doi: 10.36689/uhk/hed/2022-01-071 HED Hradec Economic Days

Spatial Differentiation of the Situation on Local Labor Markets in the Areas of Impact of Airports in Poland

Agata SURÓWKA

Rzeszow University of Technology, Rzeszow, Poland; kmi@prz.edu.pl

Abstract: Spatial autocorrelation makes it possible to learn about the spatial structure of the dependence of the objects of the set and the interaction between the values of the studied variable in different locations. In the own research, it was used to assess the specificity of spatial differentiation of districts located in the areas of influence of Polish airports. In the course of their conduct few publications related to common areas of impact of airports were noticed. It was an inspiration to undertake research on such issues. The article has been divided into two parts. In the first part, districts located in the areas of influence of two or more Polish airports were identified; in the part, the spatial differentiation of regional labor markets in the studied area was assessed. The study was carried out in a dynamic approach, and then a comparative analysis of changes was made. As a result, it was found, inter alia that there is a phenomenon of non-random distribution of the tested objects. The selected results presented in the text are a continuation of the author's own research and fit in with the problem of verification of development differences.

Keywords: labor market; areas of impact air transport; quantitative methods; air transport; airport

JEL Classification: R11; O11

1. Introduction

Air transport is an active element of the world economy and the modern transport system. From a historical point of view, it is the most recent branch of transport and its powerful development can be observed so far. The growing economic importance of airports contributed to the increased interest in the areas in their vicinity. They attract economic entities, the location of which often requires large-area facilities, or more generally, is land-consuming. In addition, transfer hotels, office and conference centers are being built in the vicinity of airports. In this situation, the proper location of airports in relation to built-up areas has become a determinant of the possibility of effective use of development stimuli brought by their vicinity (Trzepacz et al., 2012). On the other hand, air transport is becoming more and more popular, which constantly increases the importance of its infrastructure in the socio-economic space. Growing air mobility is accompanied by growing expectations regarding the scope and quality of services provided not only by air carriers, but also by individual airports. This affects the architecture of check-in terminals, as well as the policy regarding the surroundings of these facilities, and thus their location (Trzepacz et al., 2012). Moreover, as some authors note, the development of air transport and its branch infrastructure is conducive to systematic transformations in spatial development. Airports

dynamize urbanization processes, including agglomeration, and the surrounding areas change their public and economic utility (Ruciński & Rucińska, 2017). Indeed, any investment which does not offer satisfactory medium-term prospects for use or which causes a deterioration in the use of existing infrastructure in the areas of impact of air transport cannot be regarded as contributing to the achievement of the objective of common interest. It is worth emphasizing that the issue of spatial development is an interdisciplinary issue and is at the center of interest of town planners, architects, geographers, economists, sociologists and representatives of some technical sciences, and the publication achievements in this area are impressive (Ruciński & Rucińska, 2017).

The increase in air traffic is related, inter alia, to the need to increase investments in infrastructure. At the same time this increase means inter alia the possibility of increasing employment at the airport and its surroundings as well as increasing tax revenues. This in turn has an impact on the economic development of the region. There must be a balance between the airport's response to the projected growth and the elimination of its negative impact on the environment (Syta, 2019; Kalinowski, 2016). The aim of the article is a quantitative analysis of the structure of districts located in common areas of impact of air transport at least two airports in Poland, as well as an assessment of the degree of diversification of the situation on the local labor markets of these units.

2. Areas of Impact of Airports in the Light of Economic Literature

As some authors note, the basic unit determining the spatial range of origin of passengers choosing a given airport is the areas of impact air transport. In the literature, they are differently defined and named. It is caused by the variety of purposes for which the areas of impact of airports is studied, the multiplicity of entities analyzing such a catchment area, and the multiplicity of methods of determining this zone for a specific airport (Huderek-Glapska et al., 2016). Lieshout (2012) gives the most simplified definition of it. He calls the area of impact air transport its surroundings that attract passengers (Lieshout, 2012). According to Augustyniak (2012), the term impact zone has not yet been strictly defined by science. As a general rule, he proposes to assume that this is the geographical area around the airport from which most of the passenger and freight traffic handled is originated. Sometimes this definition is also extended to the area to which most of the said traffic is heading. One interpretation of the above definitions is the assumption that there is a circle-shaped zone around the airport with a radius of 100 km, from which most passengers and goods come (Augustyniak, 2012). The latter criterion was taken into account in the authors' own research, the partial results of which are presented in the next part of the study. The most basic and often used by airports method of determining the area with the same access time is to draw concentric circles with the airport being the focal point. Still other authors precisely specify the size of this area. The radii of the circles correspond to the time or distance needed to reach the airport. Areas of influence of the airport with a radius of 60/90/120 km, respectively, are an accurate illustration of areas delineated by curves connecting points, with the same travel time to the destination point – the nearest communication airport (Paner-Cybulska, 2014).

There are also positions that the determination of the catchment area of an airport should be made by:

a) adopting the airport accessibility criterion as a criterion of the geographically relevant market, where this criterion is expressed not in units of distance (kilometers), but in time units of airport availability;

b) analysis of other criteria:

- competitive constraints from other airports, both neighboring and more distant (e.g. passengers may be more interested in direct connections from a further airport than connecting connections from a closer airport);
- the fact that an airline based in one hub airport is in competition with an airline based in another hub;
- the fact that the carrier actually threatens to transfer the connections to
- another airport, even if that airport is not an alternative from the point
- view of passengers (Czernicki & Skoczny, 2011).

According to Trzepacz et al. (2012) it is a space within which there are entities that use a given airport for the purpose of air travel. In the analysis of passenger air transport, it is therefore residents or persons visiting a given area in relation to a specific airport. There are also positions that the load zone is:

- the geographical area of origin of departing passengers,
- the geographic area targeted by arriving passengers,
- estimated passenger distribution for both of the above-mentioned categories (Kujawiak, 2016).

The catchment area, or the area of influence of a given airport, is also understood as the ability to attract visitors and customers. It depends on the number of people living in the vicinity and the possibility of surface transport. The designation of such an area makes it possible to show the geographical dimension of the functioning of a given airport on the market of air transport services. The studies on the example of Polish airports have shown that the catchment areas depend on transport accessibility (Trzepacz et al., 2012). Passengers are often faced with the choice of one of several airports that operate in the conditions of strong competition of overlapping areas of gravity. In this situation, the choice of a given airport will often be determined by factors such as the network of connections, the transport availability of the airport or the price of the air ticket. In the course of the research, it was observed that the choice of the port to travel depends mainly on the availability of the connection network. Reaching your destination often requires a transfer at a larger port. In such a situation, a greater offer of connections with a large transfer port, giving the possibility of a flexible choice of travel dates, may be a more advantageous solution than a schedule with individual flights a week to various destinations. The quality of passenger service is also important for the selection of airports (Trzepacz et al., 2012).

The range of the ports' influence is determined by economic, social, functional and spatial relations with the airport. As aviation activity increases, the branch infrastructure and superstructure develop, and in the immediate vicinity of airports, unique functional structures

are formed, activating the development potential of these areas (Ruciński & Ruciańska, 2017). Ports and airport-proximate zones strengthen the competitive and marketing potential of cities and regions, stimulate their development and effective use of shared resources. Following the example of world experience, there is also a tendency to create airport-proximate areas around airports in Poland. This, in turn, is the result of a wide spectrum of natural and socio-economic conditions. And indicating the distance from the airport as a factor determining the "catchment area" is necessarily arbitrary and cannot be treated as a decisive criterion for determining the relevant market (Czernicki & Skoczny, 2011).

The area of the airport's impact on the activity of entities in its vicinity is called the airport's catchment area. The analysis of this area allows, inter alia, to assess the volume of demand for air transport. The acquired data is an important element in the management and development process of an airport, including the expansion of the existing and construction of new airport infrastructure (Kujawiak, 2016; Rutkowski, 2018). In this context, it is worth noting that, in fact, the interests of influence in the areas of impact of air transport overlap.

3. Methods of Measuring Spatial Autocorrelation

Global statistics are used to study the occurrence of spatial autocorrelation in the scope of the entire spatial system. They are complemented by local measures, determined individually for each of the regions included in a given system. One of the most frequently used measures to assess the strength and direction of spatial autocorrelation is the global Moran I statistics (Kołodziejczyk & Kossowski, 2016). It is determined by a formula:

$$I = \frac{n}{S_0} \times \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij}(y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^{n}(y_i - \bar{y})^2} \quad (1)$$

where:

n – number of units in space,

a_{ij} – individual elements of the neighborhood matrix A,

S_0 – sum of all elements of matrix A,

y_i – value of the phenomenon for the i-th unit,

$\bar{y}$ – generalized arithmetic mean from all areas.

Usually, this statistic is interpreted as a correlation coefficient, although its value is not limited to the interval (-1,1). Positive autocorrelation means that neighboring objects are similar and that there are clusters of similar values. Negative autocorrelation resulting from the differentiation of neighboring objects corresponds to islands that are definitely different from the surrounding values. Several orders of neighborhood are distinguished in spatial analysis. First-order neighborhood refers to the direct neighbors of the tested object. The neighborhood of the second and further rows concerns the next neighbors of these neighbors. Most often in practice, the neighborhood of the first row is used.

4. The Problem of Overlapping Areas of Pressure in the Context of Conducting Research on the Impact of Air Transport on Regional Labor Markets

It should be noted that the areas of influence of most airports extend beyond the area of the voivodeship where they are located, which results in the existence of a common catchment area. On the other hand, as a result of a review of the literature to date, we notice that the problematic of overlapping areas rarely becomes a source of interest in scientific research (Tłoczyński, 2017; Bul, 2018). With the above in mind, one of the research objectives was to identify statistical units located in overlapping areas of influence of Polish airports. For this purpose, with the help of the Geostatistics Portal, the names of districts in the studied areas were determined. The results obtained in this way are summarized in Table 1. A detailed description of this procedure can be found in the literature (Surówka, 2019).

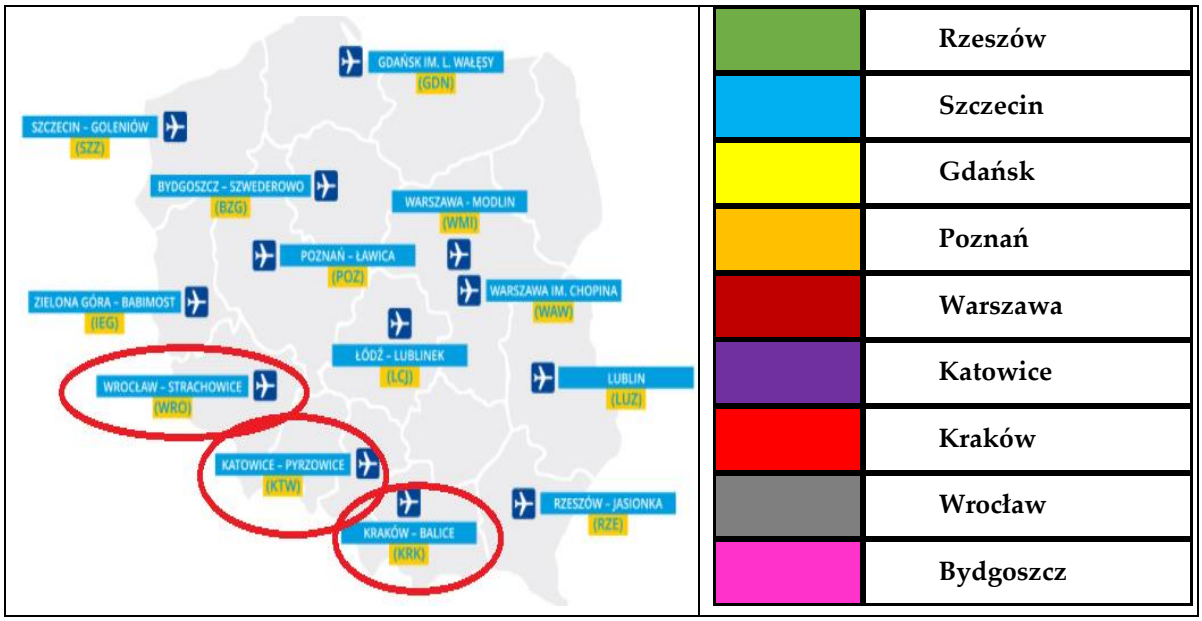


Figure 1. Illustrative map of designating districts located in the areas of influence of overlapping airports

The names of the districts are marked with colors according to the legend in Figure 1. Each airport is marked with a different color. Additionally, the names of the cities in which the port is located are given in brackets.

In the next step of the study, the results from Table 1 are presented in a graphical manner in the figures below in Figure 2. The color of the dot refers to the area of influence of the port to which a given unit belongs (see Figure 1).

Analyzing the information contained in Table 1 regarding the area of influence of the Solidarity Szczecin- Goleniów Airport, we note that out of the twenty-three sites only the czarnkowsko-trzcianecki and choszczeński districts are also within the influence of Poznań Airport. It is the smallest number of them. In the area of influence of Bydgoszcz Airport we note that four statistical units (Grudziądz, mogeliński, nakielski and żniński districts) are also in the area of influence of other airports. These are units characterized by a bad situation on local labor markets. In Grudządz a large imbalance in the labor market is observed, and the

Table 1. Cities and cities with districts rights belonging to the protection of 100 km of airports in Poland – Part 1

Rzeszów International Airport	Areas: biłgorajski, janowski, krasnostawski, kraśnicki, lubelski, **tomaszowski (Warszawa),** zamojski, **bocheński (Katowice, Kraków**), **brzeski (Katowice, Kraków, Wrocław),** dąbrowski, gorlicki, **nowosądecki (Katowice, Kraków**), **proszowicki (Kraków) tarnowski (Kraków), Tarnów (Kraków**), lipski, bieszczadzki, brzozowski, dębicki, jarosławski, jasielski, kolbuszowski, krośnieński, leżajski, lubaczowski, łańcucki, mielecki, niżański, przemyski, przeworski, ropczycko-sędziszowski, rzeszowski, sanocki, stalowowolski, strzyżowski, tarnobrzeski, leski, Krosno, Przemyśl, Rzeszów, miasto Tarnobrzeg, **buski (Kraków**), **kazimierski (Kraków, Katowice), kielecki (Katowice**), opatowski, ostrowiecki, **pińczowski (Kraków, Katowice),** sandomierski, staszowski
Solidarity Szczecin - Goleniów Airport	Areas: gorzowski, strzelecko-drezdenecki, Gorzów Wielkopolski **czarnkowsko-trzcianecki (Poznań),** białogardzki, kołobrzeski, koszaliński, **choszczeński (Poznań),** drawski, myśliborski, pyrzycki, szczecinecki, świdwiński, wałecki, łobeski, Szczecin, goleniowski, gryficki, gryfiński, kamieński, policki, stargardzki, Świnoujście
Gdansk Lech Walesa Airport	Areas: **Grudziądz (Bydgoszcz),** bytowski, chojnicki, gdański, kartuski, kościerski, kwidzyński, lęborski, malborski, **nowodworski (Warszawa),** pucki, starogardzki, tczewski, wejherowski, sztumski, Gdańsk, Gdynia, Sopot, braniewski, elbląski, Elbląg
Poznań Ławica Airport	Areas: **górowski (Wrocław), mogileński (Bydgoszcz), nakielski (Bydgoszcz) , żniński (Bydgoszcz)**, międzyrzecki, sulęciński, **wschowski (Wrocław**), Zielona Góra, **chodzieski, czarnkowsko-trzcianecki (Szczecin**), gnieźnieński, **gostyński (Wrocław**), **grodziski (Warszawa), jarociński (Wrocław), koniński, kościański (Wrocław), krotoszyński (Wrocław), leszczyński (Wrocław)**, międzychodzki, nowotomyski, obornicki, pilski, **pleszewski (Wrocław**), **poznański, rawicki (Wrocław**), słupecki, szamotulski, **średzki (Wrocław), śremski (Wrocław)**, wągrowiecki, wolsztyński, wrzesiński, Konin, **Leszno (Wrocław), Poznań, choszczeński (Szczecin)**
Warsaw Chopin Airport	Areas: Warszawa, pruszkowski, piaseczyński, warszawski zachodni, **grodziski (Poznań**), legionowski, **nowodworski (Gdańsk**), otwocki, żyrardowski, wołomiński, miński, sochaczewski, grójecki, pułtuski, skierniewicki, Skierniewice, rawski, wyszkowski, płoński, garwoliński, białobrzeski, węgrowski, kozienicki, łowicki, ciechanowski, makowski, płocki, przysuski, **tomaszowski (Rzeszów),** brzeziński, Radom, Siedlce, rycki, łukowski, Płock
Katowice Airport im. Wojciecha Korfantego	Areas: **bieruńsko-lędziński (Kraków)**, chrzanowski, **myślenicki (Kraków), oświęcimski (Kraków), bocheński (Rzeszów, Kraków), kluczborski (Wrocław), Jastrzębie-Zdrój (Kraków),** wodzisławski, wielicki, krapkowicki, **Sosnowiec (Kraków),** gliwicki, pajęczański, będziński, Gliwice, **Jaworzno (Kraków)**, Częstochowa, cieszyński, **rybnicki (Kraków), nyski (Wrocław), suski (Kraków), Bytom (Kraków), Rybnik (Kraków), wadowicki (Kraków), mikołowski (Kraków), wieluński, opolski (Wrocław),** Siemianowice śląskie, **Świętochłowice (Kraków), Mysłowice (Kraków**), Ruda Śląska, kłobucki, **Piekary Śląskie (Kraków), Żory (Kraków**), Zabrze, **pszczyński (Kraków)**, kędzierzyńsko - kozielski, **Opole (Wrocław)**, strzelecki, głubczycki, Katowice, radomszczański, zawierciański, krakowski, myszkowski, **namysłowski (Wrocław),** włoszczowski, miechowski, raciborski, **pińczowski (Rzeszów), żywiecki (Kraków), tarnogórski (Kraków), lubliniecki (Kraków),** piotrkowski, bełchatowski, **Dąbrowa Górnicza (Kraków),** łaski, **proszowicki (Rzeszów, Kraków**), **olkuski (Kraków), Bielsko-Biała (Kraków), Tychy (Kraków), prudnicki (Wrocław),** oleski, częstochowski, **jędrzejowski (Kraków),** konecki, **brzeski (Wrocław, Rzeszów, Kraków**), **Chorzów (Kraków), kielecki (Rzeszów), kazimierski (Rzeszów, Kraków), wieruszowski (Wrocław), bielski, (Kraków)**

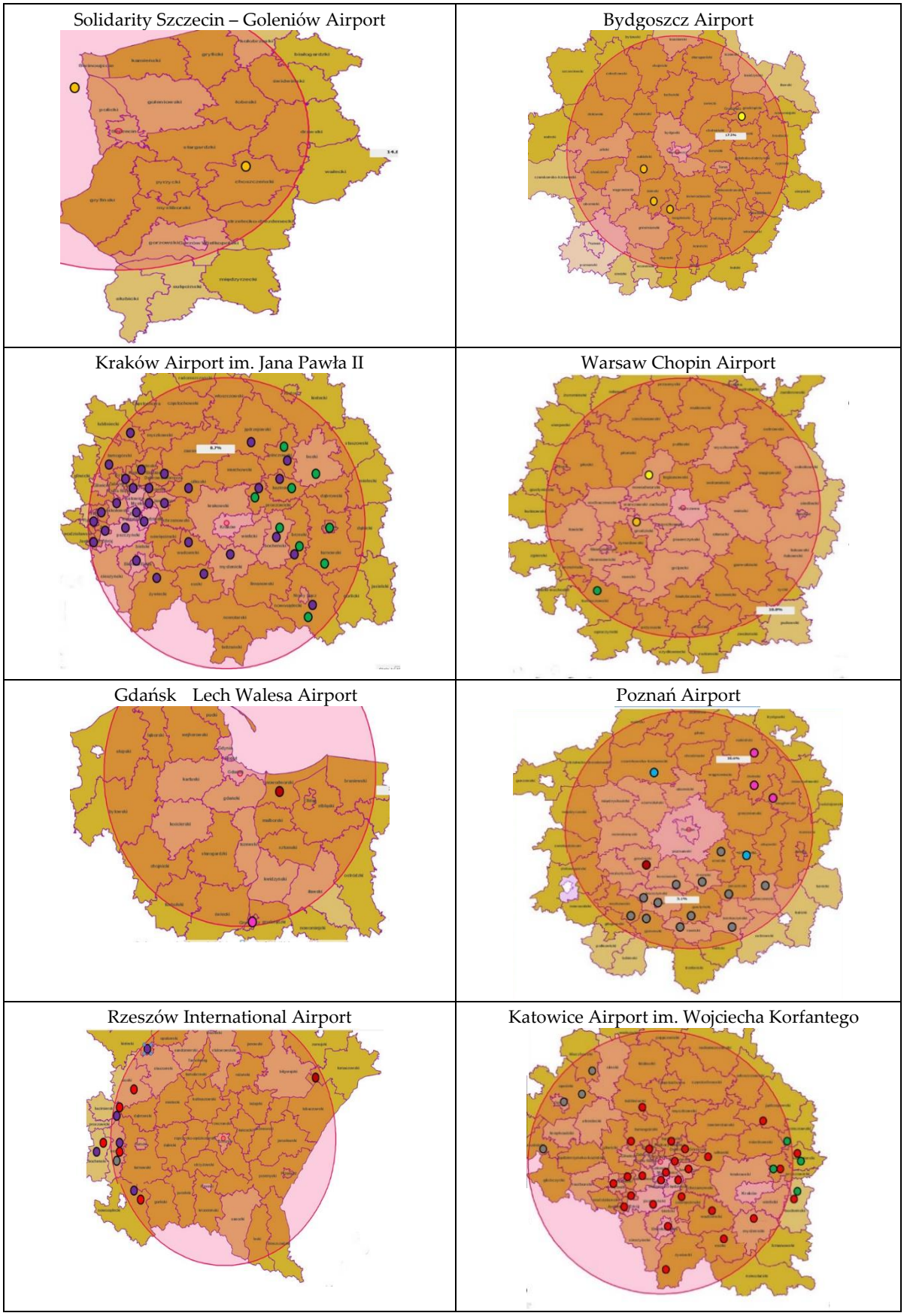
phenomenon of unemployment has become severe and is one of the main problems in the development of the local community. In the opinion of the local government, it causes constant impoverishment of the inhabitants. In the area of influence of the Krakow Airport im. Jana Pawła II, the most numerous group is the districts located also in the catchment area

Table 1. Cities and cities with districts rights belonging to the protection of 100 km of airports in Poland – Part 2

Kraków Airport im. Jana Pawła II	Areas: **bocheński (Rzeszów, Katowice),** **brzeski (Rzeszów, Katowice, Wrocław**), chrzanowski, dąbrowski, krakowski, limanowski, miechowski, **myślenicki (Katowice),** **nowosądecki (Katowice, Rzeszów),** nowotarski, **olkuski (Katowice),** **oświęcimski (Katowice),** **proszowicki (Rzeszów, Katowice),** **suski (Katowice),** **tarnowski (Rzeszów),** tatrzański, **wadowicki (Katowice**), wielicki, Kraków, Nowy Sącz, **Tarnów (Rzeszów**), będziński, bielski, cieszyński, częstochowski, gliwicki, **lublinieckі (Katowice),** **mikołowski (Katowice)**, myszkowski, **pszczyński (Katowice),** **rybnicki (Katowice),** **tarnogórski (Katowice),** **bieruńsko-lędziński (Katowice**), wodzisławski, zawierciański, **żywiecki (Katowice),** **Bielsko-Biała (Katowice),** **Bytom (Katowice),** **Chorzów (Katowice**), Częstochowa, **Dąbrowa Górnicza (Katowice)**, Gliwice, **Jastrzębie-Zdrój (Katowice),** **Jaworzno (Katowice)**, Katowice, **Mysłowice (Katowice),** **Piekary Śląskie (Katowice**), Ruda Śląska, **Rybnik (Katowice**), Siemianowice Śląskie, **Sosnowiec (Katowice),** **Świętochłowice (Katowice),** **Tychy (Katowice)**, Zabrze, **Żory (Katowice),** **buski (Rzeszów),** **jędrzejowski (Katowice),** **kazimierski (Katowice, Rzeszów),** **pińczowski (Rzeszów, Katowice),** włoszczowski
Wroclaw Airport	Areas: wrocławski, Wrocław, **Opole (Katowice),** **Leszno (Poznań**), lubiński, **leszczyński (Poznań),** Legnica, jeleniogórski, **śremski (Poznań),** **średzki (Poznań**), oławski, ostrowski, trzebnicki, **kościański (Poznań**), ostrzeszowski, Jelenia Góra, świdnicki, kępiński, bolesławiecki, **gostyński (Poznań),** **pleszewski (Poznań**), oleśnicki, **brzeski (Kraków, Rzeszów, Katowice)** głogowski, milicki, polkowicki, **namysłowski (Katowice**), złotoryjski, **wschowski (Poznań),** **jarociński (Poznań**), ząbkowicki, legnicki, **opolski (Rzeszów, Katowice),** **kluczborski (Katowice),** **rawicki (Poznań),** **krotoszyński (Poznań),** krapkowicki, wołowski, dzierżoniowski, **nyski (Katowice),** **wieruszowski (Katowice**), strzeliński, jaworski, wałbrzyski, kłodzki, lwówecki, kamiennogórski, **prudnicki (Katowice),** **górowski (Poznań)**
Bydgoszcz Airport	Areas: bydgoski, toruński, Bydgoszcz, Toruń, brodnicki, chełmiński, golubsko-dobrzyński, grudziądzki, rypiński, wąbrzeski, **Grudziądz (Gdańsk),** aleksandrowski, lipnowski, radziejowski, włocławski, Włocławek, inowrocławski, **mogileński (Poznań),** **nakielski (Poznań),** **żniński (Poznań),** sępoleński, świecki, tucholski

of the Katowice-Pyrzowice Airport. On the right-hand side of this impact area, the green dot (see Table 1) marks the districts also located within the area of influence of the Rzeszów International Airport. In the area of impact of the Warsaw Chopin Airport, there are three districts (Grodziski, Nowodworsk and tomaszowski districts), located also in the area of influence of the second airport. Grodziski district is also located in the area of the isochrone of Poznań Airport. It is characterized by a decline in the unemployment rate. Nowodworski district in the catechment area of Gdańsk Lech Walesa Airport and tomaszowski district in the area of impact of Rzeszów International Airport. They are distinguished by high rotation in the labor market. The analysis of information on Poznań Airport shows that its area of influence is also in the zones of influence of four other ports. Among them, the following districts: mogileński, nakielski and żniński are also located in the catchment area of the Bydgoszcz Airport. When analyzing the data relating to the Rzeszów International Airport, we notice that on the left side of the studied area there are objects located in the areas of influence of overlapping isochrones of airports. Among them, the brzeski district is also located to the area of influence of the airports in Katowice, Kraków and Wrocław. The vast majority of objects are located in the isochrones of the neighboring ports in Kraków and Katowice. Four districts (Bochnia, nowosądecki, kazimierski and Pińczów) are located in the zone of influence of two additional ports. Due to the fact that in the area of impact of Katowice

Figure 2. Graphical presentation of districts located in the areas of overlapping isochrones



Airport im. Wojciecha Korfantego there are most districts located also in the catchment areas of Kraków Airport im. Jana Pawła II and Wrocław airport, these objects became a source of interest in the next part of the study (see Figure 1).

4. Discussion and Conclusion

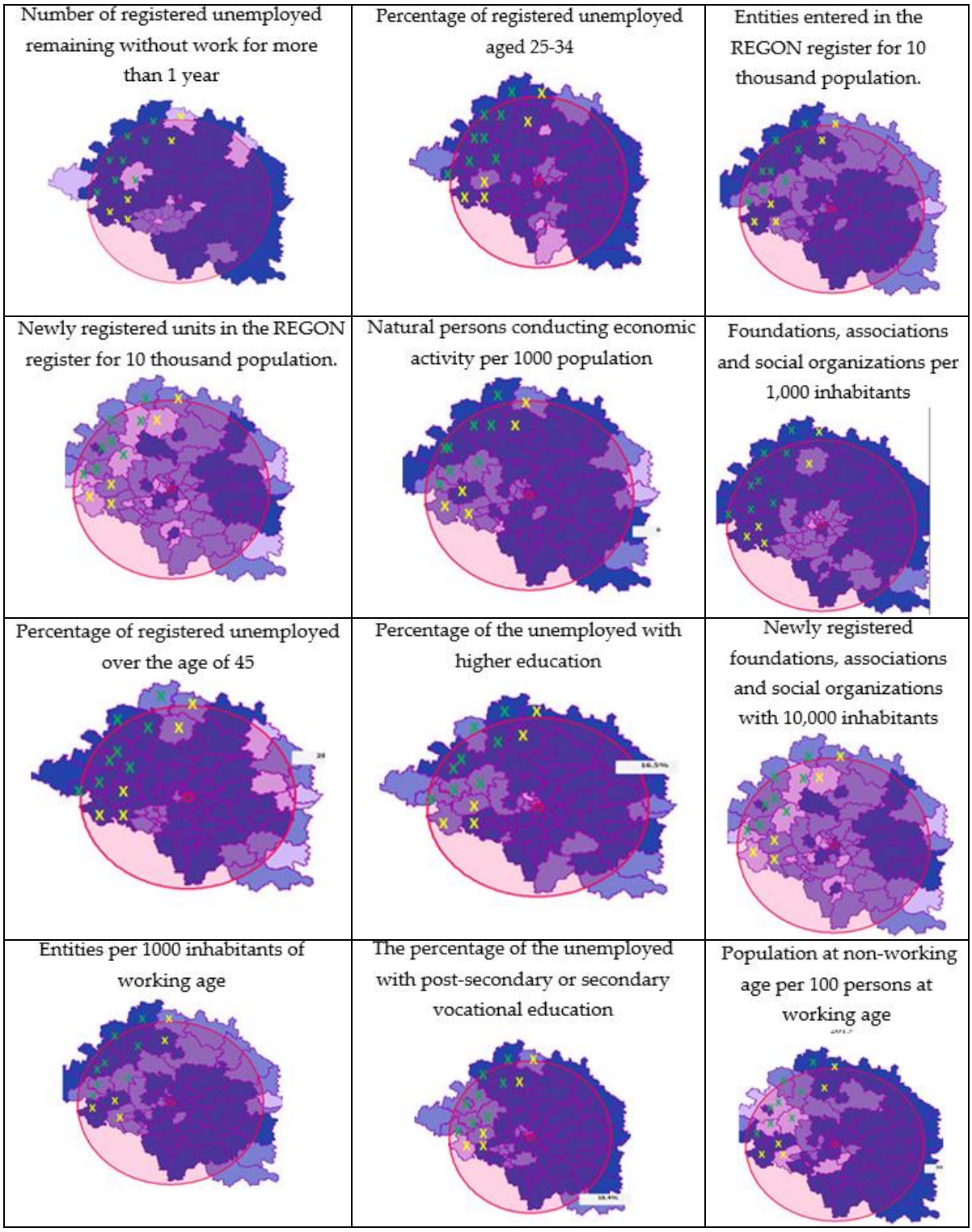
The catchment area analysis is used by some airports, for example in the process of planning future investments. Unfortunately, in Polish and European literature we can find only a few results of research related to a comprehensive analysis relating to districts located in the areas of overlapping isochrones. Considering the above, the analyzes carried out by the author may be a source of inspiration for further research. In the course of the own research, a number of conclusions were drawn. Due to the limited scope of the publications, only selected ones are included in it. It was observed in the research procedure that the fewest objects belonging to more than one load area are located in the area of isochrones of airports in Gdańsk, Warsaw, Bydgoszcz and Szczecin. The most numerous group of facilities located in the area of at least two airports can be found in the zones of influence of airports located in the southern part of Poland (in Kraków, Wrocław and Katowice). The conducted research also assessed the degree of differentiation of the examined counties in terms of the situation on local labor markets (Surówka, 2020). The subject of interest in the text are only objects located in the area of the Katowice Airport im. Wojciecha Korfantego. The adopted list of characteristics determining the labor market can be found in the author's earlier publications (Surówka, 2019). The obtained results of spatial differentiation of regional labor markets in the areas of pressure of the analyzed ports, together with the list of indicator names, are also presented in Figure 3. The following designations have been adopted in the figure: the green dot marks the districts also located within the impact zone of Wrocław Airport, and the yellow dot Kraków Balice. Results refer to the year 2017.

In order to detect the nature and strength of the observed spatial relations in a given area, the Moran I spatial autocorrelation coefficient is used (Pośpiech, Mastalerz-Kodzis, 2016). Its significance is verified by the test of autocorrelation coefficients. As a result of the analysis of the determined values of these measures (Moran's I coefficients and p-value), it was noticed that almost all features are statistically significant throughout the entire period under investigation. Thus, it allows to consider the positive spatial autocorrelation as significant for most of the variables. The obtained results are presented graphically in the figures in Figure 3.

As a result of its analysis, the question arises whether the objects located within the range of more than one airport are characterized by different specificity. The conducted research allowed to answer this question and draw detailed conclusions. Among other things, by analyzing the ratio of units newly registered in the REGON register per 10 thousand. population, we observe a high level of concentration within a given location of areas with similar values of the analyzed variable. These areas form a group of poviats located in the eastern part of the studied region. It contains only objects located in the area of influence of the port under study. Most of the structures located in the areas of impact of air transport neighboring ports form the second cluster, located in the north-western part of the studied region. When analyzing the indicators selected for the study, in most of them, we do not

observe a tendency to cluster areas within a given location (districts located in the catchment area of at least one airport) with similar values of the analyzed variables. The exception is the entities per 1,000 inhabitants of working age index, for which the districts located also in the

Figure 3. Differentiation of the situation on local labor markets in districts located in the area of the Katowice Airport im. Wojciecha Korfantego



area of influence of the Rzeszów International Airport and Kraków Airport im. Jana Pawła II create areas with similar values of the analyzed variable. In the course of the research, it was

also observed that the ratio of the share of the total unemployed with higher education in relation to the number of working age population is characterized by a tendency to cluster objects that became the source of interest in the text. Such an indicator of natural persons conducting economic activity per 1,000 population was also analyzed. Positive values of the obtained Moran's I coefficients (2011-2017) indices indicate the presence of a positive spatial autocorrelation of this feature. The spatial autocorrelation coefficients of this feature were statistically significant (at the level of 0.05) and had a similar value. A similar trend in 2017 was observed for the feature of foundations, associations and social organizations per 1,000 inhabitants. Graphical analysis of this feature allows us to distinguish three clusters. One of them included almost all the districts located in the north-western part of the analyzed area. It is distinguished by the largest number of foundations, associations and social organizations per 1,000 inhabitants, which is the largest in this group. On the other hand, the analysis of the Moran I coefficients shows a very weak correlation between newly registered foundations, associations and social organizations per 10 thousand. residents. This means a very low increase in these forms of activity. The detailed results of the study are presented graphically in Figure 3. They give the opportunity to make your own interpretation.

Conflict of interest: none

References

Augustyniak, W. (2014). Analiza konkurencji na rynku polskich portów lotniczych po Euro 2012. *Przegląd Komunikacyjny,* (11), 31-35.

Bul, R. (2018). Oferta i siła oddziaływania lotniska Poznań-Ławica na obszar województwa wielkopolskiego w kontekście funkcjonowania sąsiednich portów lotniczych. *Rozwój Regionalny i Polityka Regionalna,* (44), 67-89.

Czernicki, F., & Skoczny, T. (2011). *Usługi portów lotniczych w Unii Europejskiej i Polsce-wybrane zagadnienia*. Wydawnictwo Naukowe Wydziału Zarządzenia UW, Warszawa.

Huderek-Glapska, S., Inchausti-Sintes, F., & Njoya, E. (2016). Modeling the impact of air transport on the economy-practices, problems and prospects. *LogForum, 12*(1), 47-61.

Kalinowski, S. (2016). The impact of air transport on regional labour markets in Poland. *Uniwersytet Ekonomiczny we Wrocławiu*, *37*(2), 337-340.

Kołodziejczyk, A., & Kossowski, T. (2016). Wykorzystanie metody autokorelacji przestrzennej do analizy ubóstwa na obszarach wiejskich. *Wiadomości statystyczne*, *10*(665), 22-32.

Kujawiak, M. (2016). Analiza obszaru oddziaływania portu lotniczego – przegląd metod badawczych. *Studia Oeconomica Posnaniensia, Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, Poznań,* (4), 112-124. https://doi.org/10.18559/SOEP.2016.7.6

Lieshout, R. (2012). Measuring the Size of an Airport Catchment Area. *Journal of Transport Geography, 25*, 27-34, https://doi.org/10.1016/j.jtrangeo.2012.07.004

Pancer-Cybulska, E., Olipra, Ł., Cybulski, L., & Surówka, A. (2014). *Transport lotniczy a regionalne rynki pracy w Polsce*. Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.

Pośpiech, E., & Mastalerz-Kodzis, A. (2016). A Spatial and Temporal analysis of Labour Market Characteristics. *Folia Oeconomica Stetinensia, 16*(2), 60-71. https://doi.org/10.1515/foli-2016-0025

Ruciński A., & Rucińska, D. (2017). Współzależności rozwoju portów lotniczych i struktur zagospodarowania przestrzeni z uwzględnieniem stref okołolotniskowych. *Prace Komisji Geografii Komunikacji PTG, Wyższa Szkoła Bankowa we Wrocławiu, 20*(2), 57-68. https://doi.org/10.4467/2543859XPKG.17.011.7393

Rutkowski, M. (2018). Factors influencing the development of the Katowice International Airport in Pyrzowice - case study. In *Proceedings of the 10th Anniversary International Scientific Conference on Analysis of International Relations - Methods and Models of Regional Development, Katowice 2018* (pp. 63-69). University of Economics in Katowice. https://air.ue.katowice.pl/pdf/2018b/08_Rutkowski.pdf

Syta, J. (2019). Rola władzy lotniczej w zapewnieniu zrównoważonego rozwoju transportu lotniczego. *Nowoczesne Systemy Zarządzania, 14*(2), 83-98.

Surówka, A. (2020). Comparative analysis of the dynamics of indicator changes PKB per capita in the regions of Greece, Germany and Romania. In *Proceedings of the International Scientific Conference Hradec Economic Days 2020* (pp. 749-760). University of Hradec Králové. https://doi.org/10.36689/uhk/hed/2020-01-085

Surówka, A. (2019). Portal Geostatystyczny jako narzędzie badawcze nierówności na lokalnych rynkach pracy. *Nierówności społeczne a wzrost gospodarczy,* (59), 162-172.

Trzepacz, P., Boruta, P., Marada, M., & Quodomine, R. (2012). Sto lat doświadczeń portów lotniczych w przestrzeni Europy. *Instytut Geografii i Gospodarki przestrzennej, Prace Geograficzne, Karaków 2012, zeszyt* (131), 35-53.

Tłoczyński, D. (2017). Obszary konkurencji w segmencie portów lotniczych. Porty lotnicze w Poznaniu i we Wrocławiu. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu,* (487), 318-330.