport and intra-metropolitan transport (e.g., Budapest and Sofia). This group, side by side with the metropolises mentioned, contains both regions previously well equipped with infrastructure (e.g., the Gliwice region in Poland), areas whose development is strongly conditioned by other factors (Zilinsky kraj in Slovakia), as well as areas, where high values of the indicator are the effect of their "low base level" (e.g., the Ostroleka-Siedlce region in Poland). In the first of these cases, most probably, the level has already been attained beyond which further dependence between the development of the network and economic growth is problematic (conforming to the conclusions from the literature based on Western European examples).

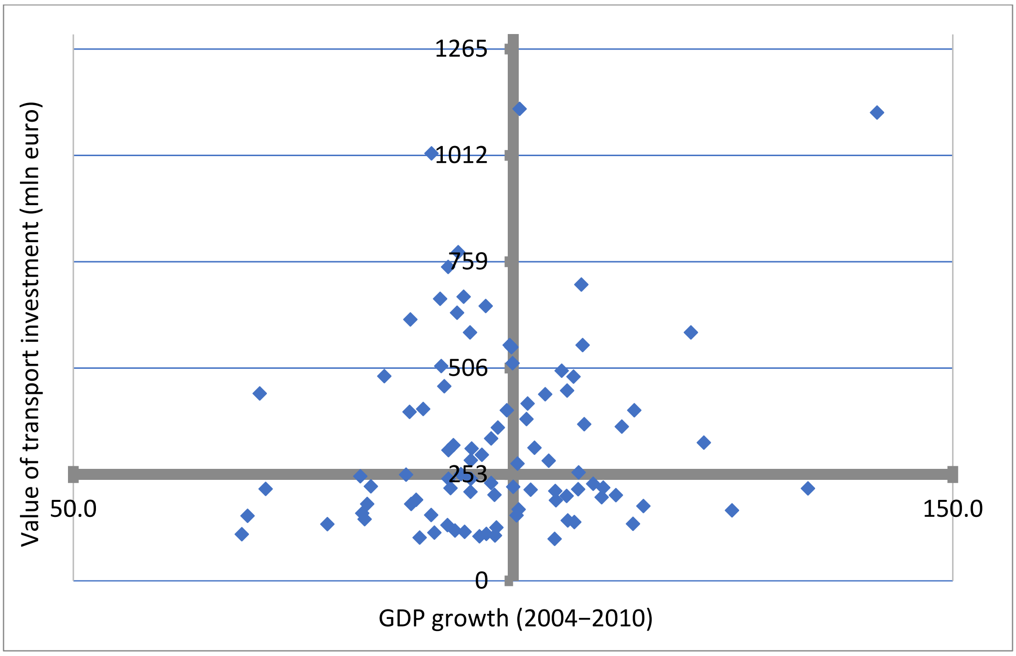

Figure 7. Types of regions defined on the basis of GDP increase (in relation to national averages) and the value of investment projects in railway and road transport (only units with EUR >100 million worth of projects).

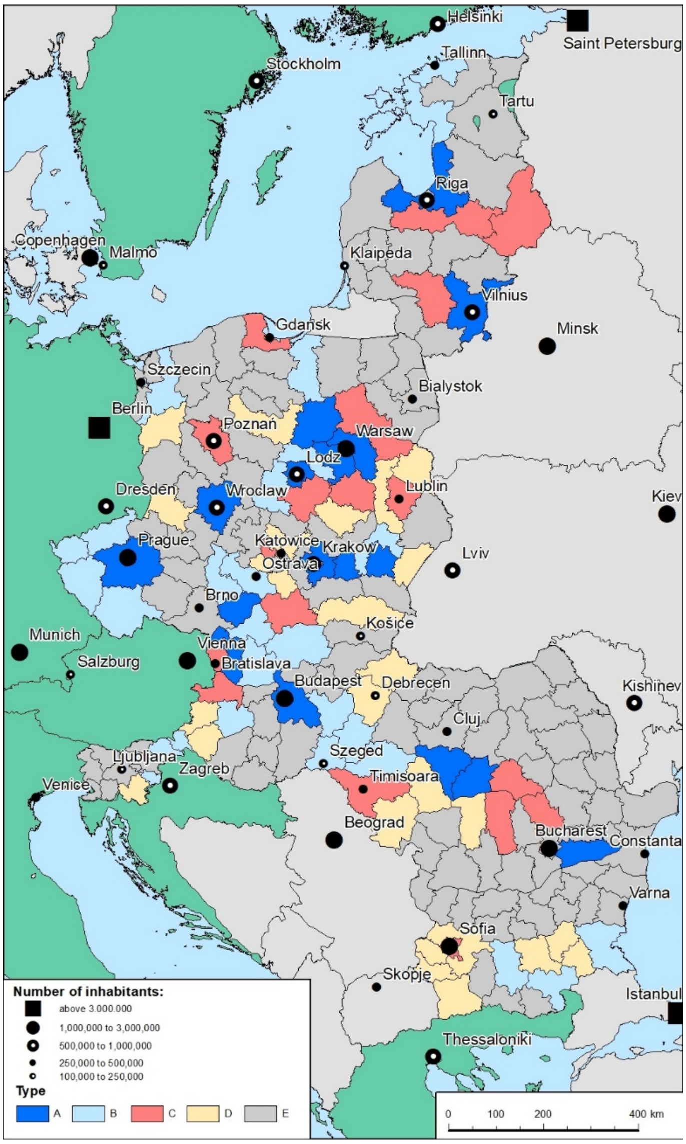

Figure 8. Types of regions defined on the basis of the GDP increase (in relation to the national averages) and the value of investment projects in railway and road transport.

More attention ought to be paid to the regions in which economic growth was slower despite high investments in railway and road transport (type "B"). These regions, as a rule, do not include the metropolises selected for analysis (with the exception of the Polish Tri-City agglomeration), their centres being located in smaller cities. One finds in this group quite a number of areas bisected by large linear projects (e.g., Polish region of Sieradz or Ustacky kraj in Czechia). Such a spatial setting might indirectly confirm the opinion that the beneficiaries of the linear projects are primarily determined by the presence of large nodes located in the metropolitan centres (where the concentration of various development factors takes place), while a "tunnel effect" may arise in the areas between such nodes. The potential economic effects in the "transit" regions might be expected to appear with a definite delay. Besides, these potential effects depend strongly on local transport solutions, such as the location of interchanges on motorways (this being confirmed by the evaluation studies conducted in Poland). The same group also includes a number of near-border units where some of the trans-border projects were carried out, thus bringing benefits on a European scale but not having a direct impact on the situation in the region (e.g., the Elblag region in Poland, through which an expressway was constructed towards the border with the Kaliningrad district of the Russian Federation).

The image obtained might also be interpreted in the context of the assessment of the location of investment projects from the point of view of cohesion policy (linking core/dynamic areas with peripheral/lagging ones by means of infrastructure). Regions featuring small increments of GDP, which at the same time were not the beneficiaries of significant investments in transport, encompass both the units classified in type "D" and "E" (value of railway and road projects lower than EUR 100 million). Against this background, one should give a positive assessment of the Hungarian projects (extending the network towards the outer boundaries), the Slovak ones (the improvement of accessibility of the eastern part of the country), those in southeastern Poland (motorway up to the Ukrainian border) and the Bulgarian ones (connection between Sofia and the north and southeastern peripheries of the country). This kind of orientation of the investment process is not, on the other hand, observed in Romania, where the economically lagging northeastern part has obtained practically no support for the development of supra-regional road and railway infrastructure. Yet, in spite of this, the region in question noted significant increases in the value of GDP (partly, of course, due to the "low base level" effect).

Type A—high level of investment value (EUR >253 million) and high increase in GDP value;
Type B—high level of investment value (EUR >253 million) and low increase in GDP value;
Type C—low level of investment value (EUR 100–253 million) and high increase in GDP value;
Type D—low level of investment value (EUR 100–253 million) and low increase in GDP value;
Type E—very low level of investment value (EUR <100 million €).

7. Discussion and Conclusions

Through the results provided here, the effect of the investments in transport infrastructure in the setting of the macroregion (CEE) of the individual countries has been assessed and 30 metropolises considered. This basis served to formulate conclusions as to the effectiveness of cohesion policy in the new accession countries, as well as recommendations for further transport policy.

The investment projects undertaken with a contribution from EU funds in the ten countries considered increased internal polarisation regarding the broadly conceived transport situation. This increase in polarisation took place both on the scale of the entire CEE macroregion and inside particular countries (especially the bigger ones, such as Poland and Romania). This appears to be an unavoidable consequence of the wide programme of investment projects.

The projects carried out on railway transport had almost exclusively the character of modernisation. Construction of longer new routes was not undertaken. In general, existing lines were modernised to accommodate speeds not exceeding 160 km/h, and the CEE countries did not go in for constructing high-speed railways. At the same time, the majority of larger road projects were new developments (construction of motorways and expressways). A very important influence on the strategy of investing EU funds was exerted by the initial state of the infrastructure at the time of accession. The countries featuring an advanced level of transport network development concentrated on closing the road systems (Czechia, Hungary) or even moved the emphasis over to railway investments (Slovenia). Those countries where the scale of delays was more serious conducted a policy of more dispersed investing in the spatial sense and often also in the modal sense (Poland).

Investment projects supported by EU funds were concentrated in the western part of the CEE area (Slovenia, Czechia, western Poland and western Slovakia) and within particular countries, also most frequently in their western parts. In this context, the investment process might be perceived in the category of diffusion of innovation (diffusion of modern transport systems) from Western Europe towards the new member states. This means, at the same time, that investment projects were, to a greater extent, a response to already existing demand (from freight and passenger traffic) than they were used as an instrument of regional policy (support for peripheral areas, which, in the majority of CEE countries, are more concentrated in their eastern parts).

The investments realised contributed to better integration of the transport systems of the CEE countries with the old member states (mainly with Germany and Austria) and, to a somewhat lesser degree, to mutual integration between the accession countries (most notably to the connections between Hungary and its neighbours). Linkages across the outer boundary of the European Union were only improved in a couple of locations. The eastern boundary of the Union remained a barrier to the development of network connections of the metropolises of the CEE countries. Vast areas remain in the macroregion that are deprived of significant transport investments. They are concentrated in the eastern part of the area, but also, in some cases, within the borderlands between individual CEE countries. Among the capitals, the position of Warsaw was particularly improved, the following ones being Ljubljana, Budapest, Bucharest and Sofia. Gains were relatively smaller for the Baltic State capitals Prague and Bratislava. In the group of second-order metropolitan centres, the positions of Tartu, Klaipeda, Lodz, Gdansk, Wroclaw, Szczecin and Timisoara were strengthened.

Relating the results obtained to the considerations presented in the international literature, we should state that the study carried out appears to confirm the propositions formulated by Cieślik and Rokicki [21], concerning the existence of interdependence between the development of metropolises and higher-level infrastructure, with such an interdependence being much less visible for the entire regions. At the same time, the spatial pattern of the investments and the economic variables analysed (GDP) might also confirm the opinion of Crescenzi and Rodriguez-Pose [23], namely that the developmental role of large-scale linear infrastructure is apparent mainly in the earlier stages of development. It is possible to formulate, on this basis, a hypothesis on the dynamic-spatial sequence regarding the dependence between investments in infrastructure and the development of regions and metropolises (see Table 2). This hypothesis would require further studies based on longer time series.

Table 2. Influence of large linear transport investments on development.

Stage of Development of Transport Infrastructure	Investments (Motorways, Expressways, Railways Modernised to the Speed of 160 km/h)	Influence on Socio-Economic Situation of Regions	Influence on Socio-Economic Situation of Metropolises
Stage I	Development of the basic infrastructure between the main centres and/or radial connections from these centres	Conditional acceleration of development (necessary, but not sufficient condition)	Significant acceleration of development
Stage II	Closing of the basic network systems	Conditional and limited influence on development	Conditional acceleration of development (necessary, but not sufficient condition)
Stage III. Variant A	Further extension (densification) of the basic network	Lack of influence	Conditional and limited influence on development
Stage III. Variant B	Investments in local transport solutions	Conditional and limited influence on development	

The results also confirmed, in an indirect manner, the apprehensions of some authors that problems in demonstrating the statistical dependence between investments in infrastructure and economic development result partly from political conditioning of the decision on location [23]. Thus, we deal here with a kind of paradox. Decision makers make investment-related decisions in the "belief" that they exert a direct influence on economic development. Driven by such an assumption, they introduce into the respective ranking lists projects situated in lagging behind and peripheral areas. In addition, routes are placed on the same ranking lists whose purpose is restricted to transit through particular regions. Some of these projects are then carried out. Later on, in the evaluation phase, they are subject, along with the entire network, to statistical analysis in order to verify the hypothetical influence that they exert on economic development. These analyses produce negative or ambiguous results. It is difficult, from the methodological point of view, to avoid such distortions. This may be facilitated by the use of accessibility indicators (rather than just density and even less length of the network), as well as an assessment of the socio-economic impact of specific routes on the basis of detailed local studies.

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