Market choice and technology intensity of exports in international business networks: Firm-level evidence from Poland

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A B S T R A C T
Objective: The objective of the article is to study links between market choice and technology intensity of exports in international business networks for firms located in Poland during the 2016-2020 period.
Research Design & Methods: We analysed the decisions of firms to sell in one or more geographical markets (national, European, non-European) using the Community Innovation Survey of Polish manufacturing and services firms. We singled out firms that are subsidiaries of multinational enterprises originating from large developed economies including the US, Germany, UK, and France, and compared their market choices to those of indigenous firms.
Findings: The results show that membership in international business networks increases the probability of exporting. However, the effects differ by the parent company's country of origin. The increase in the probability of EEA+ market presence is especially high in the case of German and British business groups and less pronounced in the case of American and French groups. On the other hand, membership in the American, French, and other business groups increases the probability of selling to non-EEA+ markets. The role of foreign business groups depends on the technology intensity of the industry in which they operate. German subsidiaries are the most likely to export if they are active in the high-tech, medium-low-tech, and low-tech manufacturing sectors. For French subsidiaries, it is in the medium-high-tech and high-tech manufacturing sectors. High-tech services are likely to be exported by members of foreign business groups regardless of the origin of the parent company.
Implications & Recommendations: Our study showed the essential role of European integration for exports of firms based in Poland. It also showed that the risk of technologically stagnant 'East' – 'West' networks, similar to Mexican *maquilladora,* based mainly on the low cost of labour, did not materialize.
Contribution & Value Added: The work is original as it uses a unique Polish CIS firm-level dataset that allows for distinguishing between market choices of foreign-owned and indigenous firms located in Poland.
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INTRODUCTION

During the last three decades a global tendency for international business networks (IBNs) to dominate the reinforcement of corporate growth strategy has been observed. Mirroring this development, multinational enterprises (MNEs) decentralized their internal structures in the 1990s to become networked firms (Buckley & Casson, 1998). Extensive literature has emerged on the formation of IBNs that seeks to explain the determinants and motives of firms to engage in such networks.

IBNs, which are usually organized by Western MNEs lead to a division of labour within the value chain of an industry and may stretch across many countries.

Participation in IBNs has been of particular importance for developing and transitioning economies through the expansion of global value chains (GVCs). The inability of actors in production networks to self-organize due to institutional uncertainty or coordination failures can affect the prospects for reconfiguring their economies and integration with the world economy. This process may lead to the emergence or non-emergence of network organizers that act as promoters of innovation, production, and trade linkages. Therefore, understanding the transformation of business networks and their realignment with global networks requires a better understanding of network organizers. This issue is especially relevant in the context of Central and East European countries (CEECs) where during the communist period enterprises acted as production units only, while technology development was delegated to isolated academic organizations and innovation processes were governed through government and party hierarchies. After the collapse of communism and successful economic transition MNEs became the most active network organizers in CEECs.

International trade patterns of CEECs cannot be fully understood without considering the strategies of MNEs that have been shaping foreign direct investment (FDI) and outward processing traffic (OPT) in the region (Radosevic & Hotopp, 1999). In particular, the international fragmentation and globalization of production within MNEs imply that their subsidiaries might be export-oriented due to the strategic decisions of parent companies. Consequently, the participation of foreign-owned firms in host country exports can be higher compared to that of indigenous firms. The influence of IBNs on CEECs is supposed to improve their competitive positions in foreign markets. However, studies on the integration of indigenous firms into such networks in CEECs and their performance are still rather limited.

The discussion and research on IBNs in CEECs started already in the late 1990s. For example, Ellingstadt (1997) predicted the emergence of 'East' – 'West' IBNs that would resemble *maquilladora* types of relationships in Mexico. According to his view, CEECs could operate only as a low-cost labour base with restricted innovation opportunities. In the alternative vision, CEECs would operate as complements of West European economies (Zysman & Schwartz, 2008). Kurz and Wittke (1998) used the example of German firms to show that they do not exploit cheap labour but rather develop complementary specialization that results in a strategic rearrangement of tasks and functions within value chains. In this way, CEECs capacities could be integrated into GVCs organized by Western MNEs.

However, the formal validation of these competing views requires extensive empirical research based on individual firm-level datasets. Therefore, the main objective of this article is to study links between market choice and technology intensity of exports in IBNs for firms located in Poland during the 2016-2020 period using the Community Innovation Survey (CIS) of Polish manufacturing and services firms. The case of Poland is particularly illustrative and worth investigating. Poland is the biggest of the new EU member states and one of the most successful transition economies in terms of attracting FDI. According to Statistics Poland (2024), in 2022, the country hosted 22204 foreign affiliates which accounted for over 14% of total employment and 55% of all exports.

In our study, we focused on the decisions of firms to sell in one or more geographical markets (national, European, non-European) and see how these decisions differ with firms' participation in various IBNs and domestic firms. In particular, we singled out firms that are subsidiaries of multinational enterprises originating from large developed economies such as the US, Germany, the UK, and France, and compared their market choices with those of Polish standalone firms and members of Polish business groups. Furthermore, we extended our analysis by studying interactions between foreign business group membership and the technological intensity of exports.

We performed estimations for two overlapping periods with different dependent variables. Firstly, we estimated the Tobit model for shares of sales to three markets (national, European, and non-European) for the period 2018-2020. Secondly, we ran the probit model by estimating the dummy variable describing firms' presence in one of the three markets for the 2010-2020 period.

Our study shows that membership in IBNs increases the probability of exporting compared to domestic companies. However, the effects differ by the parent company's country of origin. The increase in the probability of EEA+ market presence is especially high in the case of German and British business

groups and less visible in the case of the American and French groups. On the other hand, membership in the American, French, and other business groups increased the probability of selling to non-EEA+ markets. Moreover, membership in a foreign business group increases the probability of exporting to the EEA+ market in the majority of sectors. This pattern is especially visible in the case of German and French subsidiaries. The highest values of estimates in the case of German groups are visible in the case of low-tech, medium-low tech and high-tech sectors. In the case of French subsidiaries, the highest probability is observed in high-tech sectors. It is also high in the case of medium high-tech and high-tech services. The pattern of EEA export orientation of British and American groups is also quite noticeable but diversified. Noteworthy, membership in all foreign business groups increases the chances of exporting high-tech services and rarely in low-tech services.

The structure of this article is as follows. In the next section, we will provide the literature review. Then, we will describe the analytical framework and the dataset. Subsequently, we will report and discuss our empirical results. The last section will provide a summary and conclusions.

LITERATURE REVIEW

The literature defines networks as groups of firms that can take various forms. Typically they include market-based or hierarchical ties. However, they can also consist of firms engaged in horizontal trust-based cooperation. In particular, networks involve relationships that depend on the use of various resource-sharing and monitoring mechanisms to overcome problems resulting from contract incompleteness. By pooling their resources, the members of a business network can increase their flexibility through better specialization and risk- and knowledge-sharing. Rugman (1997, p. 182) noted that the lead company at the centre of a network, 'provides … strategic and organizational leadership … beyond the resources that, from an accounting perspective, lie directly under … [its] … management control.' According to Ernst (1999, pp. 15-16), 'the lead company derives its strength from its control over critical resources and capabilities and from its capacity to coordinate transactions between different network nodes. Both are the sources of its superior capacity for generating economic rents. The lead firm heavily determines the growth and direction of suppliers.'

The business networks have a spatial dimension. They can be local, regional, national, or international. In the international business literature, the last dimension receives the most emphasis due to MNEs' activities in host countries. In principle, network organizers can be any actors with the necessary capability and resources. However, given management, finance, and technology gaps in CEECs, MNEs are regarded as the most important network organizers. Moreover, MNEs may affect innovation dynamics, productivity, and export performance in host countries (Pereira *et al.*, 2020; Wang & Wang, 2021; Liu & Li, 2022). In the literature on FDI spillovers, foreign subsidiaries are considered conduits of their parent companies' knowledge, technology, and expertise which may spill over onto local firms (Marin & Bell, 2006; Duan *et al.*, 2020; Almodóvar & Nguyen, 2022).

The magnitude and quality of interactions of foreign-owned firms with indigenous firms is dependent on their resources and capabilities. In particular, the literature on the effects of FDI on host country economies has emphasized the importance of indigenous firms possessing absorptive capacity, not only to allow them to interact with foreign subsidiaries but also to get the most out of such interactions (Cohen & Levinthal, 1990; Marin & Bell, 2006; Kolasa, 2008; Yokota & Tomohara, 2010; Cieślik & Hagemejer, 2014; Villar *et al.*, 2020).

Anecdotal evidence shows that MNEs are important network organizers in CEECs. The car manufacturing industry example underlines the role of individual firms in shaping patterns of networks (Pavlinek, 2002; 2006). Foreign car manufacturers transferred their networks to the CEE region creating supply networks and systems of innovation (Tulder, 2004). Industry studies document that they range from low-cost base operations to those where they operate as a complementary production base. Tulder and Ruigrok (1998, p. 223) concluded that four types of IBNs in the European car industry have different strategic goals for the region: 'Followers and lock-out networks largely see the region as a still limited market. Peripheral firms primarily use the region as an entry into the West European car market. Front-runner firms have adopted the most sophisticated (and also the most difficult to

manage) strategy: they see the region as a production site for cheap reimports back into the home base; they see it as a source for lower-end world cars and components; and they see the region as a market.' Jürgens and Krzywdzinski (2009) examined the evolution of work models in the car industry to argue that work models in CEECs did not follow the low-road trajectory.

Furthermore, MNEs directly affect the export performance of host countries as they often play a leading role in organizing and shaping GVC activities (Ryan *et al.*, 2020). Global value chains reinforce globalization, reshape the structure of international trade, increase direct collaborations between indigenous firms, and affect their performance. In recent years, Poland has emerged as one of the champions in GVCs and firms in Poland are actively engaged in European value chains. In particular, Germany is an important source of the 'imported' value added in other European countries' exports and has a large share of foreign VA in gross exports. Domestic value added in gross exports of Poland to the EU countries increased in the majority of sectors, including modern technology sectors (such as electrical and optical instruments) over the period of 1995-2011 (Taglioni & Winkler, 2016). Cieślik *et al.* (2021) investigated the relationship between foreign ownership of firms and innovation activities in a wide group of CEECs. In particular, they studied the effects of FDI and firms' participation in hierarchic GVCs on product, process, marketing, and organizational innovations. Their results show that participation within MNE GVC networks makes firms less likely to introduce innovations, especially product and marketing innovations and that this effect is particularly strong in CEECs.

However, no attempt so far has been made to study the link between business group memberships, technology intensity of exports and the probability of entering various types of markets for a new EU member state like Poland. This is surprising given the fact that Poland is the biggest country among the new member states that joined the EU in the first wave of the Eastern enlargement in 2004 and has strong business links to Germany (Taglioni & Winkler, 2016; Becker & Cieślik, 2020). Therefore, this article attempts to fill an existing gap in the literature. In particular, we hypothesized that companies that are members of international business groups, and hence enjoy better access to external resources, are more often integrated in GVCs, and are more likely to export than domestic firms. We can also expect that export performance depends on the country of origin of the lead company and the sector's technological advancement. In particular, we believe that members of international business groups organized by the EEA-based firms are more likely to export to European markets compared to the Polish firms and the members of the non-EEA-based firms. Moreover, in line with case study evidence, we hypothesized that membership in IBNs increases the probability of exporting in all sectors, including more technologically intensive goods and services. Our findings should contribute to a better understanding of firm-level determinants of the export performance of firms in Poland.

RESEARCH METHODOLOGY

Our dataset consisted of five runs of the Polish edition of the Community Innovation Survey. The survey included all of the manufacturing firms employing more than 49 people, as well as a sample of firms employing 10-49 people. The questionnaire did not cover micro firms employing fewer than 10 workers. For services, we surveyed a sample of firms from selected industries. In total, we have 74 218 observations from the 2012, 2014, 2016, 2018, and 2020 waves of CIS. The survey embraced a total of 34 521 unique firms (the panel was not balanced). Table 1 shows the breakdown of firms by the number of times they appear in the CIS.

Table 1. The number of firms surveyed in Poland's CIS database

Times in CIS	1	2	3	4	5
Number of firms	17 438	6 491	3 392	2 378	4 822

Source: CIS survey.

The CIS questionnaire was significantly modified in 2018 when scholars introduced the question of the estimated share of sales to three types of markets. Consequently, for the 2018 and 2020 editions of the CIS, we had the data on the estimated shares of sales to the domestic market (we call this variable

share_ntl) in 2018 and 2020 respectively. The firms also answered questions about their estimated shares of sales to the EU or associated countries (*share_EEA+*) and to other countries (*share_oth*). Our baseline analysis consisted of the estimation of double-censored Tobit models of these shares.

On the other hand, for earlier editions of the CIS (2012, 2014, and 2016) we only had dummy variables indicating whether a firm did or did not sell to a given market. We call these variables *market_ntl, market_EAA+,* and *market_oth,* respectively. These variables refer to the respective three-year periods, *e.g.* 2010-2012 for CIS 2012. Since these questions were not included in CIS in 2018 and 2020, we imputed the data based on the estimated shares, *e.g., market_ntl=1* if and only if *share_ntl>0.* We then validated the results from our Tobit regressions by estimating probit models that covered all five editions of the CIS.

As for the independent variables, we were particularly interested in the effects of participation in IBNs and the technology intensity of exports. We singled out domestic firms (standalone and those that belonged to Polish business groups) or those that belonged to IBNs. In the case of IBNs, we included dummies for the subsidiaries of multinational enterprises that were the largest foreign investors in Poland. In particular, we singled out four major countries of investors that included: Germany, France, the UK, and the US, which had the largest number of foreign subsidiaries in our sample.

Our control variables included the percentage of workers with higher education (our measure of human capital), dummies for the members of domestic groups of firms, variables related to the innovation performance of firms, and OECD technological categories (based on NACE-Rev-2 classification). We also controlled for firm size, because larger firms can exploit scale economies more easily. We controlled for the innovation performance of firms, because it can be correlated with a variety of firm capabilities that are important for exporting. However, we did not believe we could identify any causal relationship between innovation and exporting in our simple framework. Therefore, we did not interpret (or even report) the estimated coefficients. Due to the confidentiality conditions imposed by Statistics Poland, data on revenue and the exact number of employees were unavailable. Instead, we only had information on the firm size category (*i.e.,* small which is the reference, medium, and large).

In our baseline analysis, we started by estimating key dependent variables, *i.e. share_ntl, share_EEA+* and *share_oth.* Since these dependent variables are, obviously, from the [0-100] interval, for each variable, we applied a separate double-censored Tobit model. Specifically, we assumed that:

$$y_i = \begin{cases} 0 & \text{if} & y_i^* \leq 0 \\ y_i^* & \text{if} & 0 < y_i^* < 100 \\ 100 & \text{if} & y_i^* \geq 100 \end{cases} \tag{1a}$$

and

$$y_i^* = \mathbf{x_i}\boldsymbol{\beta} + \varepsilon_i \tag{1b}$$

in which y was one of our dependent variables (*e.g. share_ntl*), y^* was the respective latent variable, $\mathbf{x_i}$ was the vector of independent variables (see Table 1), $\boldsymbol{\beta}$ was the vector of parameters to be estimated, and we assumed that $\varepsilon_i \sim N(0, \sigma^2)$. In the context of these estimations, we also reported the marginal effects for both extensive and extensive margins.

In the next part of our analysis, we estimated separate probit models for *market_ntl, market_EAA+,* and *market_oth*. This is a series of probit models on a pooled dataset in which we lumped together observations from all five waves of the CIS (2012-2020). By analogy to (1a)-(1b), we considered the following specification:

$$z_i = \begin{cases} 0 & \text{if} & z_i^* \leq 0 \\ 1 & \text{if} & z_i^* > 0 \end{cases} \tag{2a}$$

and

$$z_i^* = \mathbf{x_i}\boldsymbol{\gamma} + \epsilon_i \tag{2b}$$

in which z was one of the binary dependent variables (*e.g. market_ntl*), the vector of explanatory variables $\mathbf{x_i}$ was the same as in the model (1a)-(1b), $\boldsymbol{\gamma}$ was the vector of parameters to be estimated and we assumed that $\varepsilon_i \sim N(0, \rho^2)$.

Finally, we extended our empirical analysis by including interactions between foreign business group

membership and the technological intensity of exports. In this way, we verified our hypotheses concerning the technological intensity of firms operating in Poland and exporting goods to various markets.

Table 2. Definitions of variables

No.	Variable	Description	Type of variable
		Independent variables	
1.	*share_ ntl*	The share of firm's sales on the domestic market	continuous [0-100]
2.	*share_EEA+*	The share of firm's sales on the EEA+ market (EU, UK, NO, CH, IS and LI)	continuous [0-100]
3.	*share_oth*	The share of firm's sales on other foreign markets	continuous [0-100]
4.	*market_ ntl*	The firm sells to the Polish market	dummy
5.	*market_EEA+*	The firm sells to the EEA+ market	dummy
6.	*market_oth*	The firm sells to other foreign markets	dummy
		Key explanatory variables	
7.	*group_DE*	Member of a group of firms and the parent company is located in Germany	dummy
8.	*group_US*	Member of a group of firms and the parent company is located in US	dummy
9.	*group_FR*	Member of a group of firms and the parent company is located in France	dummy
10.	*group_GB*	Member of a group of firms and the parent company is located in United Kingdom	dummy
11.	*group_foreign_oth*	Member of a group of firms and the parent company is located in other foreign country	dummy
12.	*Domestic*	Standalone firm or member of a group of firms and the parent company is located in Poland	dummy
		Control variables (estimates not reported)	
13.	*Medium*	The firm has between 51 and 250 workers	dummy
14..	*Large*	The firm has more than 250 workers	dummy
15.	*high_ed*	Percentage of workers with higher education	continuous [0-100]
16.	*prod_inn*	The firm introduced product innovations in the last three years	dummy
17.	*proc_mnf_inn*	The firm introduced process innovations in the last three years	dummy
18.	*org_inn*	The firm introduced organizational innovations in the last three years	dummy
19.	*markt_inn*	The firm introduced marketing innovations in the last three years	dummy
20.	*Industry*	2-digit NACE-Rev 2 industry	categorical
21.	*Year*	year of the CIS	discrete
		Technology interaction variables	
22.	*HT*	High-technology manufacturing	dummy
23.	*HTS*	High-tech services	dummy
24.	*MLT*	Medium-low-technology manufacturing	dummy
25.	*LTS*	Low-technology services	dummy
26.	*MHT*	Medium-high-technology manufacturing	dummy
27.	*LT*	Low-technology manufacturing	dummy
28.	*LTS*	Low-technology services	dummy

Note: EEA+ market includes EU, UK, Norway, Switzerland, Iceland and Liechtenstein.
Source: CIS survey.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 3 reports the descriptive statistics of our sample covering the period 2016-2020. We had 14 711 observations from the 2018 wave of CIS (2016-2018) and 14 010 from the 2020 wave (2018-2020). There were 8 597 firms covered by both runs of the survey.

The data summarized in Table 3 reveals that small firms were underrepresented in our sample. The share of medium firms was close to 47% and that of large firms – to 16% in 2020. Noteworthy, we surveyed all manufacturing firms employing more than 49 people and only a sample of firms employed 10-49 people. Moreover, for services firms, we looked at a sample of even larger companies. According

to Statistics Poland, a few years earlier in 2016, the composition of firms with at least 10 workers was as follows: small firms 64%, medium 20%, and large firms 7%. About 6% of firms belonged to foreign-owned companies; the largest shares of firms belonged to German (3.3%), American (0.9%), and French (0.8%) business groups. On the other hand, the overwhelming majority in the sample were Polish standalone firms or belonging to Polish business groups. They constituted our reference group. We noted that 70% of firms delivered their goods to the national market (PIE, 2019). Thus, the Polish market remains the most important market for most firms.

Table 3. Summary statistics for CIS 2020: Key variables

variable	share_ntl	share_EEA	share_oth	group_DE	group_US	group_FR	group_GB	group_oth	group_dom	medium	Large	high_ed
mean 2020	69.378	25.042	5.544	0.033	0.009	0.008	0.004	0.063	0.112	0.467	0.164	32.971

Source: own elaboration based on CIS data.

In the extension of our study, we analysed the exports of foreign-owned firms defined by techno-logical categories. These subgroups are defined by the classification of Eurostat NACE technological categories of industries (see Table A1 in the Appendix for details).

Econometric Analysis: Baseline Results

Table 4 shows our baseline estimation results. We obtained them from the Tobit model, a model of the shares of revenue from sales to the national market, European market, and other markets, for the 2018-2020 period. In Table 4 and in all other estimations in this text, we included control variables for firm size, the level of human capital, innovation performance, and year and industry variables, as defined in Table 2.

Table 4. Tobit estimations based on CIS 2018 and CIS 2020

VARIABLES	(1) share_ntl	(2) share_EEA+	(3) share_oth
group_DE	-34.90***	35.92***	-1.695
	(1.529)	(1.479)	(1.208)
group_US	-45.68***	21.32***	28.86***
	(2.595)	(2.334)	(2.379)
group_FR	-32.46***	32.26***	3.090
	(2.594)	(2.473)	(1.988)
group_GB	-44.06***	38.63***	11.18***
	(3.477)	(3.273)	(2.715)
group_foreign_oth	-31.62***	28.57***	7.354***
	(1.073)	(1.031)	(0.852)
Constant	119.9***	-20.90***	-41.17***
	(1.300)	(1.230)	(1.272)
Observations	28 721	28 721	28 721
Uncensored	18078	17571	9122
Left-censored	1315	10333	19351
Right-censored	9328	817	248
F-test	150.9	125.7	40.82
Prob > F	0	0	0
Pseudo-R2	*0.0457*	*0.0425*	*0.0380*

Note: *** p<0.01, ** p<0.05, * p<0.1. Industry, firm size, level of human capital, innovation performance, industry and time controls included (not reported); robust standard errors in parentheses.
Source: own study.

In Table 4, almost all variables were significant at the 1% level and displayed expected signs. The reference group was a standalone Polish firm or a member of a group of firms when the parent company was located in Poland. Column (1) reports the estimation results associated with a relative share of sales to the national market. Implicitly, being a Polish firm is positively related to a higher share of sales in the national market, while memberships in IBNs significantly reduces this share. It means that international business groups have a much larger scale of operation in comparison to national market. The firms from the American and the British IBNs are the most outward-oriented (least oriented towards the Polish market), while the firms belonging to the European IBNs (Germany and France) are slightly less so.

Column (2) reports the estimation results for the EEA+ market. Being a Polish firm (a reference group) reduced the share of sales to EEA+. On the other hand, being a member of a foreign IBN significantly increased the share of sales on the EEA+. The increase in the share of sales to an EU market presence was especially high in the case of members of British, German and French IBN; the estimated parameter values for American and other countries' business groups were also positive but of a lower magnitude. Thus, pro-EEA+ market orientation was the strongest among European IBN, and (probably) reflects the trade and financial liberalization within the Single European Market (SEM). In the case of membership of French business groups, the estimate for EEA+ was higher in comparison to the non-EEA+ market.

Finally, column (3) reports the estimation results for the share of sales to non-EEA+ markets. The major non-EEA+ export markets for Poland in 2019 were Russia (3.0% of exports), the US (2.8%), Ukraine (2.0%), China (1.0%), Turkey (0.78%), and Belarus (0.69%) (see: https://oec.world/en/profile/country/pol). The role of IBN for exports to non-EEA+ countries was somewhat different in comparison to European markets. Membership in a US business group had the strongest positive effect on exports to other markets. The membership in the UK and other business groups had also a positive effect on these exports. These results probably reflect the global scope of operation, including the GVCs, of American, British, or other business groups. Meanwhile, the membership in German and French IBN had no significant effect on the share of sales to non-European markets in comparison to Polish firms. This result probably reflects a large share of Russian, Ukrainian, and Belarusian markets in Poland's exports, where EU firms were probably less active compared to Polish ones. This might be also explained by the fact that German firms organize their GVCs mostly among European firms (Taglioni & Winkler, 2016).

To complete the picture we report in Table 5 the marginal effects of the IBN variables of our baseline Tobit model. For this type of model, we had two types of marginal effects. Noteworthy, the intensive margin was from 0 to 100, while the extensive margin – from 0 to 1.

Table 5. Marginal effects of IBN membership (cf. Table 4)

VARIABLES	(1) intensive share_ntl	(2) intensive share_EEA+	(3) intensive share_oth	(4) extensive market_ntl	(5) extensive market_EEA+	(6) extensive market_oth
group_DE	-34.90***	35.92***	-1.695	-0.921***	0.819***	-0.0375
	(1.529)	(1.479)	(1.208)	(0.0605)	(0.0622)	(0.0473)
group_US	-45.68***	21.32***	28.86***	-1.220***	0.361***	0.654***
	(2.595)	(2.334)	(2.379)	(0.0813)	(0.0809)	(0.0711)
group_FR	-32.46***	32.26***	3.090	-0.750***	0.739***	0.162**
	(2.594)	(2.473)	(1.988)	(0.114)	(0.0991)	(0.0825)
group_GB	-44.06***	38.63***	11.18***	-1.126***	0.742***	0.347***
	(3.477)	(3.273)	(2.715)	(0.102)	(0.107)	(0.0961)
group_foreign_oth	-31.62***	28.57***	7.354***	-0.812***	0.521***	0.262***
	(1.073)	(1.031)	(0.852)	(0.0438)	(0.0358)	(0.0308)
Constant	119.9***	-20.90***	-41.17***	2.487***	-0.674***	-1.369***
	(1.300)	(1.230)	(1.272)	(0.0899)	(0.0348)	(0.0372)
Observations	28 721	28 721	28 721	28 155	28 721	28 721

Note: Industry, firm size, level of human capital, innovation performance, industry and time controls included (not reported); robust standard errors in parentheses.
Source: own study.

Firstly, we reported the intensive margin, *i.e.* the average increase in the variable *assuming* that it is inside the interval (columns (1)-(3) in Table 5. For instance, conditional on the firm having *some* exports, a firm belonging to German IBN has a share of EEA+ exports that was 35.9 percentage points higher than an average firm in the sample.

Columns (4)-(6) of Table 5 report the intensive margin, *i.e.* the average increases in the probability of selling to a specific market. Apparently, the probability that a German-owned firm sells to the EEA market was 0.819 higher than the probability of an average firm selling to this market. This effect was a bit stronger than for French and British IBNs and substantially higher than for US-owned IBNs. Hence, these results show a higher probability of starting and expanding exports to the EEA+ market of firms that belong to German, French, and British IBNs.

The baseline Tobit estimations reported in Tables 4 and 5 were based on the 2018 and 2020 editions of CIS. To validate them, we additionally performed a series of probit models on a pooled dataset, in which we merged observations from all five waves of the CIS, covering the period 2010-2020. In this case, the dependent variable was also a dummy indicating if the firm was selling to a given market or not. Table 6 shows the results of these estimations.

Table 6. Baseline probit estimations for the period 2010-2020

VARIABLES	(1)	(2)	(3)
	market_ntl	*market_EEA+*	*market_other*
group_DE	-0.672***	0.848***	0.0460
	(0.0477)	(0.0489)	(0.0384)
group_US	-0.995***	0.411***	0.607***
	(0.0651)	(0.0661)	(0.0578)
group_FR	-0.494***	0.671***	0.251***
	(0.0886)	(0.0770)	(0.0634)
group_GB	-0.736***	0.755***	0.239***
	(0.0861)	(0.0883)	(0.0795)
group_foreign_oth	-0.403***	0.193***	0.0612***
	(0.0220)	(0.0173)	(0.0171)
Constant	0.755***	-0.930***	-1.377***
	(0.0359)	(0.0330)	(0.0338)
Observations	74,216	74,216	74,216

Notes: Robust standard errors in parentheses. Industry, firm size, level of human capital, innovation performance, industry, and time controls included (not reported); robust standard errors in parentheses.
Source: own study.

The results in Table 6 support conclusions regarding the market choices of firms in Poland. Those belonging to foreign IBNs had a lower probability of entering the national market than Polish reference firms and were much more export-oriented. Firms from European IBNs (German, British, and French) had a higher probability of entering the EEA+ market, while firms belonging to the US IBNs were more outward-oriented, towards other markets.

Extended Analysis: The Interaction Between Capital Groups and the Technological Intensity of Exports

To enrich our analysis, we analysed the structure of the technological intensity of exports of foreign IBNs. Table 7 reports the results of the extended study that includes interactions between foreign IBN membership and the technological intensity of exports as defined by the OECD categories. This allowed us to verify our hypotheses concerning the technological intensity of firms operating in Poland. Therefore, we made estimations for various subgroups of foreign-owned firms. The extended analysis focused on the main foreign business groups and we skipped the estimations for Polish firms and other countries IBNs.

Table 7. Extended estimations with interactions between foreign business group membership and technological intensity

VARIABLES	-1	-2	-3	VARIABLES	-1	-2	-3
	share_ntl	share_EEA	share_oth		share_ntl	share_EEA	share_oth
DE_HT	-40.00***	46.64***	-11.58*	FR_HT	-22.58*	33.23***	-20.86
	-8.405	-8.359	-6.225		-11.64	-10.71	-14
DE_HTS	-29.38***	36.29***	-6.123	FR_HTS	-21.47***	26.73***	-3.056
	-5.91	-5.516	-4.458		-6.219	-5.917	-4.536
DE_LT	-36.82***	37.50***	-1.284	FR_LT	-26.21***	25.40***	6.356
	-3.015	-2.927	-2.632		-6.492	-5.955	-5.207
DE_LTS	-6.887	8.483*	-5.62	FR_LTS	-12.52	4.468	-7.466
	-4.773	-4.55	-3.752		-11.56	-10.76	-9.386
DE_MHT	-30.36***	30.68***	-6.758***	FR_MHT	-36.65***	38.51***	-4.92
	-3.241	-3.238	-2.557		-5.512	-5.658	-4.223
DE_MLT	-25.63***	26.51***	-0.958	FR_MLT	-18.30***	16.17***	4.094
	-2.764	-2.605	-2.132		-5.334	-5.212	-3.8
US_HT	-44.26***	15.09**	30.19***	GB_HT	-47.51***	61.05***	-0.943
	-10.89	-6.939	-10.97		-4.26	-4.104	-3.163
US_HTS	-44.26***	13.76***	34.48***	GB_HTS	-51.23***	47.89***	7.987
	-5.688	-4.916	-5.217		-7.176	-7.354	-5.679
US_LT	-43.93***	30.38***	21.12***	GB_LT	-23.05***	28.66***	-5.832
	-6.375	-6.133	-5.811		-8.834	-8.197	-5.889
US_LTS	-12.17	-3.671	13.59	GB_LTS	-18.30*	16.34	4.461
	-10.84	-9.839	-10.07		-10.34	-9.983	-7.934
US_MHT	-31.91***	11.10**	18.67***	GB_MHT	-43.30***	33.52***	7.772
	-4.866	-5.446	-4.272		-8.671	-8.848	-6.932
US_MLT	-36.44***	24.82***	18.01***	GB_MLT	-31.67***	23.08***	18.29***
	-5.16	-5.03	-4.307		-7.855	-7.012	-5.639
Constant					123.0***	-23.70***	-42.24***
					-1.35	-1.276	-1.293
Observations					28 721	28 721	28 721
Uncensored					18 078	17 571	9 122
Left-censored					1 315	10 333	19 351
Right-censored					9 328	817	248
F-test					489.4	657.3	38.39
Prob > F					0	0	0
Pseudo-R2					*0.0393*	*0.0368*	*0.0362*

Notes: Abbreviations for analyzed sectors: HT: High-technology manufacturing; HTS: High-tech services; MLT: Medium-low-technology manufacturing. LTS: Low-technology services; MHT: Medium-high-technology manufacturing; LT: Low-technology manufacturing. The detailed list of OECD categories is listed in the Appendix. Control variables included (not reported); robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: own study.

The results for the EEA+ market, reported in columns (2), show that IBN memberships increased the estimated shares of sales to the EEA market for most sectors. This pattern was especially visible in the case of German and British subsidiaries. The EEA+ market orientation was pronounced in all six subsectors of German and French IBNs, and in five subsectors in the case of the American and British firms. German IBNs were especially active in high-tech manufacturing and services and in low-tech sectors. We observed a similar pattern towards high-tech sectors in the case of British and French IBNs, while the American IBNs were more oriented towards low-tech sectors.

Column (3) reports the results obtained for exports to non-European markets. They show that membership in the American IBNs matters for almost all sectors. The highest values were reported for high-tech manufacturing and services sectors, and they were not significant for low-tech services.

There was no clear pro-export orientation towards non-European markets in the case of members of German and British IBNs; which was in line with expectations.

CONCLUSIONS

In this article, we explored the relationships between market choice, business group memberships, and technological intensity of Polish manufacturing and services firms in 2010-2020. We based our firm-level analysis on five runs of the Polish edition of the Community Innovation Survey. Specifically, we analyzed the decision of the firms to sell in one or more geographical markets, namely national, European (EEA+), and non-EEA+, and evaluated how firms differ in terms of firm business group membership and technology characteristics. In line with our literature-based predictions, being a member of IBNs increased the probability of exporting. However, the effects differed by the lead company's country of origin. The increase in the probability of EEA+ market presence was especially high in the case of German, British, and French business groups and less visible in the case of the American business groups. On the other hand, membership in the American, and British business groups increased the probability of selling to non-EEA+ markets.

We extended the baseline analysis by looking at the interaction between international business group membership and technological intensity of exports. The membership in IBNs increased the probability of exporting to the EEA+ market in the majority of sectors. This pattern was especially visible in the case of German and French subsidiaries. The highest values of estimates in the case of German business groups were visible in the case of high-tech sectors (manufacturing and services) and in low-tech, medium-high-tech sectors. In the case of French subsidiaries, we observed the highest probability in high-tech sectors. It was also high in the case of medium high-tech and high-tech services. The pattern of EEA+ export orientation of British and American business groups was also quite noticeable but more diversified. Noteworthy, membership in all foreign business groups increased the likelihood of exporting high-tech services but rarely in low-tech services.

Thus, the firms located in Poland that are members of IBNs enjoy better access to external resources, are more often integrated into GVCs, and are more likely to export than domestic firms. The members of IBNs organized by European-based firms were more likely to export to the EEA+ markets compared to the domestic firms and the members of the non-EEA-based firms. Our study showed the essential role of European integration for exports of firms based in Poland. In particular, the importance of proximity to large European markets is essential for managers of all firms that operate in Poland, especially those that are members of IBNs. It also showed that the risk of technologically stagnant 'East' – 'West' networks, similar to Mexican *maquilladora,* based mainly on the low cost of labour, did not materialize. Polish firms, members of IBNs, are active in both high-tech manufacturing and services and not only in low-tech or medium-low sectors. The main limitation of our study was its focus on a single country. Therefore, in future studies, researchers need to extend the analysis of IBNs to include other CEECs.

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Appendix A: Classification of manufacturing industries in the sample by technology intensity

High-technology manufacturing	NACE-Rev-2 code
Manufacture of basic pharmaceutical products and pharmaceutical preparations	21
Manufacture of computer, electronic and optical products	26
Medium-high-technology manufacturing	
Manufacture of chemicals and chemical products	20
Manufacture of electrical equipment	27
Manufacture of machinery and equipment n.e.c.	28
Manufacture of motor vehicles, trailers and semi-trailers	29
Manufacture of other transport equipment	30
Medium-low-technology manufacturing	
Manufacture of coke and refined petroleum products	19
Manufacture of rubber and plastic products	22
Manufacture of other non-metallic mineral products	23
Manufacture of basic metals	24
Manufacture of fabricated metal products, except machinery and equipment	25
Low-technology manufacturing	
Manufacture of food products	10
Manufacture of beverages	11
Manufacture of tobacco products	12
Manufacture of textiles	13
Manufacture of wearing apparel	14
Manufacture of leather and related products	15
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	16
Manufacture of paper and paper products	17
Printing and reproduction of recorded media	18
Manufacture of furniture	31
Other manufacturing	32
High-tech services	
Air transport	51
Publishing activities	58
Motion picture, video and television programme production, sound recording and music publishing activities	59
Programming and broadcasting activities	60
Telecommunications	61
Computer programming, consultancy and related activities	62
Information service activities	63
Financial service activities, except insurance and pension funding	64
Insurance, reinsurance and pension funding, except compulsory social security	65
Activities auxiliary to financial services and insurance activities	66
Low-tech services	
Wholesale trade, except for motor vehicles and motorcycles	46
Land transport and transport via pipelines	49
Warehousing and support activities for transportation	52
Postal and courier activities	53

Source: Eurostat (2021).

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The contribution share of authors was equal and amounted to ⅓ for each of them.
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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.