OLSZTYN ECONOMIC JOURNAL
2021, 16(1), 113–121
ISSN 1897-2721 e-ISSN 2083-4675 DOI: 10.31648/oej.7317

ORIGINAL PAPER

ECONOMIC COMPETITIVENESS AND AVAILABILITY OF ROAD INFRASTRUCTURE

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JEL Classification: R11, R40.

K e y w o r d s: economic competitiveness, development of the region, road infrastructure, transport.

A b s t r a c t

The level of road infrastructure development brings about several benefits, such as shorter travel times, reduced transport costs, or improved road safety. Undoubtedly, it is also a factor that has had a beneficial impact on the growth of certain regions. This is particularly important for the entire economy (in the macroeconomic context), for regions (on the meso-regional level) and for business enterprises (the macroeconomic aspect). The aim of this study has been to evaluate the effect of the availability of road infrastructure on the economic competitiveness of Polish voivodeships. To this end, the Regional Competitiveness Index (RCI) was compared with the ratio of the density of hard-surface roads per 100 km^2. The analysis showed that the highest regional competitiveness and simultaneously the highest road density ratio were in the voivodeships: śląskie, małopolskie and mazowieckie. However, the majority of regions in Poland are composed of voivodeships with both of these indicators scoring below zero. These are regions in the eastern part of Poland; as well as the lubuskie and zachodniopomorskie voivodeships.

How to cite: Merło, P., Juszkiewicz, J., & Łątkowski, Sz. (2021). Economic Competitiveness and Availability of Road Infrastructure. *Olsztyn Economic Journal*, *16*(1), 113-121. https://doi.org/10.31648/oej.7317.

KONKURENCYJNOŚĆ GOSPODARCZA A DOSTĘPNOŚĆ DO INFRASTRUKTURY DROGOWEJ

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Słowa kluczowe: konkurencyjność gospodarcza, rozwój regionu, infrastruktura drogowa, transport.

Abstrakt

Poziom rozwoju infrastruktury drogowej przekłada się na zmniejszanie czasów podróży, redukowanie kosztów transportu, poprawę bezpieczeństwa i wiele innych aspektów. Wynika z tego, że rozwój infrastruktury transportowej pozytywnie oddziałuje na rozwój regionu. Jest to niezwykle istotne chociażby z punktu widzenia przedsiębiorstw. Celem badań była ocena wpływu dostępności do infrastruktury drogowej na konkurencyjność gospodarczą polskich województw. W tym celu porównano wskaźnik RCI ze wskaźnikiem gęstości dróg o twardej nawierzchni przypadających na 100 km^2. Przeprowadzona analiza wskazała, że najwyższym poziomem konkurencyjności regionalnej, z jednocześnie wysoką gęstością dróg, charakteryzują się województwa śląskie, małopolskie i mazowieckie. Najliczniejszą grupą regionów w Polsce są jednak województwa z obydwoma wskaźnikami na poziomie ujemnym. Są to regiony znajdujące się we wschodniej części kraju, a także województwa lubuskie i zachodniopomorskie.

Introduction

In the economy, competitiveness is defined as the ability to achieve success in economic competition. Considering the field of regional development, we define economic competitiveness as the ability of regions to adapt to constantly changing conditions in order to maintain or improve their position (Kamerschen, 1991). Issues pertaining to determinants of regional competitiveness are an important component of economic research, because they help to understand which factors can accelerate the development of a region. Knowledge of these underlying conditions can facilitate more effective investment in the region's development. Economists point to the influence of many factors that shape the development of a region, including natural resources, climate, availability of human labour,

quality of human capital, opportunities to secure land for investment projects, and broadly understood road infrastructure (Koźlak, 2014; Nazarczuk, 2013). Easier access to transportation channels reduces transport time and costs for all finished products, raw materials or semi-finished products (Domańska, 2006; Krakowiak-Bal, 2007). This is a significant factor to consider by managers of the companies where transport costs make a considerable contribution to total costs.

The main purpose of this study has been to assess the relationship between the availability of road infrastructure and the competitiveness of Polish voivodeships. To this end, the Regional Competitiveness Index (RCI) was compared to the road infrastructure availability indicator.

Road infrastructure as a determinant of economic competitiveness

Benefits from the development of road infrastructure and its stimulating impact on economic growth and regional development are broadly described in the subject literature (Pawłowska, 2013). The way infrastructural investments affect the level of regional competitiveness is a multi-faceted and complex process, above all because of a large number of mutual links between regions.

Road infrastructure is an element of transportation infrastructure. It plays an important role, especially in the transport of cargo over short and medium distances (Pyza, 2010). The principal indicator showing the transport structure is the share of transport work carried out by all transport branches. Whilst analysing this structure, the distinctly prevalent role of road transport emerges. According to statistical data from 2010, 70.4% of transport work was performed using road vehicles as the means of transport. The second most popular means of cargo transport was railway transport, at 15.4% of transport work done. This is a huge difference, which is continually increasing as time passes (Ambroziak & Pyza, 2011).

In the second half of the 20th century, numerous economists undertook research on infrastructure. For example, P.N. Rosenstein-Rodan (1959) analysed benefits from infrastructural investments in comparison to other types of investment. An extremely important achievement of that analysis was that it gave rise to the concept of the big push. In line with the big push model, it is stated that less developed regions find it difficult to overcome a certain development threshold, which would allow them to attain self-sustaining growth. Special attention has been drawn to capital constraints, which forces decision-makers to choose between infrastructural investments and investment into production.

Ragnar Nurkse drew attention to the impossibility of importing infrastructure and to limited possibilities of purchasing its services abroad, while simultaneously

there are no obstacles to importing industrial products. In his opinion, in a situation of the simultaneous presence of unsatisfied demand for industrial goods and infrastructural services, infrastructure should be constructed (Nurkse, 1963).

Connections between infrastructure and the development of other links in the economy must not be viewed in terms of the absolute superiority of one possibility over another, In different economies, depending on economic, geographical, political or demographic circumstances, a different, appropriate development strategy will exist (Ratajczak, 2000). In 1989, D. Aschauer (1989) hypothesised that the development of infrastructure has a considerable influence on the total productivity of production means. This hypothesis was crucial when creating the theoretical grounding for the analysis and evaluation of the effect of infrastructure on economic growth and incomes earned by societies. Current studies concerning the role of infrastructure in the economy focus on pro-development effects and issues of effectiveness. It turns out that a rise in the availability of infrastructure contributes to a growth in GDP and improved productivity of production means. Thus, infrastructure is an important contributor to the activation, convergence and also competitiveness of regions. A turning point in substantiating this opinion was the publication of a manuscript by C. Calderón and L. Servén (2004), which summarised studies carried out for many years, based on data from 121 countries covering the years 1960-2000. The main conclusion drawn from observations of the positive impact of the development of infrastructure on the increase in GDP and decrease in disproportions of incomes earned by the population was that the development of infrastructure is an essential determinant of the economic activation of regions and reduction of spatial disparities.

The development of infrastructure favours the growing competitiveness of regions, and helps to achieve social goals. Many authors claim that the development of infrastructure leads to enhanced productivity, lower costs, time savings, improved safety and lower unemployment (Burnewicz & Grzywacz, 1989; Hawlena, 2012; Ratajczak, 1999). On the other hand, when road infrastructure is underdeveloped, marginalisation of a given region could be a consequence (Koźlak, 2007). Sites located far from main roads and hubs are less attractive to domestic and international investors. Even in less developed countries, regions with the best connections to major EU regions and/or the highest growth centres in their own countries develop the fastest. A region's investment attractiveness is a compilation of location advantages as perceived by economic entities. This attractiveness, and hence the ability to attract investors, has an influence on the overall attractiveness of the region. Both research and surveys addressed to foreign investors indicate that transport accessibility and transport infrastructure are among the major determinants of a region's competitiveness (Kaczyńska & Korycińska, 2014). It is also noticeable that investment into transport infrastructure contributes to a greater effectiveness of production and distribution processes. Moreover, it creates opportunities to take advantage of economies of scale, promote production specialisation and stimulate the development of logistics systems

by reducing their costs. Overall, it is beneficial to the increasing efficiency of business and thus to GDP growth (Koźlak & Pawłowska, 2014).

The main purpose of investing into road infrastructure is to improve the accessibility of a given area. Owing to such investments, travel time is shorter while transport costs are reduced. Investing into road infrastructure generates, both directly and indirectly, more advantages than disadvantages. The former include: higher employment, improved labour productivity and prevention of social exclusion. However, there are some negative consequences as well, of which the adverse impact on the natural environment should be considered as the gravest (Wacek, 2013).

Research methodology and results

The empirical part of this study was based on secondary data obtained from the Polish databases created by Statistics Poland (GUS) and global databases maintained by the European Commission. The conclusions were drawn by analysing the relationships between:

– the Regional Competitiveness Index (RCI), and
– the density ratio of hard-surface roads per 100 km^2.

The RCI serves to measure different dimensions of regional competitiveness. It shows both strengths and weaknesses of the EU regions, including Polish voivodeships. It also facilitates the determination of possible investment directions, accounting for a region's characteristics and the level of its general development. The index comprises three groups, referred to as pillars. The basic pillar consists of institutions, macroeconomic stability, infrastructure and health; as well as the quality of primary and secondary education. Notably, infrastructure is implicated as one of the most important dimensions, included in the set of principal determinants of regional competitiveness, which is significant in the light of the goal set for this study. The second group, known as the efficiency pillar, comprises tertiary education, labour market efficiency and the size of the market. The third and last pillar is called the innovation pillar, and is composed of technological readiness, business sophistication and innovations (Dijkstra, 2011).

The study also included the density ratio of hard-surface roads per 100 km^2. For this purpose, the length of roads with a hard surface (cobblestone, brick, concrete, stone and concrete slabs, asphalt, gravel, paved) per 100 km^2 of a voivodeship's area was determined (Statistics Poland, 2021),

To ensure the comparability of variables in the study, the data were standardised using the *z*-score method. This enabled us to express all data on one scale (Knoke, 2002):

$$X_{\text{Std}} = \frac{x - \bar{x}}{\sigma},$$

where:

$\bar{x}$ – mean of a sample,

σ – standard deviation of a sample.

Our analysis of the standardised ratio of the density of hard-surface roads and standardised RCI for every Polish voivodeship allows us to determine the dispersion between these data (Fig. 1).

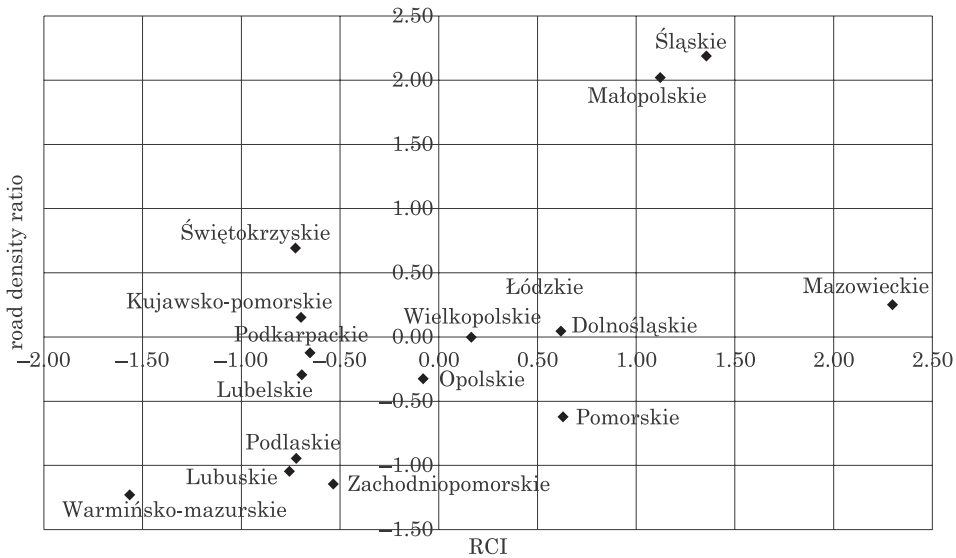

Fig. 1. Dispersion between the RCI and the hard-surface road density ratio in Polish voivodeships in 2019

Source: developed by the authors, based on data from Statistics Poland and the EU Regional Competitiveness Index.

The analysis allowed us to distinguish regions which clearly stood out, in both a positive and negative sense, against the country's average. Special attention should be drawn to two voivodeships: śląskie (RCI = 1.35) and małopolskie (RCI = 1.12), in which both the RCI and road density ratio were higher than in the other Polish regions. These two voivodeships are characterised by a high level of industrialisation, mainly because of their large stocks of natural resources. Large quantities of mined coal have long been a factor attracting industrial plants in which coal is the main fuel. However, this is not the only determinant of the development of these regions. Industry also needs well-developed road infrastructure, which facilitates the transport of semi-finished goods, finished goods and the fuel mentioned before. The RCI is higher in just one other province, namely the mazowieckie voivodeship (RCI = 2.3). This area owes its high level of development to the location of the country's capital city, which attracts many

companies and investors. This voivodeship is also a region with the highest share of services in the employment structure (*Rozwój usług w Polsce*, 2021). Due to their specific nature, services are less dependent on road infrastructure, which explains why the mazowieckie voivodeship may not have the highest hard-surface road density ratio in Poland, despite scoring the highest RCI in the country.

The most numerous group was composed of the voivodeships with both indicators scoring below zero. These are voivodeships located in the eastern as well as the north-western parts of Poland. The lagging development of Eastern Poland is rooted in the times of Poland's partition, because when Poland regained independence the eastern outskirts of the country were in a much worse socio-economic situation than the other regions. However, this is not the only reason for its lower competitiveness. The lack of strategic resources and poorly developed transport infrastructure mean that the eastern voivodeships are hardly competitive relative to the other areas in Poland. The north-western block, which comprises the lubuskie (RCI = -0.76) and zachodniopomorskie (RCI = -0.54) voivodeships, is a region which can take advantage of being located in the neighbourhood of Germany in its development strategy. Well-developed road infrastructure would improve the efficiency of transport and encourage some investors to transfer capital to the Polish voivodeships. Lower labour costs in Poland are certainly of interest among investors from behind the western border of Poland, and good road infrastructure most certainly would be another asset.

The pomorskie voivodeship is the only region in which a relatively high competitiveness level coincides with the road density below Poland's average. However, this region, owing to its seaside location, has an above-average access to other transportation channels. Moreover, the agglomeration of three cities, Gdańsk, Sopot and Gdynia, which makes a strategic part of the voivodeship, has a well-developed railway infrastructure. All these factors contribute to the positive level of competitiveness even with a negative road density ratio in this voivodeship.

Conclusions

The level of economic competitiveness depends on many factors, whose role changes in relation to the achieved level of growth and dominant economic paradigm. To a large extent, however, economic competitiveness depends on the condition that many scholars consider to be the basic one, that is on the access to road infrastructure. The same is implicated by the results of this study. They seem to suggest that a well-developed network of roads in conjunction with other pro-developmental stimuli, greatly improves the competitiveness of a region. Road infrastructure is often the major factor that drives the development as it facilitates efficient transport of semi-finished products. The śląskie and

małopolskie voivodeships are a good example, as both were able to develop their industries owing to the well-developed road infrastructure. Development of road infrastructure should be a priority in a development strategy of regions which in this study were determined to have a negative RCI and a negative road density ratio. For the voivodeships located in the north-western part of Poland, this is a chance for a more rapid development, which has not been taken advantage of yet. The question arises why the local governments in these voivodeships do not invest in roads. For one thing, this is a long-term investment, and both planning and executing road development takes years. However, the implementation of such an investment translates into an increased interest in a given region among both national and international companies. In consequence, new jobs are created and tax revenues increase. Better access to road infrastructure is also beneficial for working people as they can often commute to work in a shorter time. It also facilitates a decision to look for a better-paid post or an occupation that fits one's education better. Nonetheless, it is worth noting that road infrastructure is not the only factor that can drive and intensify a region's development. An example is the pomorskie voivodeship, where, owing to the access to maritime and aviation infrastructure, the regional competitiveness index value is above the country's average despite the road density ratio being below the average value for Poland.

Translated by Jolanta Idźkowska
Proofreading by Michael Thoene

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