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COMMUNICATION INFRASTRUCTURE AND FOREIGN DIRECT INVESTMENTS INFLOW INTO THE REGION

Abstract: The goal of this study is to specify correlation between enrichment of communication infrastructure of individual voivodeships and foreign direct investment inflow. In the first part of this article direct investments were characterized and communication infrastructure was shown as a factor of FDI location. In the second part of this article, on the basis of statistical data, a correlation between the level of communication infrastructure development and foreign direct investment inflow in individual voivodeships in years 2011-2015 was examined.

Key words: foreign direct investments, communication infrastructure.

INTRODUCTION

Extension and modernization of individual elements of communication infrastructure is one of the means to increase the attractiveness of a country (region) not only to domestic investors but also to foreign entities. It is very important due to the fact, that inflow of foreign financial resources and capital goods has become a central driver of many modern economies. Generally, one can distinguish two types of foreign investments, indirect (they are characterized by acquisition of securities of a participating nature and foreign debt issuers) and direct.

It seems, that foreign direct investments (FDI) are of significant matter for the development of a host country and operating there entities. They constitute nowadays a crucial sphere of conducting business entities and they are often a proof of a market maturity of business entities.

The aim of this paper is to define relations between enrichment of communication infrastructure of individual voivodeships and foreign direct investments inflow. A need for this type of research is based on the assumption, that poor infrastructure constitutes a crucial barrier in FDI inflow. Information about local attractiveness of FDI (determined, inter alia, by infrastructural investment), can be used to create strategies of FDI acquirement.

The analysis included all 16 voivodeships in Poland. A synthetic indicator of communication infrastructure level was made for this research and a correlation analysis was conducted. The main criterion of variables selection was their completeness and their availability for all entities analyzed in years 2011-2015. The main source of data describing individual elements of infrastructure and volume of FDI in individual voivodeships was Local Data Bank (LDB) of the Central Statistical Office.

FOREIGN DIRECT INVESTMENTS

In the literature direct foreign investments do not have one commonly acceptable definition. The most often citied definitions of direct foreign investments, which are often regarded as model definitions are the definitions provided by the International Monetary Fund (IMF) and the Organization for Economic Cooperation and Development (OECD). According to the IMF definition, direct foreign investments are a category of international investments, which are made to create a lasting impact on performance of foreign business entity [*Balance of Payments Manual* 1993, p. 86]. According to the OECD guidelines [*OECD Benchmark Definition of Foreign Direct Investment* … 1996, p. 7-8] FDI shall mean investments made by resident of one economy ("direct investor") in order to obtain a lasting interest in an enterprise resident in an economy other than that

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of the investor (“ direct investment enterprise”). Lasting interest implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and a significant degree of influence by the investor on the management of the enterprise. A valued threshold which allows to gain the alleged influence is to have at least 10% of ordinary shares or entitlement to the 10% voting rights.

W. Karaszewski defines direct investments as "capital investments made outside the investor’s residence country to establish there a business entity from the very beginning or acquisition of property rights from existing business entity in the degree which allows a direct participation in the management” [Karaszewski 2004, p. 19]. I. Michałków describes FDI as a form of an abroad long-term capital investment, which involves establishing a new business from the very beginning or buying out such shares, which could enable to control it [Michałków 2003, p. 48]. In the theory of economics the first type of investment is defined as *greenfield investment* and buying out the whole of a business or part of it in a degree which allows to control it is called *brownfield investment*.

Both natural and legal persons can be the investors to undertake a business entity according to the FDI in the host country. Not only big entrepreneurships (trade corporations) can be foreign direct investors in the business practice, but also smaller entities which want to improve results for the business (e.g. by lowering the manufacturing costs). Foreign direct investments can inflow to the host country in different forms. For the economy of the host country key are aforementioned *greenfield investments*. This FDI form is based on building a branch or a department abroad from the very beginning. Such measures are usually chosen by the biggest corporations with well-known brand and which are operating globally or at least regionally, because of the high costs of entering and gaining the position on market. Those entities are well prepared in terms of people and technology to operate in turbulent environment, and they are adapting their strategies to changing conditions of the environment, that their establishments are working in [Ancyparowicz 2009, p. 13]. What matters, such investments are generating a multiplier effect, which is revealed by thousands of small orders for the domestic businesses. In result they contribute to the creation of new workplaces, increase of remuneration and employees expenses and improving the occupational qualifications [Michałków 2003, p. 49-50].

Table 1. The number of business in Poland with foreign capital

Specification in years	2011	2012	2013	2014	2015
The number of entities with foreign capital	24910	25914	26128	26464	25961
The number of newly born entities	1536	1 712	1489	1369	534
Greenfields	1239	1397	1214	1104	384
The inflow of FDI (millions of PLN)	47184	40458	11459	45011	50784

Source: Self-study based on the data from the Central Statistical Office and the National Bank of Poland

In the analyzed period, the biggest percentage growth in the number of businesses with foreign capital was made in the Podkarpackie voivodeship – the growth was 36,69% (the number of businesses with foreign capital grew from 387 in 2011 year to 529 in 2015 year) and in Lubelskie voivodeship – the growth was 48% (the number of businesses with foreign capital grew from 353 in 2011 year to 460 in 2015 year). The biggest number of newly born businesses was noticed in Mazowieckie voivodeship (approx. 445) Wand Śląskie voivodeship (approx. 97). The greatest annual average investments costs of the businesses with foreign capital were noted in Mazowieckie voivodeship (PLN 37,43 billion) and Wielkopolskie voivodeship (PLN 8,86 billion). In the analyzed period the lowest number of businesses with foreign capital was noticed in Świętokrzyskie voivodeship (annual average was 4) and Warmimńsko-Mazurskie voivodeship (approx. 8). On annual average, the biggest number of direct investment businesses were established in the trade

industry, in the maintenance of motor vehicles industry (386) and in the manufacturing industry (191).[8]

Table 2. The businesses with foreign capital for each voivodeship in years 2011-2015

Voivodeship	The average number of businesses with foreign capital	The annual average investments costs of the businesses with foreign capital (expressed in million PLN)	The average number of newly born businesses with foreign capital
łódzkie	1055	2751	36
mazowieckie	9975	37426	445
małopolskie	1675	3202	88
śląskie	2368	7244	97
lubelskie	409	841	22
podkarpackie	460	2363	34
podlaskie	180	496	16
świętokrzyskie	182	998	4
lubuskie	736	909	23
wielkopolskie	2290	8857	80
zachodniopomorskie	1444	2100	52
dolnośląskie	2345	5462	82
opolskie	477	905	15
kujawsko-pomorskie	579	1249	16
pomorskie	1398	3098	49
warmińsko-mazurskie	302	372	8
Poland	25875	231894	1068

Source: Based on self-study

This may lead to the question, what are motives of businesses which are making FDI on the territory of our country. The businesses are interested in investing their capital in another country, only if it means bigger profits than having an entrepreneurship in the host country. The tendency to investment depends proportionally on the size of the achieved benefits from the capital invested in different countries. Therefore, there is a connection between location of the business and manufacturing costs, the choice of foreign investment is vital from the business's perspective [Lizińska i in. 2011, p. 192]. According to the A.Golejewska the factors, that are encouraging a given business to make FDI in a given country, could be [Golejewska 2008a, p. 21] a desire: to lower the manufacturing costs, to gain or to expand a sales market and to create better economic and social impacts of the host country. To the locational advantages of the host country, which enable businesses on foreign markets to achieve economy of scale or price advantage, we can include [Golejewska 2008b, p. 177]: spatial structure of distribution of factors in manufacturing and in sale market, quality and efficiency of productive resources and pricing of the product, transport and communication costs, the scope and nature of the state intervention, investment climate, the condition of economic, transport and institutional, etc. infrastructure, psychological distance (inter alia cultural barriers), economies of scale in the scope of research and development and in the manufacturing scope. In the literature we can find varied classifications of factors which stimulate

[8] Own calculations based on the data from the Local Data Bank (LDB) of the Central Statistical Office.

inflow of FDI. K. Przybylska highlights determinants, which result from motives of making FDI and determinants, which result from investment climate of the host country. She includes to the first group market determinants (i.a. market capacity), cost determinants (i.a. access to natural resources and to research facilities), efficiency determinants (i.a. possibility to cooperate with local entities). To the second group the author includes conditions of functioning of foreign businesses (i.a. regulations), improvements in running of the business (i.a. providing transport and telecommunication infrastructure for a given region) and the investment risk level [Przybylska 2001, p. 100]. In the report of United Nations Conference on Trade and Development (UNCTAD) four key groups of economic factors were distinguished, which decide about attractiveness of a given economy towards direct foreign investors, namely [*World Investment Report* …2012, p. 30]: attractiveness of the market (i.a. size of the market, purchasing power), availability of cheap labor (i.a. unit labor costs), natural resources (i.a. resources exploitation) and accessibility of infrastructure (i.a. transport infrastructure, telecommunication infrastructure).

While analyzing factors that enable inflow of FDI, one can assume without any reservations, that investors during their decisions about localization of FDI are guided with internal factors (characteristic for given entity) and submit to individual evaluation in relation with scale of the business run, branch and the specific nature of the host country. P. Siemiątkowski notes, that at the initial phase of the process of classification of the factors determining FDI one can distinguish two groups. The first one includes factors, which decide about making a decision to invest directly abroad, and the second one includes factors, which specify ongoing business of the foreign investors [Siemiątkowski 2005, p. 332].

Many studies which analyze conditions of inflow of FDI, recognize communication infrastructure as a basic determinant of making such investments. It is often argued that well developed communication infrastructure has an impact on lowering transaction costs, increasing effectiveness of private investments, enables expanding of sales market, gives an easy access to customers and suppliers. The meaning of infrastructure as a factor, which stimulates the inflow of FDI, was confirmed by research conducted in many countries. From the Ernst&Young report [*Restart Ernst & Young's 2011 European attractiveness survey* 2011, p. 39] it results, that according to the global business leaders, well developed communication infrastructure has greater meaning than i.a. facilitating access to funding, harmonization of taxation, relieves to the labor law and cutting red tape with regard when deciding in making FDI in Europe. The analysis is similar for Cushman&Wakefield report [*European Cities Monitor 2010* 2010, p. 6], that shows the result of research conducted in year 2010 among 500 European entrepreneurships, from which it was clear that, the quality of telecommunication infrastructure and domestic and international transport connections are key factors, that decide about inflow of investors to the biggest European cities. According to the opinion of respectively 55% and 51% entities, those factors were considered to be the most crucial while making location decision. F.R. Root and A.A. Ahmed were the first ones to show the positive impact of communication infrastructure on the level of FDI [Root, Ahmed 1979, p. 751-767]. Later many researchers verified and confirmed the result of their study. L.K. Cheng and Y.K. Kwan while analyzing location of the FDI in 29 Chinese regions in years 1985-1995 proved, that good infrastructural accessories, measured as the density of all types of roads, improve the inflow of FDI [Cheng, Kwan 2000, p. 379-400]. In year 2001 N. Kumar analyzed in detail the role of infrastructural availability in creation of attractiveness of countries for the inflow of direct foreign investments. While applying a composite indicator of availability of transport, telecommunication, informational and energy infrastructure, calculated for 66 countries showed, that the infrastructure plays a crucial role in stimulating of direct foreign investments. As the author claims, the obtained results suggest, that the development of infrastructure should be an integral part of FDI attraction strategy [Kumar 2001, p. 3-29]. The scale of problem of communication infrastructure in Poland, in the context of inflow of foreign investments, is noticed i.a. in the report

of World Economic Forum (Schwab 2010), concerning competitiveness of given countries. It results from this report, that the qualitative and quantitative infrastructural gap that is in Poland is significantly lowering the attractiveness for foreign investors. Due to its level of infrastructure development (72 in ranking) Poland is beaten in the ranking by: Puerto Rico (49), Barbados (23) or Namibia (54). One of the keys of the competitive disadvantage in Poland's position in this ranking is low quality of road, port and aviation infrastructure.

CORRELATIONS BETWEEN COMMUNICATION INFRASTRUCTURE AND FDI

In the analysis below are included indicative variables, without strict variables, what allowed, to certain extant, to avoid distortions arising from specific features claimed by some of the voivodeships (e.g. much bigger area or the number of inhabitants in comparison with the rest of voivodeships). As a result of variables analysis addressing form and content, 12 sub-indices referring to the enrichment of regions in communicative infrastructure were suggested. The output set of variables were divided into 5 groups according to content criteria:1.1.Road transport infrastructure: K_{11} – an indicator of public roads density; K_{12} – an indicator of public hard-surfaced roads density; K_{13} – an indicator of public hard-surfaced improved roads; K_{14} – an indicator of motorways density; K_{15} – an indicator of expressways density; 1.2. infrastructure of railroad transport: K_{21} – an indicator of railway lines in operation density; K_{22} - an indicator of electrified railway lines density; K_{23} – an indicator of double- and multiple-track railway lines density; 1.3. aviation transport infrastructure: K31 – public and non-public airports for 100km^2; K_{32} – an indicator of air mobility; 1.4. postal infrastructure: K_{41} – an indicator of postal network density; 1.5. telecommunication infrastructure: K_{51} – main telephone lines for 1000 inhabitants.

Table 3. SM values of communication infrastructure in individual voivodeships

Voivodeship	SM of communication infrastructure					An average investment in years 2011-2015
	2011	2012	2013	2014	2015	
łódzkie	0,2848	0,3355	0,3414	0,3835	0,3817	4,4
mazowieckie	0,3984	0,4171	0,4168	0,4215	0,4234	3,0
małopolskie	0,4513	0,4690	0,4619	0,4819	0,4885	2,0
śląskie	0,5988	0,6037	0,6084	0,6085	0,6125	1,0
lubelskie	0,1575	0,1524	0,1584	0,1740	0,1825	14,0
podkarpackie	0,1967	0,2020	0,2132	0,2281	0,2318	12,4
podlaskie	0,1177	0,1094	0,1490	0,1174	0,1239	16,0
świętokrzyskie	0,2414	0,2477	0,2421	0,2460	0,2506	9,8
lubuskie	0,2237	0,2211	0,2709	0,2806	0,2828	9,0
wielkopolskie	0,2591	0,2611	0,2697	0,2737	0,2823	8,6
zachodniopomorskie	0,1992	0,2029	0,1953	0,1738	0,1809	13,0
dolnośląskie	0,3114	0,3101	0,3081	0,3073	0,3081	4,8
opolskie	0,2950	0,2889	0,2861	0,2962	0,3056	5,8
kujawsko-pomorskie	0,2665	0,2724	0,2765	0,2909	0,2961	7,0
pomorskie	0,2171	0,2298	0,2380	0,2384	0,2527	10,6
warmińsko-mazurskie	0,1251	0,1892	0,1825	0,1576	0,1571	14,6

Source: Self-study based on the data from the Local Data Bank (LDB)

In analyses in spatial layout it is often necessary to compare multi-characteristic objects and their arrangement. In order to quantify the level of development of transport and institution infrastructure in given voivodeships a TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method was used. Application of synthetic measure (SM) is explained by the fact,

that it replaces the description of entities examined thanks to many features (in this case variables describing equipment of voivodeships in given infrastructure elements), with a description by means of one aggregate value, what make analysis of examined entities similarities and prioritization much easier (we have defined point of reference – unlike non-model methods). The table below shows the values of SM of communication infrastructure.

While analyzing the date from the table above, one can realize, that the communication infrastructure level in Poland is diversified. Śląskie voivodeship is characterized by the tightest infrastructure SM, what results from relatively high values of given diagnostic variables in every subsystem of communication infrastructure (high number of large urban areas, which are characterized by good infrastructural facilities). A surprisingly low position of Wielkopolskie voivodeship can be noted, it may result from the fact, that the infrastructure in and around Poznań is well developed and poorer infrastructural facilities in the remaining areas of the voivodeship. The lowest SM values in the analyzed period were noted in both Podlaskie and Warmińsko-Mazurskie voivodeships where one of the lowest (for the whole country) FDI characteristics were noted. In the table 4 are shown values via values of the correlation coefficient between infrastructure SM and the number of newly born businesses with foreign capital, the general number of businesses with foreign capital, investment expenses of businesses with foreign capital and foreign capital per capita in years 2011-2015. In order to reduce a negative impact of possible outlined values on the result of correlation analysis the Spearman nonparametric coefficient of rank correlation was used.

Table 4. The Spearman coefficient of rank correlation between communication infrastructure SM and FDI in individual voivodeships in years 2011-2015

Specification in years	2011	2012	2013	2014	2015
Newly born businesses with foreign capital per capita	0,4235	0,4824	0,4471	0,4853	0,1971
The number of businesses with foreign capital per capita	0,5147*	0,4441	0,4735	0,4412	0,4676
Investment expenses of businesses with foreign capital per capita	0,6029*	0,4588	0,5529*	0,5441*	0,5471*
Foreign capital per capita	0,7353*	0,7382*	0,6059*	0,5029*	0,5000*

* The values are statistically significant if $p < 0.05$

Source: Based on self-study

From the table above we can see, that in the analyzed period the infrastructure SM is the most closely correlated (positively) with foreign capital per capita and with investment expenses of businesses with foreign capital per capita. Throughout the period under discussion we can only speak about average dependence of significance $p<0.05$ between the number of newly born businesses with foreign capital and the general number of businesses with foreign capital per capita. It is mostly provided by the fact of absorption of the absorption of the considerable part of FDI by Mazowieckie voivodeship (mostly the city of Warszawa), Wielkopolskie voivodeship, Śląskie voivodeship and Dolnośląskie voivodeship. In year 2011 65,36% of all businesses with foreign capital were located in those four voivodeships, and in 2015 year the percentage was equal to 65,48% . In result the large urban areas are enjoying the most interest of investors, because those areas have well developed, complex communication infrastructure, and because of the large urban areas smaller areas are often not taken into consideration while making decisions about business location. In the table 5 coefficient of rank correlation between coefficients of given communication infrastructure assets and indicators of investment units of companies with foreign capital and the size of foreign capital per capita.

Table 5. Coefficients of rank correlation between unit investments, size of foreign capital and selected components of the communication infrastructure in individual voivodeships

	Indicator of investment unit per capita					The size of foreign capital per capita				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
K11	0,2618	0,1176	0,2206	0,2000	0,0912	0,3206	0,3206	0,2588	0,1676	0,1853
K12	0,4742	0,4412	0,4176	0,4235	0,3029	0,5596*	0,5618*	0,5265*	0,4235	0,4206
K13	0,4912	0,4824	0,4206	0,4783	0,3441	0,5441*	0,5588*	0,5735*	0,4798	0,4912
K14	0,2089	0,1382	0,4882	0,2294	0,3324	0,4385	0,3647	0,1147	0,1235	0,1824
K15	0,4469	0,3599	0,4030	0,5141*	0,5096*	0,4817	0,5634*	0,4415	0,4030	0,3970
K21	0,3412	0,2294	0,3824	0,3853	0,3882	0,4765	0,4559	0,4824	0,4176	0,3912
K22	0,5765*	0,4176	0,5824*	0,5294*	0,4265	0,7118*	0,7118*	0,6235*	0,5971*	0,5912*
K23	0,5147*	0,4000	0,5618*	0,4706	0,4441	0,5794*	0,5794*	0,4941	0,4471	0,4647
K31	-0,1618	-0,0618	-0,2353	-0,0706	0,1206	-0,0882	-0,0882	0,0206	-0,0529	-0,0559
K32	0,7434*	0,6889*	0,6652*	0,8074*	0,5529*	0,6853*	0,7497*	0,8134*	0,7719*	0,7659*
K41	0,5912*	0,6206*	0,6029*	0,7412*	0,6824*	0,6824*	0,6824*	0,7353*	0,6529*	0,6324*
K51	0,6971*	0,4706	0,5824*	0,6676*	0,7185*	0,7822*	0,7294*	0,5500*	0,6559*	0,6265*

* The values are statistically significant if $p < 0.05$

Source: Based on self-study

As shown in table 5, there is generally a positive correlation link between the size of investment units and infrastructure facilities (without K_{31} variable). Although it is necessary to highlight, that only for variables K_{32}, K_{41} and K_{51} was noted at least four times a presence of statistically significant correlation link with the degree of significance $p<0,05$ in the analyzed period. For the variables which are reflecting the density of voivodeships in road and rail transport infrastructure, a presence of positive, but usually statistically irrelevant correlation link. In the analyzed period much bigger annual average values were noted while taking in consideration the size of foreign capital per capita (without K_{14}). The only negative correlation link was noted between the symptoms of FDI inflow and infrastructure facilities of regions for the variable K_{31}, which reflects the density of voivodeships in airports (probably due to the fact that the policy of expanding airport network is highly selective).

Table 6. The correlation indicators between the number of businesses with foreign capital and the number of newly born businesses with foreign capital, and communication infrastructure in given voivodeships

	The number of businesses with foreign capital per capita					The number of newly born businesses with foreign capital per capita				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
K11	-0,1235	-0,1471	-0,1059	-0,0735	-0,0647	-0,1029	0,0206	0,0382	0,0735	0,1294
K12	0,0766	0,0176	0,0500	0,0382	0,0559	0,0457	0,2294	0,1647	0,2059	0,0941
K13	0,0765	0,0206	0,0500	0,0559	0,0824	0,0559	0,2618	0,2059	0,2575	0,1588
K14	0,3956	0,3176	0,3618	0,3412	0,3206	0,2430	0,0588	0,2382	0,1794	0,0765
K15	0,5360*	0,5398*	0,4148	0,4178	0,4208	0,4741	0,4690	0,3733	0,4000	0,1096
K21	0,3706	0,3235	0,3500	0,3647	0,3471	0,2618	0,2294	0,2765	0,2441	-0,1000
K22	0,3765	0,3294	0,3382	0,3382	0,3529	0,2500	0,3882	0,3588	0,2912	0,1029
K23	0,3794	0,3265	0,3206	0,3265	0,3382	0,2441	0,2441	0,2147	0,1882	-0,1176
K31	-0,1088	-0,1118	-0,0706	-0,0824	-0,0853	-0,0441	-0,0529	-0,0324	0,2324	0,1059
K32	0,6389*	0,6089*	0,6593*	0,6696*	0,6874*	0,6478*	0,7985*	0,8208*	0,7422*	0,5793*
K41	0,3000	0,2735	0,3647	0,4118	0,4500	0,2500	0,5000*	0,5353*	0,5059*	0,2471
K51	0,8088*	0,8206*	0,7765*	0,8324*	0,8029*	0,9029*	0,8441*	0,8500*	0,7853*	0,5618*

* The values are statistically significant if $p < 0.05$

Source: Based on self-study

From the analysis undertaken one can see, that for the majority of the elements of communication infrastructure considered, there is, at the very most, an average correlation link between general number of businesses with foreign capital and the number of newly born businesses with foreign capital in individual voivodeships and the infrastructure facilities of regions. Positive, high, and, what is important, relevant statistical correlation links were identified exclusively for variables K_{32} and K_{51}. It seems, that single infrastructural elements have no bigger meaning for the location of entities with foreign capital in the region, but what matters is complex development of communication infrastructure

CONCLUSION

The positive effect of FDI on economy of the host country causes, that measures aimed at inflow stimulation are having much bigger meaning. Crucial are effective actions undertaken by the state and local governments which target at improving investment climate, including in terms of expanding and modernization of infrastructure (social and economic (including communication)). In this article synthetic meters of communication infrastructure development were determined on the basis of TOPSIS method, which were used to order voivodeships given the level of the phenomena analyzed. Next, the relation between the level of communicative infrastructure development and inflow of foreign direct investments in given voivodeships was examined by using Spearman coefficient of rank correlation. From the analysis conducted it results, that there is an average statistical relation between the level of communication infrastructure development and general number of businesses with foreign capital and the number of newly born entities of such type. It can result from, i.a. impact of infrastructural investments which are delayed in time on the size of financial resources coming from abroad or location requirements other than infrastructural (i.a. the quality of labor, labor costs, tax) of particular foreign investors. Because of the range of functions performed by particular elements of communication infrastructure one can assume, that it is a factor, that is necessary, but insufficient to raise the level of foreign direct investments in the region.

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