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## Local Determinants of Foreign Direct Investment in Poland

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**Local Determinants of Foreign Direct Investment in  
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## Local Determinants of Foreign Direct Investment in Poland

**JEL Classification:** *F23, F23, R12.*

**Keywords:** *foreign direct investments (FDIs), location determinants, regional and spatial distribution of FDI, LAU 1, Poland.*

### Abstract

**Research background:** The internationalisation of economies, which foreign direct investments significantly contribute to, affects the growth of regional and local economies. Their choice of location is the topic of frequent debates among scholars, politicians and regional/local authorities.

**Purpose of the article:** Given the scarcity of empirical evidence on the locational determinants of foreign direct investments at the local level of analysis (LAU 1) in Poland, and the time that has passed since similar analyses were run on a regional scale, we conduct a study investigating the locational determinants of FDIs in Poland between 2011 and 2015.

**Methodology/methods:** We use a unique dataset comprising data available in public statistics and information gathered from computations run using GIS software indicating the average distances of districts to selected points of interest (such as the border, motorway/express road, airport, railway line, special economic zone, etc.). The utilisation of GIS-based data is a significant improvement to the past research, which tended to use dummy variables in this regard. To identify the key locational determinants, we run a series of negative binomial regressions, due to the count character of the dependent variable.

**Findings:** The results prove that a significant part of the spatial distribution of FDIs in Poland can be attributed to factors originating from New Economic Geography, whereas the rest stems from the heterogeneity of local areas. The lower and more detailed scale of the analysis brings to light new facts on the choice of location as compared to previous studies, especially regarding the role of SEZs or proximity to agglomerations.

## Introduction

The increased internationalisation of individual countries' economies has a significant impact on the development of cities and regions of these economies, especially the processes of locating and concentrating economic activity taking place in their area. According to Cieřlik (2005a), international businesses are playing an increasingly greater role in these processes. By their presence in many countries and easy access to global markets as well as global knowledge resources, they are viewed as stimulants of changes taking place in countries which host foreign investors.

In Polish literature, the analysis of the location of FDIs was most often carried out at relatively high data aggregation on - the national economy (Aleksandruk & Forte, 2016; Torrissi, Delaunay, Kocia, & Lubieniecka, 2009; Walkenhorst & Peter, 2001; Wojciechowski, 2013) or provinces (NUTS 2) (Ablov, 2015; Chidlow, Salciuviene, & Young, 2009; Cieřlik, 2005a, 2005c, 2005b, 2013; Cieřlik & Ryan, 2005; Domański, 2001). However, the high internal diversification of Polish regions (Bogdański, 2012; Nazarczuk, 2015), as well as the suggestions of new economic geography along with the experiences of a new, new trade theory, indicate the need for more detailed analyses in this scope, covering analyses on less aggregated units.

Therefore, the aim of the article is the identification of locational determinants of business entities with foreign capital share in Polish districts (*powiat*). Using data taken from the Central Statistical Office (GUS), information obtained from calculations on maps as well as negative binomial regression, the most important determinants of the location of companies with foreign capital were identified, referring to the structural characteristics of the districts as well as localization factors resulting from the teachings of new economic geography.

## Research Methodology

Compared to earlier studies on the determinants of FDIs in Poland (Cieřlik, 2005a, 2005c, 2005b, 2007; Cieřlik & Ryan, 2005), we carry out the analysis on the lower level of aggregation, i.e. districts (LAU 1), falling more in line with the teachings of new economic geography and the concept of heterogeneity. In addition to the structural features of districts, we also account for their average distances (communes in individual districts) from select points in space (first and second nature factors), including national borders. We do not use dummy variables for this purpose as was the case in previous studies, but introduce continuous variables, thanks to

which we are better able to show the border effect or account for the potential impact zone of select places.

The work uses data obtained from the local data bank for districts on the location of companies with foreign capital share in Poland and select structural characteristics of local economies. The remaining data covering the average distances of communes in individual districts from select places in space (in accordance with the teachings of new economic geography), i.e. the border, airport, express road/motorway, national road, railway line, SEZ, and province capital, were obtained using the Quantum GIS program and expressed in km.

The most frequently used approach to the empirical study of the choice of location by companies with foreign capital in literature on the subject is the logistic regression model (McFadden, 1974). An alternative approach is based on econometric models based on count data, which do not assume constant values. Two of the most popular approaches to estimating the above dependencies are Poisson regression and negative binomial regression (Cieślík, 2005c, 2013; Cieślík & Ryan, 2005). Thus, a similar approach to the analysis of the determinants of FDI location in Poland was applied in the present work.

The general form of Poisson models being the subject of estimation was expressed by the following formula:

$$Pr(y_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!}, y_i=0,1,2,\dots \quad (1)$$

where: parameter  $\lambda_i$  signifies the expected value of the number of companies with foreign capital in the  $i^{\text{th}}$  district. Independent variables describing the local characteristics of districts were also introduced to the model, described by the formula:

$$\ln \lambda_i = \beta' x_i \quad (2)$$

In which the vector of parameters estimated over the course of modeling, found near independent variables, was marked by  $\beta$ .

However, due to the frequently occurring case of excessive dispersion in the case of analysing count data, i.e. when variation is higher than the average value, negative binomial regression is a better choice, while in the case of variation and average value being equal – Poisson regression is more appropriate (Cieślík, 2007). Since we are dealing with the first case, the work presents the results of estimations using negative binomial regression, carried out using the Stata 14.2 application. This choice was confirmed by the results of the likelihood ratio test, which unanimously preferred the

negative binomial model to the Poisson's, further confirmed by the significance of the  $\alpha$  parameter (table 2). Moreover, in order for it to become possible to compare the quality of the assessed models between individual specifications, we use two information criteria – AIC (Akaike Information Criterion) as well as BIC (Bayesian Information Criterion).

### Estimation results of local determinants of foreign direct investment in Poland

Table 3 contains the results of estimations regarding the expected number of FDIs in the Polish districts in the years 2011-2015 using negative binomial regression according to different specifications. In Column 1, Table 2, only variables related to geographical features were used, indicating the distance from selected points in space as well as the border. Among all of the above-mentioned factors – mainly second nature factors, in accordance with the teachings of new economic geography, the proximity of the location in relation to the province capital, special economic zone, airport, port or national border is of key importance. The nearness of a border and province capital ensure high accessibility to national and foreign markets and, especially in the case of the later, facilitate access to well-educated labour resources. They also point to the importance of perceiving the importance of an agglomeration by foreign investors.

SEZs, by means of tax breaks, make it possible to, above all, gain a cost advantage and increased productivity as compared to entities outside of the zone. They are also, more and more frequently, an integrative element attracting FDIs, increasing the chances of a FDI being located in the given area when accompanied by other favourable conditions (the fulfilment of other location criteria). The short distance from an airport and port indicate the significance of good transport infrastructure. The two variables describing the proximity of road infrastructure were not significant in the logarithmic specification of the model, both the distance to: (1) a national road, and (2) an express road or motorway were not statistically significant.

**Table 2.** Results of estimates of local FDI determinants in Poland

Variables	(1)	(2)	(3)	(4)	(5)
dist_reg_cap	-0.530*** (0.117)	-0.528*** (0.118)	-0.191*** (0.0484)	-0.213*** (0.0494)	-0.158*** (0.0465)
dist_SEZ	-0.453*** (0.0854)	-0.451*** (0.0868)	-0.230*** (0.0605)	-0.171*** (0.0527)	-0.171*** (0.0540)
dist_mway	0.0580 (0.0732)	0.0996 (0.0728)	-0.0402 (0.0348)	0.0124 (0.0318)	0.00623 (0.0310)
dist_nroad	-0.0665	-0.131	-0.0824	-0.0885*	-0.0905*

	(0.104)	(0.109)	(0.0579)	(0.0498)	(0.0514)
dist_railway	-0.159	-0.0875	-0.205***	0.0235	0.0148
	(0.102)	(0.0985)	(0.0589)	(0.0566)	(0.0542)
dist_airport	-0.554***	-0.628***	-0.154**	-0.0578	-0.134**
	(0.123)	(0.143)	(0.0603)	(0.0597)	(0.0632)
dist_port	-0.219***	-0.0798	-0.0473	0.0417	0.0577
	(0.0772)	(0.125)	(0.0510)	(0.0472)	(0.0820)
dist_border	-0.158***		-0.146***	-0.0944***	
	(0.0603)		(0.0365)	(0.0338)	
comp10k			2.604***	1.500***	1.239***
			(0.200)	(0.227)	(0.247)
remun			0.747**	0.288	0.309
			(0.346)	(0.344)	(0.365)
unemp_rate			-0.300***	-0.464***	-0.489***
			(0.0878)	(0.0930)	(0.0915)
roads			0.645***	0.800***	0.813***
			(0.0639)	(0.0642)	(0.0646)
industry_sh				0.0279***	0.0281***
				(0.00356)	(0.00391)
services_sh				0.0385***	0.0415***
				(0.00462)	(0.00444)
higher_educ					1.920**
					(0.929)
dist_pl_de		-0.362***			-0.218***
		(0.0949)			(0.0660)
dist_pl_cz		0.0319			0.0663
		(0.108)			(0.0560)
dist_pl_sk		-0.0727			-0.0843
		(0.113)			(0.0722)
dist_pl_ru		0.133			-0.101
		(0.143)			(0.130)
dist_pl_by		0.278			0.117
		(0.170)			(0.149)
dist_pl_ua		-0.151			-0.255**
		(0.128)			(0.103)
dist_pl_lt		-0.198			0.148
		(0.246)			(0.224)
Constant	10.73***	11.35***	-21.10***	-15.32***	-13.15***
	(0.727)	(2.227)	(3.078)	(3.078)	(3.736)
Observations	1,890	1,890	1,890	1,890	1,890
Year FE	NO	NO	YES	YES	YES
Year FE (p-val)			0.000	0.000	0.000
No. of clusters	378	378	378	378	378
Pseudo R2	0.129	0.140	0.218	0.242	0.250
LogPseudoLik	-8185	-8086	-7350	-7130	-7052
LR	163.8	338.2	954.9	1438	1627
LR( p-val)	0.000	0.000	0.000	0.000	0.000

Alfa	0.781	0.713	0.308	0.235	0.215
Alfa (p-val)	0.000	0.000	0.000	0.000	0.000
AIC	16391	16204	14736	14299	14157
BIC	16446	16292	14836	14410	14307

Source: own compilation.

Information: The individual Year Fixed Effect is not presented due to limited space. The joint significance of the aggregate time effects is embraced in Year FE (p-val). Clustered standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Despite the fact that the relative nearness to the border was an important factor encouraging the location of FDIs, the actual effect of the proximity of the border was heterogeneous (Column 2) in Table 2, and depended on the geographical direction or country bordering Poland. Only in the case of Germany did the location near the border work to the advantage of locating companies with foreign capital. The remaining geographic directions were characterized by insignificant estimates. The obtained result shows one of the key locational determinants to be the proximity of markets and focus of companies with foreign capital on export-oriented activity, which determines their location decisions in the context of future directions of sales.

In Column 3, Table 2, selected features of individual districts, i.e.: the level of agglomeration of businesses, remuneration, unemployment rate, and quality of road infrastructure measured by the length of roads with a hard surface are added to the factors of economic geography (from Column 1). All of these location criteria in this specification of the model were statistically significant, indicating the role of both the agglomeration of businesses and situation on the job market, as well as the road infrastructure. Interestingly, higher remunerations were not a deterring factor for FDIs and, on the contrary, attracted them.

Other factors which are significant as far as the location of FDIs is concerned, and falling into the diversification of districts, were those connected with the structure of the local economy (Column 4 in Table 2). Companies with a share of foreign capital locate themselves in areas with a higher share of the second and third sector in the employment structure. Moreover, in this model, the variable describing the nearness to national roads became statistically important.

In specification 5 of the model, in Table 2, we include the measure of the quality of human capital and the distance from individual borders. Results obtained in such a way, found in the last column, are characterized by the lowest AIC and BIC criterion and highest pseudo R<sup>2</sup> of all those presented in Table 2. Their analysis confirms the role of the agglomeration, proximity to SEZs, nearness of transport infrastructure (national road, airport), and also the border (especially with Germany and additionally - Ukraine). Among the features of districts, important localization factors



besides the agglomeration of businesses, good access to people with a higher education, and a good situation on the labour market was also the economic structure of the district.

The specification of the model with the dependent variable delayed by one period was also additionally tested. However, despite the desirable sign, it was characterized by the lack of statistical significance, thus was not included in Table 2.

## **Conclusions**

The main aim of the study was the assessment of location determinants of foreign direct investments in the districts of Poland using negative binomial regression. The obtained results indicate the role of both geographic factors, associated with the proximity of location in regard to selected points in the economic space, as well as certain structural features. Generally speaking, FDI's were more frequently located in districts with a higher level of development (also infrastructure), located closer to large urban centres, characterized by a relatively good situation on the job market, and with wide access to people with a higher education. Therefore, the location of FDI's by the selection of places with a relatively high level of development leads rather to the strengthening of existing regional/local differences than overcoming them.

One ought to keep in mind that the carried out analyses pertained to general FDI determinants, without distinguishing their sectoral structure, due to the lack of accessibility to such data. In actuality, the obtained estimates for companies in individual sectors could indicate the various significance of individual factors, due to the dissimilar preferences stemming from the specification of the business activity carried out.

As compared to previous studies carried out on a higher level of data aggregation (Cieřlik, 2005a, 2005c, 2005b, 2007; Cieřlik & Ryan, 2005) (16 NUTS 2 provinces and 49 old provinces), as well as a varied period of time (the 90s and middle of the 2000s), thanks to increasing the precision of data as well as introducing variables of a continuous nature instead of dummy variables, we positively assess: (1) the proximity of SEZs as a location factor, and (2) the distance from the province capital, as a potential growth pole initiating agglomeration processes in space. It is, however, difficult to state whether SEZs alone can be a factor attracting FDI's and overcoming at least some of the observed local development barriers, or if they are rather treated as a kind of starting package for discussions regarding the future location of a company.

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