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Determinants of the spatial distribution of exporters in regions: the role of ownership

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Abstract

Spatial distribution of exporters only recently has attracted the attention of researchers, while the location of economic activity as such has been subject of profound analysis for a long time. Regions have become more open and thus vulnerable to external shocks. Nevertheless, the increase in the number of exporters in the population of firms is one of the top priorities of regions' economic policy agenda, as it improves competitiveness and overall productivity. Literature overview shows an important gap, which is insufficient consideration of the role of ownership, as regards the determinants of the spatial distribution of exporters. The study identifies the differences between the determinants of spatial location of foreign-owned exporters (FOEs) and domestic-owned exporters (DOEs), in particular the role of metropolis, the proximity to infrastructure and the consequences of historical factors and thus the path dependency. The FOEs and DOEs differ in their location preferences. In particular, our results indicate that FOEs pay more attention to proximity to infrastructure and are more susceptible to the presence of agglomeration externalities in the vicinity of metropolitan areas. In addition, historical factors affect the spatial distribution of exporters, especially if the interaction of path dependency and infrastructure endowment is introduced.

JEL Classification R12 · F14 · R15 · C21

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1 Introduction

The location of the economic activity has been subject to numerous theoretical and empirical analyses; however, the inquiry into the spatial distribution of exporters is a relatively new thread. The growing openness made the knowledge on the nature of the nexus between regional and foreign markets important for several reasons: the region's vulnerability (sensitivity), particularly as regards the labour market performance; the assessment of competitiveness and—last but not least—the imperative of implementing efficient policies aimed at attracting the most competitive, productive and export-oriented firms. An increase in exports is often perceived as one of the principal goals of the economic policy, as part of the activities aiming to improve the internationalisation of regions.

Spatial distribution of the exporters has been subject to infrequent scientific inquiry. Rodríguez-Pose et al. (2013), by concentrating on firm-level and regional features, have acknowledged the role of foreign ownership in the extensive margin of exports. Farole and Winkler (2014) have shown that firm-level characteristics are more important for exporting in non-core regions, while regional characteristics matter more in core regions. Cassey et al. (2016), Koenig (2009) and Koenig et al. (2010) have undertaken another aspect of exporters' location, which is destination-specific externalities. According to their findings, exporters co-locate in order to reduce costs and share the risk. Greenaway and Kneller (2008) have investigated whether the co-location of exporters takes place in the same region or industry.

The ownership characteristics seem to be a neglected aspect of exporting firms in prior research. Our approach supplements the above literature by directly comparing locational criteria of FOEs versus DOEs. To fill this gap, the heterogeneity concept is used with respect to both regions and firms. Regional heterogeneity is strongly determined by path dependency since the investment conditions in regions are influenced by path-dependently inherited business and entrepreneurial culture, infrastructure and quality of institutions.

According to Mayer and Ottaviano (2008), the extensive margin of exports (number of exporters) should be increased in order to boost regional export base. An extensive margin has its regional dimension, given that exports do not come from an "undefined economic space", but from concrete locations. Heterogeneous firms (Melitz 2003) locate in dissimilar regions. Foreign ownership constitutes another dimension of firms' heterogeneity. Foreign-owned entities possess advantages, stemming from ownership (Dunning and Lundan 2014), experience in conducting activity globally, access to distributions networks and greater possibilities to internalise transactions. They are significantly more likely to export (Mayer and Ottaviano 2008). Their superior export position mainly stems from higher productivity, which according to Melitz (2003) is a driver of extensive margin of exports.

The present study identifies the differences between the determinants of the spatial location of FOEs and DOEs, in particular the role of metropolis, the proximity to infrastructure and the consequences of historical factors (path

dependency). The analysis is performed for the case of Polish local administrative units (LAU 1) observed over a number of years. The three hypotheses that have been formulated relate to the differences between FOEs and DOEs in locational preferences as regards the role of metropolis, infrastructure endowment and the role of path dependency:

H1 Agglomeration externalities, in the vicinity of metropolis and metropolitan areas, play a greater role in FOEs' location decisions than in the case of DOEs.

H2 The proximity to infrastructure is more important in the locational decisions of FOEs, compared to DOEs.

H3 The observed differences in the present distribution of FOEs versus DOEs are to a large extent path dependent.

Poland is an interesting case study as one of the largest transition states with significant regional heterogeneity that underwent two exogenous shocks related to economic transition itself followed by accession into the EU which affected its trade policy, trade intensity and directions as well as its economic structure and composition. The role of foreign ownership in the economy of Poland has significantly increased.

The remainder of the paper is constructed as follows. The following section reviews the literature on the spatial agglomeration of exporters and formulates the hypotheses. Section 3 discusses the utilised data and methods and presents our empirical strategy. Section 4 establishes the most important stylised facts and presents and discusses the econometric results. The final section concludes the paper.

2 Literature review and hypotheses

The determinants of the spatial distribution of exporters have only recently begun to draw the attention of researchers, while firms' locational preferences as such (including the role of agglomeration processes) have been subject to analysis for a long time. It was due to the separation of international economics and regional science, in which the international aspects of economic activity were not given the priority. Due to the improvement in access to firm-level data and to the growing openness of regions' economies, the gap between regional and international economics has gradually narrowed. As globalisation made regions vulnerable to the processes taking place in distant markets and brought volatility to the regional labour markets, the central and regional authorities demanded empirical inquiries on the links between regional and global dimensions. In parallel, the theoretical background has been profoundly developed and the new economic geography (NEG) has placed a strong emphasis on the nexus of regional and international issues. Rosik et al. (2015) stress the dominance of international accessibility over

domestic accessibility on the regional convergence of Poland, thus pointing to the significance of large investment projects linking the major metropolitan areas of Poland with Europe.

An inquiry into the determinants of the spatial distribution of exporters strongly relates to the concept of heterogeneity. Ottaviano (2011) postulates that NEG models should account for both macro-heterogeneity across locations and micro-heterogeneity across firms. The incorporation of firms' heterogeneity into NEG resulted in the next generation of the so-called new new economic geography (NNEG) models, incorporating a heterogeneous firm's Melitz-style monopolistic competition (Combes et al. 2012). In line with the NNEG, only the most productive firms can benefit from the location in larger regions. The selection effect decreases the extent of traditional agglomeration externalities. A spatial sorting effect induces the highest productivity firms to locate in the core and the lowest productivity firms in the periphery. Firm heterogeneity acts as an additional centrifugal force (Ottaviano 2011). The heterogeneity concept enables a comprehensive framework: heterogeneous firms reveal their preferences by selecting specific regions from which they export. The review of the literature points to the conclusion that productivity is the factor that differentiates exporters from non-exporters (Melitz 2003) and furthermore FOEs from DOEs [e.g. Mayer and Ottaviano (2008)]. Firms perform better in the presence of strong agglomeration externalities. Exporters gain more in terms of productivity than non-exporters, when agglomeration externalities increase (Békés and Harasztosi 2013).

Therefore, our research focuses on the spatial distribution of the most productive entities in the overall population of firms, whose activity contributes to sorting among regions. It brings significant implications for regional authorities that compete for such firms, as they positively contribute to the region's competitiveness, labour market performance and establishment of links with foreign markets. The knowledge of locational preferences of exporters is a sine qua non-condition for the formulation of efficient regional policy tools, aimed at increasing international attractiveness of regions and the growth in exports.

As mentioned, the literature on the location of exporters and their spatial concentration (within sectors) or agglomeration (across sectors), in particular, is still scarce. The focus in the research is on the firm-level approach or on a combination of firm-level and regional features. Regional dummies are usually added to the firm-level determinants. The drawback of such an approach is that it does not precisely show which features of regions, and to what extent, affect the export extensive margin. According to Farole and Winkler (2014), this is a serious drawback, because the identification of the regional determinants that shape the export costs is important, from the regional policy point of view. In the aforementioned study, however, only a few regional determinants are taken into account. Rodríguez-Pose et al. (2013), using the data on Indonesian firms, have inquired into the firm- and place-based characteristics shaping firms' exports. While the study applies a wide variety of regional factors, it does not pay sufficient attention to the differences between FOEs and DOEs. Foreign ownership has been shown to positively affect the extensive export margin; however, the aforementioned study does not make a direct comparison of FOEs versus DOEs.

An interesting thread in the literature is the destination-specific externalities in exports, inquired, that is, by Cassey et al. (2016), Koenig et al. (2010) and Koenig (2009). The agglomeration around exports' destinations stems from the possibility of cost reduction and risk sharing. These studies do not, however, make a distinction between FOEs and DOEs. Moreover, the regions' characteristics are not taken into account as factors that influence the exporting activity. In the study by Chevassus-Lozza and Galliano (2003), they manifest only in the spatial organisation of a firm structure (location of a firm head office in urban vs. rural areas) and in the proximity of a firm to the border. Greenaway and Kneller (2008), while analysing exporting, productivity and agglomeration, investigate whether the co-location of exporters takes place it the same industry or region. However, no attention is paid to the characteristics of these regions, which is in contrast to Clerides et al. (1998), who found that a firm is more probable to export, when belonging to an export-intensive industry or region, or for instance to Capello (2016), who treats space as a "…source of economic advantages (or disadvantages)" that also generates geographical advantages stemming from the cumulative nature of the economic processes.

Our research strategy is different from most of the available empirical evidence. Acknowledging that exporters are more productive than non-exporters, the paper identifies the determinants of the spatial distribution of exporters in regions, paying special attention to the firm's ownership, which has been commonly neglected in prior research. We have formulated three hypotheses.

H1 Agglomeration externalities, in the vicinity of metropolis and metropolitan areas, play a greater role in FOEs' location decisions than in the case of DOEs.

The literature well describes why economic activity is not evenly distributed in space. Exporters agglomerate for reasons similar to the overall economic activity if various centripetal forces are stronger than the centrifugal ones (Navaretti and Venables 1996). According to Arrow (1962) and Romer (1986), firms' co-location in a particular region stimulates the spillovers of spatially bounded knowledge, pooling of specialised labour and facilitates input–output interactions. It, therefore, reduces the risk of expansion to foreign markets (Chang and Park 2005; Porter 2000).

Duranton and Puga (2004) point that exporters agglomerate because of *sharing* (infrastructure), *matching* (finding necessary inputs, required for exporting and increasing productivity) and *learning* (about foreign markets, which reduces the costs of establishing exports and further exporting) (Aitken et al. 1997; Chevassus-Lozza and Galliano 2003).

The following reasons can be given why FOEs are expected to be more prone to locate in the vicinity of metropolitan areas:

- Due to urbanisation externalities, the most competitive firms are attracted to a metropolitan area (Farole and Winkler 2014; Combes et al. 2012); less productive firms are pushed outside of the area or eliminated from the market.
- FOEs represent the most competitive firms (proved by the productivity distribution (Mayer and Ottaviano 2008), also see Fig. A.1 in annexe). FOEs' premium

over DOEs stems from their ownership advantages, described in the OLI paradigm (Antras and Yeaple 2014; Dunning and Lundan 2014).

- Due to the cumulative causation, metropolis being the nodes of globalisation attract further FOEs, giving them the signals proving high investment attractiveness. Farole and Winkler (2014) have illustrated that locational characteristics matter more than the firm-level determinants of exporting in the core (metropolitan) regions. In fact, it may depreciate the firms' heterogeneity role (FOEs vs. DOEs) and work against H1; however, it clearly underlines the distinctive role of the metropolitan areas.
- Metropolis offer access to qualified resources, including human capital and innovativeness capacity. FOEs, compared to DOEs, are in a superior position in competing for these resources. The positive impact of innovativeness on exports has been shown by Chuang (2000), Aw et al. (2011), Altomonte et al. (2013) and DiPietro and Anoruo (2006). Human capital is crucial for exports, as was shown by Levin and Raut (1997), Grasjo (2008), Contractor and Mudambi (2008) and Chuang (2000).

H2 The proximity to infrastructure is more important in the locational decisions of FOEs, compared to DOEs.

NEG provides a comprehensive explanation of why falling trade costs, in an open economy, lead to the agglomeration (and relocation) of economic activity. NNEG goes even further, implementing firms' heterogeneity, predicting that only the most productive firms (represented by FOEs) are affected. Proximity to infrastructure determines the trade costs, which are taken into account in sites selection by exporters. Being less burdened by historical legacy nor anchored to a particular site, FOEs' location decisions are driven to a larger extent by factors pertaining to the evaluation of regions' investment climate (Dunning and Lundan 2014; Stam 2009). Many FOEs are part of the multinational structures, in which they participate in the global value chains, which renders the quick and just-in-time deliveries of crucial importance. They are drivers of the spatial fragmentation of the production process and described by Forsgren (2008) as "networking" multinationals. Moreover, FOEs are more active in the intra-industry trade (IIT): importing and exporting at the same time makes proximity to infrastructure and low trade costs a crucial element of assessment of particular location's attractiveness.

Basically, the NEG models refer to the costs of trade between countries; however, the infrastructure quality and density within the country are also taken into account (Lafourcade 2011; Limao and Venables 2001). According to Alfaro and Chen (2017), FOEs often bear higher trade costs stemming from sourcing intermediate inputs and reaching downstream buyers. However, the empirical inquiry into the determinants of the geography of the FDI is still looking for the factors that differentiate locational decisions of the FOEs and their domestic counterparts and what is more important on the significance of the benefits stemming from co-location or from proximity to key factors such as infrastructure (Head and Mayer 2004).

Underdeveloped transport infrastructure and other informal trade barriers could lead to market fragmentation. More mobile foreign capital is likely to prefer regions with higher road and rail accessibility as a basis for its internal expansion as well as an international expansion from a given location. DOEs, frequently lacking the resources to reallocate to more suitable locations or showing lower propensity to adjust location due to embedded preferences (local patriotism, path dependency, tradition)—continue activities from the disadvantaged locations (with lower international accessibility).

The expected differences between FOEs and DOEs can be explained with reference to Stam's (2009) theoretical framework. Being foreign investors, FOEs are more often in the accumulation phase, in which firms are bigger, which implies relatively lower location-specific costs. It facilitates selecting the most attractive sites, from the point of view of exporting activity as well as moving from one region to another. Adjustments to location and selection of the most attractive sites (regions) on the one hand contribute to the firm's overall competitiveness; on the other hand, it disrupts the existing region-specific cooperative links. For DOEs, the regional networking is relatively more important, and any decision to relocate implies higher costs associated with breaking the already established regional links. FOEs function in more internationalised networks, which makes them more footloose. It is reflected in their preference for locations with superior access to transport infrastructure. As FOEs are bigger, it shall facilitate covering the sunk costs related to relocation or choosing the most attractive sites.

We assume that the transport costs faced by an exporting firm depend inversely on the level of infrastructure (Bougheas et al. 1999). In the study of Martincus et al. (2014), a 1% increase in transport costs, has been found to result in a 6.5% reduction in firms' exports and affect the number of exporters. Reductions in the transport costs, due to infrastructural projects, depend on the type of infrastructure, for example, express roads and domestic roads with large sectoral heterogeneity in impact (Coşar and Demir 2016). They also lead to different patterns of accessibility (Castanho et al. 2017). However, complementary relationships can exist between different transportation modes in their impact on the economic development of regions, for example, between rail and road systems (Yi and Kim 2018).

Summing up, we follow the argumentation by Bosker and Garretsen (2010), who stated that the features of a region (including proximity to infrastructure) to a large extent determine trade costs. And we put an additional element into the inquiry: the differences between FOEs and DOEs, reflecting firms' heterogeneity.

H3 The observed differences in the present distribution of FOEs versus DOEs are to a large extent path dependent.

According to Garretsen and Martin (2010), "geography and history … are key to understanding the economic process". The existing asymmetries between regions, reflected in the location patterns of FOEs and DOEs, have their roots in history, including the former partitions. Fritsch and Storey (2014) and Fritsch and

Wyrwich (2014) have shown the historical roots of the regional context of entrepreneurship, social capital and the role of institutions. According to Brodzicki and Umiński (2017), the historical factors exert an impact on the current trade patterns of the regions. Additionally, FOEs, representing the more mobile capital, paying more attention to the assessment of the investment conditions in regions, and possessing ownership advantages—locate in the most attractive sites. A region's attractiveness is determined by the entrepreneurial culture and the social capital revealed in the quality of the institutions that provide business services (for an exporter) as well as in the path-dependent inherited business culture. It is also determined by the available infrastructure. An example of the quality of institutions is the efficiency of SEZ in Poland, in attracting investors (including exporters) and the quality of regional planning (including area development plans coverage). Each of the 14 SEZs has its own independent managing unit and SEZ compete for investors (including exporters) with the quality of services provided. A FOE can choose a site from a wide variety of available locations, which makes the quality of business sites an important factor of the regional business climate.

We follow Brodzicki and Umiński (2017) as well as Gajewski and Tchorek (2017) who trace the historical context in the existing differences in export performance assessed at the regional level. We extend the inquiry by focusing on locational patterns of FOEs versus DOEs.

3 Data and methods and empirical strategy

The data used compiles information on local area units in Poland (LAU 1, counties, *pl* powiats) over the period 2004–2015. The use of LAU1 level data (370 counties in Poland) allows for more precise analysis of location determinants in comparison with the use of NUTS regions (16 regions in Poland). Counties, in comparison with NUTS 2 regions, are more heterogeneous, better depict the range of local labour market conditions, investment attractiveness and intra-regional functional specialisations. Moreover, historical boundaries (related to partitions) restrict the use of regional (NUTS 2) data, since they are not in line with nowadays administrative division at this level. Thus, the use of county data gives the possibility to better tackle the research problem.

The principal data source on the number of exporters is the Customs Chamber, to which the information on powiats' structural characteristics, supplied by the Central Statistical Office (CSO) and the Ministry of Entrepreneurship and Technology, has been added. In order to provide for a better understanding of second-nature geographical factors, the distances to the selected points of interest (POIs), such as a seaport, an airport, a railway station and an administrative border (frontier), have been computed in the QGIS software. These have been linked with information on the minimal distances to an express road, a motorway, a domestic road and railway lines.

The descriptive statistics of all variables are presented in Table 1, as well as our two dependent variables: (1) the number of FOEs (*ex_foe*) and (2) the number of

Table 1 Descriptive statistics

Variables	Description	Source	*N*	Mean	SD	Min	Max
annex_a	Austro-Hungarian annex	GIS	4536	0.119	0.324	0	1
annex_p	Prussian annex	GIS	4536	0.511	0.500	0	1
annex_r	Russian annex	GIS	4536	0.370	0.483	0	1
capital	ln fixed assets per capita	CSO	4536	2.900	0.780	0.505	5.482
dist_airp	ln minimum distance to airport	GIS calc.	4536	4.151	0.712	1.096	5.658
dist_by	ln minimum distance to PL#BY border	GIS calc.	4536	5.520	0.710	2.567	6.405
dist_cz	ln minimum distance to PL#CZ border	GIS calc.	4536	5.138	0.966	1.549	6.340
dist_de	ln minimum distance to PL#DE border	GIS calc.	4536	5.538	0.821	1.628	6.432
dist_droad	ln minimum distance to domestic road	GIS calc.	4536	1.690	0.874	− 1.866	3.123
dist_lt	ln minimum distance to PL#LT border	GIS calc.	4536	5.863	0.555	2.313	6.452
dist_motor	ln minimum distance to express road or motorway	GIS calc.	4536	3.016	1.038	− 2.112	4.844
dist_rail	ln minimum distance to railway line	GIS calc.	4536	1.503	0.893	− 1.817	3.478
dist_ru	ln minimum distance to PL#RU border	GIS calc.	4536	5.604	0.695	2.086	6.335
dist_seap	ln minimum distance to seaport	GIS calc.	4536	5.570	0.757	0.381	6.441
dist_sk	ln minimum distance to PL#SK border	GIS calc.	4536	5.379	0.823	1.913	6.358
dist_ua	ln minimum distance to PL#UA border	GIS calc.	4536	5.537	0.791	1.574	6.524
ex_doe	Number of DOEs	CC	4536	42.47	80.07	1	1639
ex_foe	Number of FOEs	CC	4536	11.33	35.23	0	733
graduates	ln number of tertiary graduates	CSO	4536	− 3.017	3.803	− 4.605	11.15
metro	Metropolitan dummy	ESPON	4536	0.140	0.347	0	1
roads	ln roads with hard surface (in km)	CSO	4536	5.463	0.743	2.565	7.242
sez	Special economic zone dummy	MET	4536	0.520	0.500	0	1
sh_e_ind	ln share of employed in industry	CSO	4536	− 1.341	0.513	− 6.908	− 0.281
sh_h_edu	ln share of population with higher education	CSO	4536	− 1.323	0.305	− 2.273	− 0.698
unemp_r	ln unemployment rate	CSO	4536	2.675	0.476	0.531	3.754

Source: Own compilation in STATA 14.2

CC, Customs Chamber in Warsaw; CSO, Central Statistical Office; GIS calc., GIS calculations on maps; MET, the Ministry of Entrepreneurship and Technology

DOEs (*ex_doe*). The correlation matrix between the variables is available in online appendix (Table A.1).

Most of the data have been log-transformed, with the exception of dummy variables. The value of fixed assets has been deflated with the use of the PPI.

The *metro* dummy indicates the counties located within the core or outer sphere of eight metropolitan areas, as specified by the ESPON MEGA classification (MEGA 3 and MEGA 4). Similarly, the *sez* dummy differentiates between powiats having a special economic zone (SEZ) and without SEZ. The data on the share of the population with higher education (*sh_h_educ*), our proxy for human capital endowment, have been estimated from the National Household Censuses run in 2002 and 2011 and extrapolated to other years of the study (*ipolate* command in STATA). This has been treated as an auxiliary to the second human capital variable *graduates*, representing the log of tertiary graduates.

Due to the cross-sectional nature of the data on economic geography (time-invariant distances to selected POIs) and the nature of the dependent variables (count data variables), the choice of econometric methods has been limited. In particular, fixed effects (FE) panel estimation methods or dynamic panel estimation methods could not be applied. Furthermore, standard regressions would result in biased estimates, due to the skewness in the distribution of our dependent variables.

In many studies on the spatial distribution of the FDI (Cieślik 2005a, 2005b, 2013; Holl and Mariotti 2018; Li et al. 2017; Nazarczuk and Krajewska 2018; Piperopoulos et al. 2018; Schäffler et al. 2016), a Poisson and/or negative binomial approaches are utilised. Due to the presence of overdispersion, the negative binomial (NB) model is the preferred choice.

The NB regression introduces heterogeneity to the conditional average of the gamma distribution and thus makes it possible to relax the assumption of the equality of the expected value and variation. Both models have equal expected values y_i; however, in the case of the NB regression, the variation is higher than the average value. Given the lack of excessive zeros in the dependent variable, the zero-inflated NB (ZINB) approach has not been utilised.

To identify the general location determinants of exporters, the following empirical model has been estimated:

$$ex_{it} = \alpha_0 + \alpha_1 dist\_POI(V)_i + \alpha_2 X_i + \alpha_3 Z_{it} + u_t + \varepsilon_{it}$$

where *ex* is the number of exporters; *i* stands for the *i*th powiat; *t* stands for a year; $dist\_POI(V)_i$ represents the distance to a type V point of interest; X_i is a matrix of time-invariant regional characteristics; Z_{it} is a matrix of time-variant regional characteristics; u_t represents time-fixed effects; and ε_{it} is an error term.

The inclusion of year FE results from the need to incorporate significant changes in the business cycle during the time span of the estimation, which stemmed from the global financial crisis of 2008, affecting the number of firms and also the number of exporters. The year dummies are significantly different from the null. For comparison, refer to Table A.2. in online appendix to note the estimations without temporal effects.

The list of variables varies, depending on the specification of the model. We will report all standard measures allowing to assess the overall fit of the model—pseudo-R^2, log-likelihood, LR test, alfa as well as standard information criteria—AIC and BIC. We estimate each of the models twice for FOEs and DOEs and compare the obtained results.

In accordance with our empirical strategy, we will first estimate the model accounting for the distance to POIs, while accounting for a number of time-invariant and time-variant characteristics. The results are available in Table 4. In the second step, we will account for distance to various POIs and the distance to different borders, entering the model in separate specifications (due to their correlation). The results are available in Table 5. In the third step, we will account for initial infrastructure endowment by introducing interaction terms between various POIs and dummy variables, depicting belonging to past partitions of Poland. In order to obtain more informative results, we will account separately for each of the three historical partitions of Poland: Prussian (p), Russian (r) and Austro-Hungarian (a). The results accounting for path dependency are available in Table 6.

3.1 Stylised facts on the role of FOEs in Poland

Poland, located between two major superpowers (Germany and the Russian Federation), had a turbulent history that affected its economic growth possibilities. During the past 2.5 centuries, Poland's territory was taken over by different nations and was an area of war. The history (including over the century of annexation) has strongly shaped current status and the international position.

After the regain of independence in 1918 (after 123 years of annexation), a serious challenge for Poland was the unification of territory in legal, institutional and infrastructure terms. Fritsch and Storey (2014) show the persistence of regional differences in entrepreneurship on the example of Germany, despite abrupt political and economic changes. The issue is connected with a regionally embedded entrepreneurial culture that does not change significantly over time.

Until 1990, Poland was a centrally planned economy with a socialist regime, characterised by product shortages and a severe lack of capital and foreign currencies. The economy was to a high extent separated from global trade flows, as it was infrequently engaged in global markets, other than the Council for Mutual Economic Assistance. Starting with 1990, a major exogenous policy shift occurred and the process of transition to market economy commenced. The continuing market-oriented reforms enabled Poland's EU accession in 2004, resulting in the inclusion to the EU common market and followed by a dynamic FDI inflow.

The selection of Poland as a study example, in which different patterns of exporters' locational determinants are investigated, stems from a high contribution of FOEs to exports (Table 2). The role of Germany in this respect is crucial, being the most important trade partner in exports, for whom Poland is a supplier of intermediate goods.

FOEs generate the majority of exports in Poland, despite having only ca. 21% of the total number of exporters. FOEs are bigger, and more internationalised, compared to DOEs. However, since the global financial crisis, their role has started to diminish. The relatively high importance of FOEs in exports also results in a more intense IIT.

In regional terms, one can notice a higher spatial concentration of FOEs (Table 2). Similarly, the spatial distribution of the two also differs (Fig. 1). DOEs

Table 2 Selected stylised facts on FOEs versus DOEs exporters in Poland

Variable	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
National aggregates												
FOE in relation to the total number of exporters (%)	17.28	20.59	20.98	21.47	22.24	22.76	22.71	21.59	20.95	20.93	21.36	21.25
Share of total exports in FOE (%)	56.53	56.78	57.08	58.80	59.28	61.76	61.10	58.71	56.19	55.66	55.91	56.41
Local means/characteristics												
FOE in relation to the total number of exporters (%)	14.64	18.08	18.27	18.59	19.11	19.57	19.38	18.17	17.44	17.32	17.95	17.87
Share of exports in FOE (%)	43.87	44.80	44.67	45.24	45.60	46.28	46.67	45.98	45.08	44.44	44.80	44.76
HHI of the number of FOE	0.034	0.027	0.027	0.026	0.026	0.025	0.025	0.028	0.029	0.030	0.029	0.029
HHI of the number of DOE	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.011	0.011	0.012	0.012

Source: own elaboration

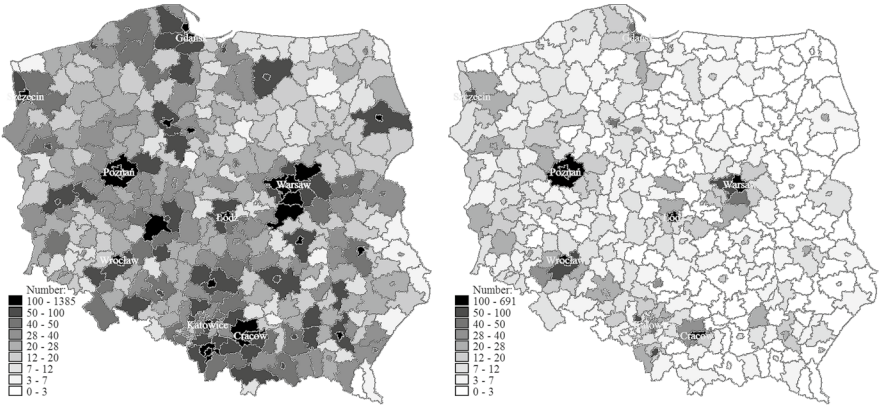

Fig. 1 Spatial distribution of DOEs in Poland (left-hand side) and FOEs (right-hand side) in 2015. *Source*: own elaboration

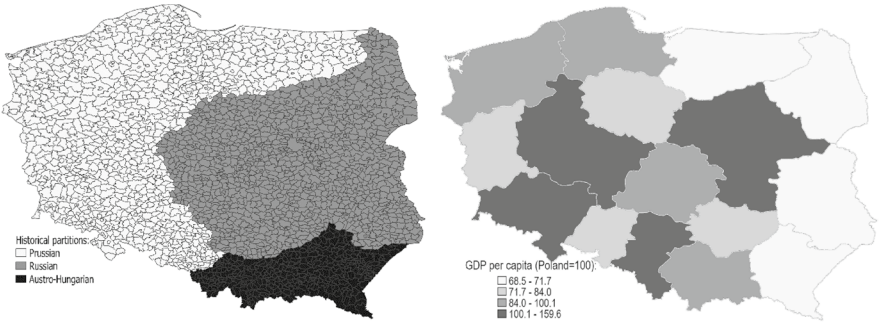

Fig. 2 Historical partitions of Poland (left-hand side) and regional GDP per capita in 2015 (right-hand side). *Source*: own elaboration

seem to be more dependent on the role of cities, firm agglomeration or past industry location (in the south), whereas FOEs gravitate more towards the western border, metropolis and high-speed road networks.

More than a century of annexation (1815–1914) and division into Prussia, Russia and Austria-Hungary[1] has resulted in an increase in regional inequalities. Different economic systems, level of economic freedom, investments—have shaped further development capabilities, due to path dependency, different postures in favour of entrepreneurship or quality of social capital. According to Zarycki (2007), these inequalities are present to date and affect many aspects of economic development,

[1] Some of Poland's area was under German control until 1945 (western part of Poland, south-western and northern-east territories).

Table 3 Mean distances (in km) to selected infrastructure endowments by regions' historical annexes

Annex	dist_motor	dist_droad	dist_rail	dist_rails	dist_seap	dist_airp	dist_regcap	dist_SEZ
Prussian	28.59	6.878	4.945	7.068	247.9	59.20	49.87	13.25
Austrian	40.55	6.956	6.522	7.937	533.0	168.0	49.71	12.18
Russian	31.02	7.413	7.885	10.09	339.1	77.82	56.40	17.01

Source: Own elaboration based on calculations in QGIS software

The distances represent the mean LAU 2 minimum distances in km (within particular LAU 1 areas) to selected infrastructure endowments: dist_motor, distance to high-speed roads; dist_droad, distance to domestic road; dist_rail, distance to railway; dist_rails, distance to railway station; dist_seap, distance to seaport; dist_airp, distance to airport; dist_SEZ, distance to the nearest special economic zone; dist_reg_cap, distance to regional capital city

including regions' international trade intensity (Brodzicki and Umiński 2017) or level of GDP per capita (Fig. 2).

The accessibility to different infrastructure endowments diversifies local areas to date (Table 3). In general, former Prussian territories inherited the best transport infrastructure (which was subsequently developed), whereas Russian and to some extent Austro-Hungarian territories, the least. The south-western part of Poland has the superior transport accessibility to international markets (Rosik et al. 2015), which simply stems from the proximity to foreign markets and the existence of high-speed roads. Moreover, cumulative causation magnifies the historically inherited inter-regional differences.

The quality of the transport infrastructure affects the spatial distribution of exporters, being among the list of their locational criteria. Better infrastructure endowment reduces the costs of exports and enhances (e.g. time factor) accessibility to foreign markets, giving the entrepreneurs an advantage over worse, inferiorly located entities. The economic, societal and infrastructural factors diversifying regions of Poland, significantly affect the business climate for foreign investors. Also non-purely economic factors matter for the location of foreign investors, that is, disregard of law and trustworthiness, which can ease or hamper economic cooperation. These deeply rooted differences are observed between the eastern and western part of Poland's territory. The regions that were under Prussian annexation are still in a privileged position in this respect.

3.2 Empirical results and discussion

In line with our expectations and postulates of the NEG and NNEG models, the metropolitan status has a positive impact on the number of exporters, both DOEs and FOEs; however, FOEs are more prone to metropolitan externalities in all model specifications (Table 4). It confirms our H1. It is worth noting that due to collinearity if the metro dummy is introduced, the *dist_airp* must be excluded from the estimation. The share of the population with higher education exerts a weaker impact on the number of FOEs (compared to DOEs), which is contrary to our expectations. It

Table 4 Differences in locational determinants of foreign-owned and domestic exporters in Poland

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	ex_foe	ex_foe	ex_foe	ex_foe	ex_doe	ex_doe	ex_doe	ex_doe
dist_motor	−0.062***			−0.065***	0.046***			0.041***
	(0.014)			(0.016)	(0.014)			(0.014)
dist_droad	−0.092***			−0.064***	−0.218***			−0.142***
	(0.018)			(0.020)	(0.016)			(0.017)
dist_seap	−0.193***	−0.190***	−0.139***	−0.143***	0.040***	0.038**	−0.005	0.072***
	(0.019)	(0.019)	(0.016)	(0.018)	(0.013)	(0.015)	(0.013)	(0.013)
capital	0.677***	0.683***	0.692***	0.504***	0.270***	0.273***	0.266***	0.120***
	(0.025)	(0.030)	(0.024)	(0.040)	(0.021)	(0.026)	(0.021)	(0.031)
graduates	0.022***	0.023***	0.032***	0.034***	0.026***	0.030***	0.038***	0.040***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
sez	0.512***	0.516***	0.560***	0.445***	0.421***	0.423***	0.508***	0.342***
	(0.026)	(0.026)	(0.025)	(0.026)	(0.023)	(0.024)	(0.022)	(0.023)
metro	0.822***	0.916***		0.828***	0.773***	0.824***		0.696***
	(0.037)	(0.039)		(0.039)	(0.038)	(0.042)		(0.038)
dist_rail		−0.114***				−0.154***		
		(0.018)				(0.017)		
dist_airp			−0.419***				−0.190***	
			(0.017)				(0.017)	
roads			0.278***				0.252***	
			(0.017)				(0.015)	
unemp_r			−0.399***				−0.724***	
			(0.034)				(0.028)	
sh_e_ind				0.419***				0.195***
				(0.058)				(0.041)

Table 4 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
sh_h_edu				0.726***				1.263***
				(0.135)				(0.103)
Constant	1.449***	1.233***	2.336***	3.469***	2.961***	2.973***	4.735***	5.646***
	(0.158)	(0.153)	(0.215)	(0.330)	(0.120)	(0.133)	(0.174)	(0.254)
Observations	4536	4536	4536	4536	4536	4536	4536	4536
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.141	0.141	0.154	0.147	0.0871	0.0843	0.101	0.0935
LogLik	− 13,379	− 13389	− 13,175	− 13,289	− 19661	− 19,722	− 19,368	− 19,523
LR	2719	2616	3895	3854	2241	1948	3380	3211
Alfa	0.491	0.496	0.418	0.474	0.381	0.392	0.334	0.359
AIC	26,798	26,815	26,390	26,623	39,362	39,482	38,775	39,091
BIC	26,927	26,937	26,519	26,764	39,490	39,604	38,904	39,232

Source: Own estimates in STATA 14.2

Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$

could indicate that in their exporting activity from Poland, FOEs rest on ownership advantages brought from abroad and supplement them with available, competitive workforce, not necessary representing high education personnel. On the other hand, DOEs, competing with FOEs operating in Poland on export markets, are forced to catch up in terms of improving their knowledge base. This observed difference in location patterns, however, needs further, thorough inquiry. FOEs, paying higher wages, can attract the desired high education personnel also from more distant areas. The wage premium allows than to cover the commuting costs.

The positive relation between the industrial base and exports is in line with expectations. Our results confirm it in the case of the number of exporters. In the case of FOEs (vs. DOEs), there is a stronger impact of the industry share in employment on the number of exporters. It may stem from the selection effect, FOEs investing into export-oriented sectors. Another reason can be cumulative causation: foreign-owned entities' exporting activity enhances the industrial base, which in turn positively impacts exports.

The obtained results (cf Table 4) indicate that FOEs are more frequently based in major cities or metropolitan areas. It may reflect their networking function (Forsgren 2008) and more interactive nature. According to the obtained results, FOEs pay greater attention to proximity to airports and motorways, which facilitates international liaisons and lowers the transport costs imperative.

Table 5 presents the role of geographical factors as well as border effects on the location of FOEs and DOEs, showing distinct elasticities towards the selected locational criteria. The results point to the different significance of proximity to infrastructure endowments, regarding the type of ownership. DOEs are more attached to proximity to domestic (national roads), which proves their embeddedness into the local (regional) economy and partly reflects the impact of path dependency (which indirectly supports H3).[2] On the other hand, FOEs locate closer to airports, high-speed road network[3] and more frequently operate within SEZs.

As the express road and motorway network in Poland has only been recently established (Rosik et al. 2015), it does not have a significant impact on the location of DOEs, who rely more on the domestic and thus local road network. DOEs to a lesser extent are subject of incentives granted in SEZs and are less susceptible to the proximity of airports (similar case as with high-speed roads). The obtained results, as expected, correspond well with the very nature of FOEs: networking (Forsgren 2008) and efficient communication (airport proximity), high mobility and adaptability to infrastructure changes (high-speed roads).

The impact of the distance to the closest seaport is vague in both types of ownership—an increase in the distance, increases or decreases the incidence ratio of exporters, depending on the specification of the model. The full explanation of the result would, however, require further investigation and inclusion of the structure

[2] Most of the express roads and motorways in Poland were built within EU-supported programmes and entered in service within the last years of the study period.

[3] Collinearity of the proximity to the railroad network (with the road network) has eliminated this mean of transportation in this set of estimations, but they are a subject of the inquiry in Table 4.

Table 5 The impact of geographical factors and individual border effects on the location of foreign-owned and domestic-owned exporters in Poland

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Variables	ex_foe	ex_foe	ex_foe	ex_foe	ex_foe	ex_foe	ex_foe	ex_doe	ex_doe	ex_doe	ex_doe	ex_doe	ex_doe	ex_doe
dist_motor	−0.087***	−0.117***	−0.129***	−0.123***	−0.113***	−0.123***	−0.123***	−0.021	−0.024	−0.023	−0.023	−0.019	−0.019	−0.020
	(0.018)	(0.018)	(0.017)	(0.018)	(0.019)	(0.019)	(0.018)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)
dist_droad	−0.355***	−0.319***	−0.310***	−0.330***	−0.340***	−0.327***	−0.306***	−0.345***	−0.342***	−0.326***	−0.336***	−0.346***	−0.346***	−0.338***
	(0.021)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)	(0.021)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)	(0.018)	(0.018)
dist_airp	−0.612***	−0.555***	−0.572***	−0.522***	−0.575***	−0.576***	−0.580***	−0.320***	−0.329***	−0.344***	−0.342***	−0.319***	−0.314***	−0.314***
	(0.029)	(0.029)	(0.026)	(0.029)	(0.027)	(0.027)	(0.027)	(0.021)	(0.022)	(0.021)	(0.023)	(0.021)	(0.022)	(0.021)
dist_seap	0.053***	−0.196***	−0.103***	0.003	0.004	−0.178***	−0.424***	0.049***	0.075***	−0.042*	0.018	0.056***	0.032*	−0.058**
	(0.018)	(0.026)	(0.029)	(0.020)	(0.018)	(0.021)	(0.032)	(0.016)	(0.020)	(0.023)	(0.018)	(0.017)	(0.017)	(0.022)
sez	0.804***	0.803***	0.823***	0.805***	0.771***	0.794***	0.812***	0.579***	0.587***	0.569***	0.584***	0.576***	0.573***	0.575***
	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)	(0.030)	(0.030)	(0.025)	(0.026)	(0.026)	(0.025)	(0.026)	(0.026)	(0.025)
dist_de	−0.342***							0.002						
	(0.015)							(0.014)						
dist_cz		−0.142***							0.046***					
		(0.021)							(0.017)					
dist_sk			0.007							−0.137***				
			(0.028)							(0.021)				
dist_ua				0.223***							−0.074***			
				(0.030)							(0.020)			
dist_by					0.428***							0.028		
					(0.027)							(0.020)		
dist_lt						0.664***							0.148***	
						(0.036)							(0.026)	

Table 5 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
dist_ru							0.626***							0.213***
							(0.029)							(0.020)
Constant	6.693***	6.744***	5.558***	3.567***	2.619***	2.097***	3.832***	5.290***	4.967***	6.618***	5.965***	5.103***	4.495***	4.656***
	(0.162)	(0.204)	(0.290)	(0.327)	(0.276)	(0.286)	(0.203)	(0.125)	(0.153)	(0.229)	(0.237)	(0.197)	(0.189)	(0.130)
Obs	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.124	0.113	0.110	0.114	0.123	0.127	0.126	0.0711	0.0715	0.0727	0.0716	0.0712	0.0724	0.0738
LogLik	− 13,650	− 13,823	− 13,862	− 13,810	− 13,659	− 13,602	− 13,611	− 20,005	− 19,998	− 19,971	− 19,995	− 20,003	− 19,979	− 19,948
LR	2496	2117	1811	1863	2446	2663	2444	1710	1810	1943	1706	1864	2067	2253
Alfa	0.576	0.631	0.639	0.621	0.585	0.571	0.575	0.441	0.440	0.435	0.439	0.441	0.437	0.432
AIC	27,339	27,684	27,763	27,659	27,356	27,242	27,260	40,048	40,035	39,980	40,028	40,045	39,995	39,934
BIC	27,461	27,806	27,885	27,781	27,478	27,364	27,382	40,170	40,157	40,102	40,150	40,167	40,117	40,056

Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$

of exports by the mode of transport. It may be a result of a concentration of the manufacturing industry in the southern part of Poland (in particular in the Silesia), which could reduce the role of maritime transport. Our results are not in line with the research presented recently by Márquez-Ramos (2016) and Naudé and Matthee (2010), who showed that seaports are a significant locational determinant of exporters' locations. This could also reflect the geographical structure of Poland's exports by product groups with a significant role of the EU member states and in particular the major eurozone countries (Germany). The proximity to them naturally favours road and rail transport. In addition, the role of Polish seaports is only recently increasing, due to large investments in container terminals (in particular in Gdańsk with the establishment of the major Baltic container hub in the Deepwater Container Terminal) and the establishment of major global container services from/to China. Previously, the port of Hamburg in Germany played the biggest role in servicing Poland's long-distance maritime exports.

The results of the inquiry into the location determinants of exporters lead to the recognition of H2, acknowledging different locational patterns of FOEs and DOEs in terms of proximity to infrastructure endowments. FOEs having more complex internationalisation strategies seem to maximise the location opportunities, affecting their export performance, relying to a higher extent on the evaluation of proximity to transport infrastructure.

Surprisingly, in most of the estimations, the role of the distance to the border is statistically significant; however, the effect is mixed, depending on the neighbouring country and the type of ownership. FOEs locate closer to Germany and the Czech Republic, whereas DOEs favour proximity to Slovakia and Ukraine. The eastern border is an unambiguous deterrent to FOEs, whereas in the case of DOEs it is double edged, depending on a particular direction.

The results also prove different relevancy of the distance to the border. The locational patterns of FOEs, to a large extent, depend on the origin of the incoming capital, the structure of exports generated in Poland (with Germany as the main partner in exports) and historical legacy, indicating, that is, former adherence of territories.

To verify H3, we account for potential path dependency in the investigated relationship. The introduction of interactive terms allows to account for initial differences in the endowments and thus eliminate potential endogeneity in the relationship. Accounting for potential endogeneity in relationships involving the transport infrastructure is of great importance, as shown by Martincus et al. (2014). The other possible strategy is the instrumentation by the initial endowment of infrastructure, which is difficult for obvious reasons (Rokicki and Stępniak 2018).

We acknowledge here that in the long run, infrastructure projects can affect the spatial reorganisation of exporting activities. This is, for instance, proven by Xu (2016) in his analysis of a major railroad project in China.

In Table 6, we report the results. We compare the results between FOEs and DOEs and furthermore re-estimate the models separately for each of the partitions, to draw more informative conclusions (we expect the coefficients to differ between partitions). Due to a high correlation with other key variables, we run separate models for the rail infrastructure.

Table 6 Interactions between former partitions and proximity to infrastructure endowments affecting exporters locational criteria

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	ex_foe	ex_doe	ex_foe	ex_doe	ex_foe	ex_doe	ex_foe	ex_doe	ex_foe	ex_doe	ex_foe	ex_doe
Annex	annex_p	annex_p	annex_p	annex_p	annex_r	annex_r	annex_r	annex_r	annex_a	annex_a	annex_a	annex_a
capital	0.583***	0.279***	0.827***	0.398***	0.573***	0.248***	0.839***	0.389***	0.613***	0.258***	0.843***	0.418***
	(0.023)	(0.020)	(0.037)	(0.029)	(0.022)	(0.021)	(0.033)	(0.028)	(0.023)	(0.021)	(0.037)	(0.033)
graduates	−0.001	0.010***	−0.006	0.010**	−0.001	0.012***	−0.008	0.011**	−0.003	0.012***	−0.007	0.010**
	(0.003)	(0.003)	(0.006)	(0.004)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)
sez	0.451***	0.367***	0.414***	0.348***	0.451***	0.395***	0.381***	0.355***	0.480***	0.377***	0.460***	0.366***
	(0.026)	(0.025)	(0.028)	(0.026)	(0.026)	(0.026)	(0.028)	(0.026)	(0.026)	(0.025)	(0.028)	(0.026)
annex	4.368***	4.733***	−0.235***	−0.605***	−2.599***	−2.417***	0.501***	0.713***	0.737	−7.611**	−0.721***	−0.082
	(0.421)	(0.340)	(0.089)	(0.071)	(0.527)	(0.378)	(0.103)	(0.082)	(5.454)	(3.818)	(0.125)	(0.090)
dist_motor	−0.332***	−0.154***			−0.033**	0.054***			−0.049***	0.022		
	(0.030)	(0.025)			(0.014)	(0.014)			(0.015)	(0.015)		
annex*dist_motor	0.353***	0.233***			−0.227***	−0.167***			−0.435***	−0.265***		
	(0.032)	(0.029)			(0.038)	(0.032)			(0.059)	(0.050)		
dist_droad	−0.181***	−0.237***			−0.077***	−0.250***			−0.123***	−0.232***		
	(0.027)	(0.026)			(0.021)	(0.022)			(0.017)	(0.018)		
annex*dist_droad	0.117***	0.062**			−0.143***	−0.005			0.106**	0.081*		
	(0.031)	(0.031)			(0.035)	(0.035)			(0.043)	(0.044)		
dist_airp	−0.589***	−0.395***			−0.381***	−0.178***			−0.523***	−0.389***		
	(0.038)	(0.029)			(0.024)	(0.025)			(0.024)	(0.023)		
annex*dist_airp	0.215***	0.048			−0.303***	−0.269***			0.308**	−0.150		
	(0.047)	(0.041)			(0.052)	(0.043)			(0.123)	(0.098)		
dist_seap	1.001***	0.959***			−0.068***	0.012			−0.141***	0.001		
	(0.081)	(0.063)			(0.017)	(0.018)			(0.020)	(0.017)		

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
annex*dist_seap	−1.050***	−1.016***			0.744***	0.690***			−0.114	1.544**		
	(0.083)	(0.066)			(0.098)	(0.070)			(0.935)	(0.660)		
dist_rail			−0.400***	−0.387***			−0.035	−0.094***			−0.228***	−0.255***
			(0.037)	(0.027)			(0.022)	(0.020)			(0.021)	(0.020)
annex*dist_rail			0.384***	0.264***			−0.487***	−0.391***			0.268***	0.205***
			(0.044)	(0.035)			(0.052)	(0.039)			(0.062)	(0.045)
Constant	−2.328***	−0.491	−0.185	2.963***	2.365***	3.583***	−0.485***	2.403***	3.182***	4.477***	−0.324***	2.540***
	(0.415)	(0.320)	(0.121)	(0.099)	(0.143)	(0.139)	(0.120)	(0.101)	(0.170)	(0.141)	(0.122)	(0.110)
Observations	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536	4536
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R2	0.154	0.0853	0.115	0.0635	0.153	0.0791	0.114	0.0645	0.139	0.0801	0.108	0.0607
LogLik	−13,175	−19,701	−13,796	−20,171	−13,204	−19,833	−13,801	−20,149	−13,420	−19,813	−13,890	−20,229
LR	4855	2662	2770	1376	4423	2263	2584	1508	2673	1963	1715	1259
Alfa	0.436	0.387	0.638	0.475	0.444	0.410	0.639	0.471	0.498	0.407	0.667	0.487
AIC	26,378	39,430	27,608	40,357	26,436	39,694	27,618	40,314	26,869	39,653	27,797	40,474
BIC	26,468	39,520	27,660	40,409	26,526	39,784	27,669	40,365	26,959	39,743	27,848	40,525

Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$

As the results do not differ significantly for standard variables, we focus on the interactive terms. Secondly, the magnitude and sometimes the direction of the impact on the dependent variables differ for partitions (due to the different initial endowment in infrastructure) and between DOEs and FOEs.

For the Prussian partition, the magnitude of the impact is higher for DOEs than for FOEs in the case of distance to motorways, domestic roads and railways. It is stronger for airports for FOEs and does not differ for the distance to seaports. Furthermore, the impact of motorways is positive, possibly due to higher accessibility by motorways in general.

In the Russian partition, the magnitude of the impact is higher for DOEs than for FOEs in the case of the distance to domestic roads and seaports. In the remaining cases, it is the opposite—stronger impact for FOEs (motorways, airports and railroads). One has to note that initial and present endowment in these types of infrastructure is inferior, in comparison with the Prussian partition.

For the Austro-Hungarian partition, the magnitude of the impact is higher for DOEs than for FOEs in the case of the distance to domestic roads, airports and seaports and the opposite for motorways and railroads. The Austro-Hungarian partition has the particularly weak endowment of motorways.

Path-dependent matters as the interactive terms are statistically significant. Accounting for initial infrastructure endowment and the differences between partitions makes sense. In here we have to stress that in a particular location in the Prussian partition significantly and positively increases the number of present exporters both foreign-owned and domestic-owned, in comparison with the Russian and Austro-Hungarian partitions. This indirectly supports the postulates of Fritsch and Wyrwich (2014) on the long persistence of regional levels of entrepreneurship.

The pattern of impact on the present location of FOEs and DOEs is complex—depending on the type of infrastructure and the specific features of the partition (it could be related to an initial endowment in different types of infrastructure, but could also reflect the difference in geographical conditions or governance quality). Rokicki and Stępniak (2018) identified discrepancies in the impact of major transportation investment projects on different measures of regional development between the rural and urban areas of Poland. In our case, we account for these, by introducing the metropolitan dummy showing an advantage in the extensive trade margin of urbanised areas.

Only in the case of the distance to domestic roads as well as the seaports, the impact for DOEs is stronger than for FOEs. For motorways and railroads in less endowed parts of the country, the impact for FOEs is stronger. As for airports, it is the case of the Prussian and Russian partitions. That can be due to the higher mobility of FOEs and thus a more conscious choice of location for the production and exporting activity.

4 Concluding remarks

The paper has shown the differences in the locational preferences of FOEs versus DOEs. This is a relatively new thread of research, as the existing literature insufficiently treats the role of ownership thereof. Compared to DOEs, FOEs pay more attention to proximity to infrastructure endowments (especially high-speed roads). The differences between FOEs and DOEs, however, are expected to be lower, once new transport infrastructure will be implemented. With time, DOEs are expected to be more prone to infrastructure endowment and their changes thereof.

Agglomeration externalities, in the vicinity of metropolitan areas, play a greater role in FOEs' location decisions. Also, historical factors affect the spatial distribution of exporters, especially if the interaction of path dependency with infrastructure endowment is introduced.

As the extensive margin of exports understood as the number of exporters in the population of region's firm shows strong regional heterogeneity, the inquiry into the determinants of the spatial distribution of exporters brings an important intelligence for regional authorities.

Exporters represent the most productive firms overall with foreign-owned enterprises in our sample enjoying an additional advantage over domestic exporters (refer to Fig. A.1 in online annexe), whose activity contributes to the sorting of regions. This has been also well established in the literature of the subject, for example, Mayer and Ottaviano (2008). Their activity thus more than proportionately can contribute to the sorting of regions by productivity. Furthermore, FOEs pay more attention to the proximity to inputs, including infrastructure, which enables a significant reduction in trade costs, given their internationalisation strategy.

On the other hand, DOEs' locations seem to reflect deeper-rooted factors, for example, connected with the location of industrial areas, local patriotism, family location or path dependency. The DOEs, having less motivation to relocate, seem to continue operation in disadvantaged regions, even with the lack or insufficient quantity/quality of inputs or accessibility to the external markets. Worse access to transport infrastructure and networks will, however, negatively affect their export performance. Our research contributes to the discussion on the differences in firms' locational behaviour. FOEs versus DOEs represent different types of entrepreneurship as explained by the theory of FDI, which according to Stam (2009) affects locational choices. Although firms' migration has not been a direct subject of our inquiry, the results of the research shed light on where the FOEs will migrate further and concentrate in space.

Our research also contributes to bridging the gap between regional and international economics. We supplement the prior seminal contributions by, for example, Farole and Winkler (2014), Rodríguez-Pose et al. (2013) or Cassey et al. (2016) by providing new evidence on the role of ownership in location decisions of exporters. Our conclusions are furthermore in line with the viewpoint of Capello (2016) that space is a source of economic advantages, which are differently utilised by FOEs and DOEs.

Referring to Stam's (2009) theoretical framework, exporting domestic-owned entities represent caterpillars that transform into butterflies. Butterflies are more productive, bigger and more innovative—compared to non-exporting domestic-owned entities (which is well described theoretically by Melitz's firm heterogeneity concept and proven empirically). However, many of these butterflies "don't leave", due to embeddedness in regions of their origin, which reflects the role of path-dependency. FOEs perform internationalised networks and are more footloose. They prefer locations with best access to transport infrastructure.

The obtained results lead to important policy recommendations, which could boost the efficiency of the regional development policy. Local authorities can enhance the attractiveness of particular locations for exporters (FOEs in particular), by investing in infrastructure and human capital for instance by adjusting vocational training systems to the existing and potential exporters' needs. It is in line with the results of Dziemianowicz et al. (2019) who show the importance of labour market supply for FDI attraction.

Noting the role of infrastructure in economic development and the existing variation in international and domestic accessibility, improving accessibility to different parts of the country should become a major direction of public policy. This implies fast extensions of major infrastructural corridors with international significance into the eastern and south-eastern parts of Poland. The elimination of gaps would create a balanced and holistic transport system. The improvements in the intra-regional transport infrastructure will decrease differences in the accessibility of urban and rural areas to regional growth poles, which would contribute to the dissemination of positive spillover effects originating in metropolis. Referring to the ongoing discussion on the direction of the regional policy, the development of the metropolitan areas should be supported. This stands in contrast to the equalisation-oriented regional policy model discussed. From a policy perspective, the observed path dependency could be perceived as a major bottleneck to the development of certain, particularly less developed regions.

We find two potential limitations to our approach. Due to data limitations, we, unfortunately, cannot account at this stage for sectoral heterogeneity as well as the origin of foreign capital. At this stage, we had to assume a similar pattern of the composition of FOEs and DOEs across sectors in LAU 1 units. Data allowing, both directions are envisaged to be explored in our future studies. Moreover, there are other possible dimensions of firms' heterogeneity to be inquired, that is, footloose versus non-footloose and FDI makers versus non-FDI makers; it may also reflect structural characteristics, for instance, the type of innovativeness.

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