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Public debt marriage with R&D management in the V4 and EU-27 countries in the context of the COVID-19 pandemic

Abstract

The aim of the article was to identify the relationship between the value of public debt and selected effects of research and development in the V4 and EU-27 countries, while taking into account the possible impact of the COVID-19 pandemic. Due to the breadth of issues related to the R&D sphere, 2 predictors were identified. The first is R&D expenditure, and the second is the number of employees with higher education employed in R&D. Statistical data analysis was used as a method of collecting and developing the empirical data. The practical implication of the study is to show that both before and in the first year of the pandemic, the relationship between public debt and research, and development activity in the V4 and EU-27 countries was strong, which justifies the in-depth monitoring and study of this relationship in subsequent years of the pandemic.

Keywords: public debt, R&D management, Pearson correlation, V4, EU-27

JEL Classification: O320

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Introduction

Nowadays, there is a significant increase in public debt in many European countries (Eurostat, 2022). The very issue of public debt began to be analyzed in the 1990s. This was especially true of post-communist countries such as Poland, Hungary, the Czech Republic and Slovakia. In each of these countries, the amount of public debt (especially when approached in absolute terms) has been growing dynamically since 1996 (Eurostat, 2022). This aspect may lead to numerous dangers related to the functioning of the state, its financial problems being the first serious hazard. In recent years, the solution to this problem has not been facilitated either by the COVID-19 pandemic (what even exacerbated the problem) or by the war between Russia and Ukraine.

As, on the one hand, research and development is one of the main engines of economic development and the creation of a modern knowledge-based economy (conditioning the efficient use of natural resources and limiting the negative impact on the environment) and - on the other hand - the issue of public debt itself has a large group of supporters and opponents, it was decided to combine these two aspects in one study.

An interesting research problem was the question whether public debt contributes to the implementation of R&D activities. Therefore, this article aims to identify the relationship between the value of public debt and selected indicators of research, and development activity in the V4 and EU-27 countries, while taking into account the possible impact of the COVID-19 pandemic. For this purpose, in the empirical part of the study, an analysis of Pearson's correlation between the amount of public debt and arbitrarily selected measures of research and development activity was carried out.

In the course of the research procedure, the following research hypotheses were formulated:

- Hypothesis (H1) assumes that public debt has a significant impact on the R&D expenditure of the V4 and EU-27 countries, both before and during the COVID-19 pandemic.
- Hypothesis (H2) assumes that there is a relationship between the number of employees with higher education employed in R&D and the public debt of the V4 and EU-27 countries, before the pandemic begins and also in the first year of its duration.

1. Public debt and research and development activities - theoretical analysis

1.1. The public debt

Various definitions of public debt can be found in the literature. For P.A. Samuelson and W.D. Nordhaus, it is […] *the entirety of government obligations in the form of bonds and shorter-term loans. Government debt does not include bonds held by quasi-governmental agencies such as the Central Bank* (Samuelson, & Nordhaus, 2004, p. 578-579).

According to the International Monetary Fund, these are exactly the financial liabilities of the government sector (International Monetary Fund, 2014, p. 36). There are two definitions of the described issue in the structures of the European Union. Both of them are included in the Council Regulation of November 22, 1993 on the application of the protocol on the excessive deficit procedure annexed to the Treaty establishing the European Community (EC No. 3605/93) and in Council Regulation (EC) No. 2223/96. In the first document it was specified that public debt is total gross debt in nominal value present at the end of the year and combined for the public sector. This debt includes deposits, cash, securities and stocks. Partly in contrast to the above explanation, it is possible to find two fundamental differences in the other document, the Council Regulation (EC) No 2223/96. According to this document, public debt has a broader structure, as it additionally includes stocks and other shares, as well as all other technical provisions. Therefore, the rates are higher. The form of valuation is also different here, where the market method was adopted.

In Polish legislation, public debt is perceived as *[…] nominal debt of public finance sector entities, established after eliminating flows between entities belonging to this sector* (Act, 2009). In turn, in the Polish scientific literature this issue was described, among others, by E. Chojna-Duch, who stated that these are *[…] the total financial liabilities of public sector entities due to various from an economic and legal point of view legal and financial events, and above all - shortages resulting from financing a surplus of public expenditure over accumulated public revenue in previous periods; these obligations should take into account their consolidation, that is, the elimination of mutual financial flows between them* (Chojna-Duch, 2012, pp. 273-274).

1.2. R&D activities

Research and development can be defined as systematic work that has been undertaken to increase knowledge about culture, man and society, and to search for completely new solutions to this knowledge (Central Statistical Office, 2022). M. Morawski and G. Kobyłko (2006, p. 201) defined R&D as systematic and planned creative work carried out in order to increase the amount of knowledge and its implementation in innovative applications.

In order for a research project to be carried out, there is a need for appropriate staff. It consists of, among others, researchers and project managers. J. Kisielnicki (2019, p. 27) observes that such projects are one of the most interesting and ambitious challenges for all teams involved in their implementation. The implementing staff, and especially the management staff (project managers), can demonstrate high and unique qualifications in the implementation of research and development tasks. Research and development projects also require the use of *[…] very specific management methods and techniques, such as knowledge management* (Foss, Pedersen et al., 2012, pp. 198-213).

To carry out research and development activities and to implement innovations, highly qualified employees are needed - their number on the market is limited, while employment costs are high. The limited number of professionals shows the direct importance of the mobility of people involved in technology transfer processes.

J. Kisielnicki (2017) added that among the methods of project management, the following are important:

- knowledge, competency and talent management;
- ability to use information and communication technology, including MIS (Management Information Systems) methods and BI (Business Intelligence) systems.

It is worth emphasizing that people involved in R&D in many cases hold academic degrees or are at the stage of obtaining them. The objects of their interest are projects characterized by scientific elements (the use of methods and principles of scientific research).

Among the organizations implementing research and development in Poland, the following can be distinguished (Marek & Białasiewicz, 2011, p. 96):

- public and private universities carrying out R&D activities;
- research centers of the Polish Academy of Sciences;
- science service units (e.g. archives, research libraries);
- research and development units (e.g. Road and Bridge Research Institute, Institute of Non-Ferrous Metals, etc.).

It can be emphasized that one of the external factors determining the implementation of R&D activities are financial resources and access to external financing sources (cf: Lesakova, Wolak-Tuzimek et al., 2016, pp. 209-259). The significant role of financial resources increases the probability of successful implementation of results. This will be manifested by organizations with (even short-term) financial surpluses or having staff with knowledge and skills in the field of obtaining, among others, government funds (e.g. EU funds).

In the case of EU funds allocated to the implementation of R&D projects, Czekański & Gajek, 2015, pp. 68-69 specify the following eligible costs:

- staff costs: researchers, technicians and other support staff to the extent that they are employed on the research project;
- costs of instruments and equipment to the extent and for the period used for the project. If the apparatus and equipment are not used for the project throughout its useful life, only the depreciation costs corresponding to the duration of the project, calculated on the basis of good accounting practice, are eligible costs;
- costs for buildings and land to the extent and for the period used for the project. For buildings, only the depreciation costs corresponding to the duration of the project, calculated on the basis of good accounting practice, are eligible costs. For land, the eligible costs shall be the transfer costs on a commercial basis or actual capital costs incurred.
- costs of contractual research, knowledge and patents purchased or used under a license granted by external sources at arm's length, and costs of consultancy and equivalent services used solely for the project.
- additional overhead costs incurred directly as a result of the project implementation.
- other operating expenses, including costs of materials and similar products incurred directly as a result of the project.

Therefore, it can be agreed that financial resources are one of the most important factors in the implementation of R&D projects. Without them, it is difficult to recruit qualified staff or create appropriate infrastructure and research equipment.

2. Public debt and R&D in the V4 and EU-27 countries - statistical data analysis

2.1. The public debt

In many European countries, public debt tended to increase, but it is worth noting that this was not the case in all of them. In tab. 1 shows the amount of public debt in the countries of the Višegrad Group and the EU-27 in 2010-2020.

Table 1. Public debt in relation to GDP in the countries of the Visegrad Group and the EU-27 in 2010-2020 (in%)

Year	UE-27	The Czech Republic	Hungary	Poland	Slovakia
2010	80,4	37,1	80,0	53,5	40,8
2011	81,7	39,7	80,3	54,7	43,3
2012	85,0	44,2	78,1	54,4	51,9
2013	86,7	44,4	77,2	56,5	54,9
2014	86,8	41,9	76,5	51,1	53,7
2015	85,0	39,7	75,7	51,3	51,8
2016	84,2	36,6	74,8	54,2	52,4
2017	81,6	34,2	72,1	50,6	51,6
2018	79,6	32,1	69,1	48,8	49,6
2019	77,5	30,1	65,5	45,6	48,1
2020	90,0	37,7	79,6	57,1	59,7

Source: own elaboration on the Eurostat (2022) data base.

It can be observed that the ratio of public debt to GDP in the V4 had the lowest rates in the case of the Czech Republic. In 2010, it was 37.1% of GDP and by 2019 this value had dropped to 30.1% of GDP. Poland and Hungary also recorded a decrease in this indicator between 2010 and 2019. In the case of Slovakia, public debt in 2010 was 40.8%, while in 2019 it was 48.1%. In 2019, the EU-27 had a public debt to GDP ratio of 77.5%. In 2020, in each analyzed case, this indicator increased, which was undoubtedly the result of the COVID-19 pandemic. At that time, government support for enterprises was launched in order to save economies. The European Commission has provided EUR 1 billion from the European Fund for Strategic Investments. This support is to be a guarantee for the European Investment Fund. Thanks to this, efforts were made to encourage banks and other lenders to guarantee financial liquidity of at least 100,000. European enterprises (cf. Malawski, 2013, pp. 62-65).

On April 6, 2020, the Commission announced that around EUR 8 billion will be made available to provide immediate financial assistance to small

and medium-sized enterprises across the EU. In December 2020, the Commission said the creation of a EUR 25 billion pan-European guarantee fund, managed by the European Investment Bank, will support companies affected by the coronavirus (European Commission, 2022).

P. Della Posta *et al.* (2004, p. 18) argued that the political responses of the EU institutions were important for a more sustainable public debt; this opinion is especially true for a highly indebted country such as Italy. In fact, the first major decision made by EU policymakers was to suspend the rules of the Stability and Growth Pact.

C.A. Patillo *et al*.(2004, pp. 18-19) conducted a study in which they found that public debt affected the economies of 61 developing countries in the years 1996–1998. The results proved that, for example, the cost of limiting the accumulation of physical capital has a negative impact on economic growth.

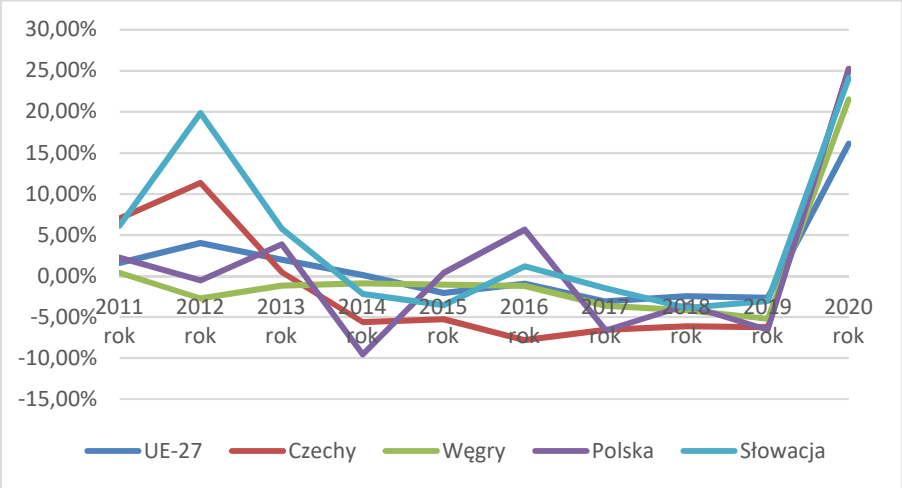

Figure 1. Dynamics of changes in public debt in relation to GDP in the countries of the Visegrad Group and the EU-27 in 2010-2020 (in%)
Source**:** Own elaboration

In turn, A. Alfonso & J. Alves (2014, p. 2), using selected indicators for 155 countries, examined the relationship between economic growth, production and public debt. It was found that debt had a negative impact on both GDP and economic growth. At the same time, the financial crisis slowed down economic growth and fiscal consolidation stimulated growth.

The analysis of changes in public debt in the V4 and EU-27 countries is complemented by the depiction of the dynamics of changes for this indicator (Fig. 1).

According to the data presented in Fig. 1, the largest increase in public debt between 2019 and 2020 concerned the Czech Republic and Poland. It was 25.25% and 25.22%, respectively. In Slovakia, an increase was recorded at the level of 24.12%, while in Hungary - 21.53%. In the EU-27, this value was 16.13%. Taking into account the fact that the V4 and EU-27 countries showed a downward trend since 2017, it can be noticed how destructive the crisis caused by the pandemic was for the economies.

2.2. R&D expenditure

The next issue to be analyzed is the expenditure on R&D in the V4 and EU-27 countries (Table 2). In turn, Fig. 2 shows the dynamics of changes in R&D expenditure in the V4 and EU-27 countries.

Table 2. Expenditure on R&D in the Visegrad Group countries and the EU-27 in 2010-2020 (in million euro)

Rok	UE-27	The Czech Republic	Hungary	Poland	Slovakia
2010	216 262,08	2 095,14	1 126,07	2 607,51	416,37
2011	228 346,01	2 551,99	1 204,63	2 836,17	468,44
2012	236 674,97	2 877,26	1 257,33	3 429,85	585,23
2013	241 491,75	2 996,67	1 415,10	3 436,28	610,88
2014	248 550,43	3 090,66	1 428,82	3 864,02	669,63
2015	258 745,82	3 250,24	1 510,94	4 316,51	927,27
2016	265 704,38	2 963,27	1 371,67	4 112,35	640,84
2017	281 437,40	3 433,34	1 672,95	4 834,04	748,96
2018	295 742,92	4 006,46	2 051,38	6 018,49	750,95
2019	311 891,50	4 348,35	2 158,62	7 046,92	776,59
2020	311 149,57	4 285,86	2 196,41	7 292,84	838,93
Mean	263 272,44	3 263,57	1 581,26	4 526,81	675,82

Source: own elaboration on Eurostate (2022) data base.

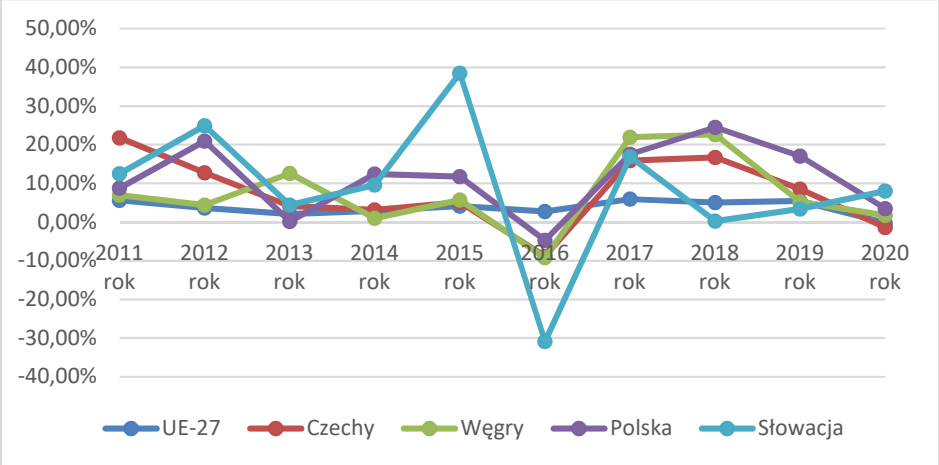

Figure 2. Dynamics of changes in R&D expenditure in the Visegrad Group countries and the EU-27 in 2010-2020 (%)
Source: Own study.

In the V4 countries, Poland had the highest R&D expenditure, on average it was approximately EUR 4.53 billion. The Czech Republic was second in this respect, which allocated an average of EUR 3.26 billion to research and development. Slovakia was the worst with EUR 675.82 million. The average in the EU-27 in 2010-2020 was EUR 263.27 billion. Importantly, the COVID-19 pandemic in this case did not have an impact, and if so, it did not affect R&D expenditure in the analyzed countries. However, this situation may be the result of previously planned and allocated research funds. Therefore, the impact of the coronavirus on this indicator may be visible in the coming years. Interestingly, back in April 2020, the US government wondered how COVID-19 would affect this sphere. It was noted that the implementation of the social distancing guidelines led to the closure of many laboratories and R&D projects. Even in the case of continued R&D projects, the effects of a pandemic can affect the efficiency and quality of this activity, for example through additional costs and challenges such as the closure of suppliers and service providers. D. Romer (2000, pp. 377-378) explains in detail the topic of the cost of using capital. Some resources devoted to ongoing research and development are also diverted to work focused on COVID-19 (cf: Morgan & Sargent Jr., 2020). A similar situation took place in the European Union (Böhme, Zillmer *et al*., 2022).

2.3. Number of employees employed in the R&D sector

As mentioned earlier, adequate financial resources are provided by, inter alia, qualified staff that can be employed in specific R&D projects. In tab. Fig. 3 presents data related to the number of employees with higher education employed in research and development activities in the V4 and EU-27 countries in 2010-2020, and Fig. 3 shows the dynamics of changes in this indicator.

Table 3. Number of employees with higher education employed in research and development activities in the V4 and EU-27 countries in 2010-2020 (in thousands)

Year	UE-27	The Czech Republic	Hungary	Poland	Slovakia
2010	75 633,7	1 906,3	1 305,4	5 633,3	845,9
2011	77 145,9	1 795,6	1 382,7	5 755,9	843,4
2012	78 950,1	1 835,9	1 438,7	5 959,2	813,5
2013	80 133,7	1 887,3	1 473,7	6 176,6	805,8
2014	82 313,4	1 921,5	1 528,9	6 497,2	818,6
2015	84 332,5	1 931,0	1 568,6	6 734,6	847,2
2016	86 580,2	1 990,5	1 594,5	6 896,3	876,0
2017	88 845,2	2 060,0	1 611,7	7 145,5	913,0
2018	91 116,5	2 101,4	1 659,5	7 338,3	960,7
2019	93 491,0	2 093,4	1 716,3	7 429,3	1 000,1
2020	94 371,0	2 117,0	1 783,6	7 521,3	1 022,6
Mean	84 810,3	1 967,3	1 551,2	6 644,3	886,1

Source: own elaboration on the Eurostat 2022 data base.

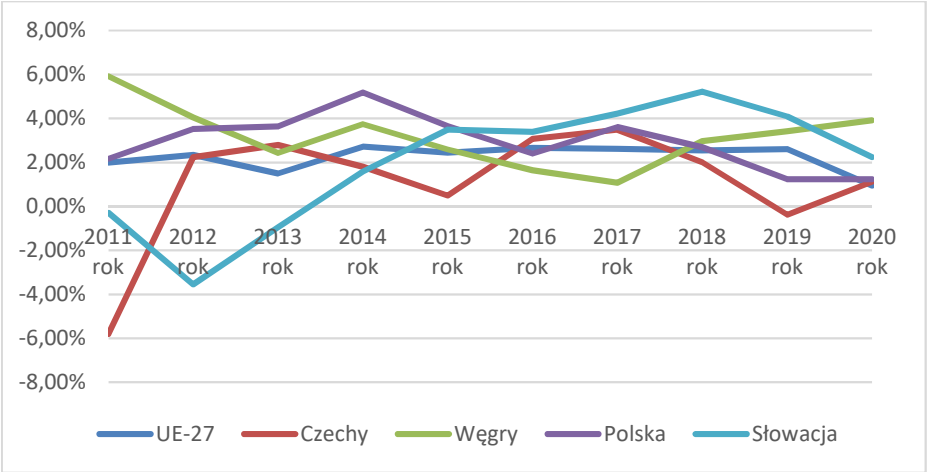

Figure 3. Dynamics of changes in the number of employees with higher education employed in research and development in the V4 and EU-27 countries in 2010-2020 (in %)
Source: own study

The highest average number of employees with higher education employed in the research and development sector in the V4 countries in 2010-2020 was in Poland, and it was 6.64 million people. The remaining countries had significantly lower rates, however, it should be noted that Poland from this group is also the most populous country. The average for the EU-27 was 84.81 billion people. The dynamics of changes in the described index was characterized by fluctuations for each of the analyzed countries. As in the case of R&D expenditure, also in this case no major negative changes were observed between 2019 and 2020. In the V4 and EU-27, an increase in the number of employees was observed in relation to the aforementioned years.

3. The relationship between the value of public debt and selected indicators of R&D activity - correlation analysis

Pearson's correlation was used in the analysis of dependencies. It was assumed that:

- 0 - 0.3 will mean no or very weak correlation;
- 0.3 - 0.5 will be a moderate correlation;
- 0.5 - 0.7 will prove a strong correlation;
- 0.7 - 1 will be characterized by a very strong correlation.

3.1. Public debt and R&D expenditure

The first two variables examined were the value of public debt and R&D expenditure in 2019, i.e. before the outbreak of the COVID-19 pandemic (Table 4) and in 2020, i.e. in the first year of the pandemic (Table 5).

Table 4. The relationship between public debt and R&D expenditure in the Visegrad Group countries and the EU-27 in 2019

Country	Public debt	R&D expenditure	$Y_i - \bar{Y}$	$X_i - \bar{X}$	$(y_i-\bar{y})(x_i-\bar{x})$	$(X_i - \bar{X})^2$	$(y_i-\bar{y})^2$
	Y_i	X_i					
UE-27	77,50	311891,50	24,14	246647,10	5954060,99	60834791938,41	582,74
The Czech Republic	30,10	4348,35	-23,26	-60896,05	1416442,12	3708328905,60	541,03
Hungary	65,50	2158,62	12,14	-63085,78	-765861,37	3979815638,21	147,38
Poland	45,60	7046,92	-7,76	-58197,48	451612,44	3386946678,35	60,22
Slovakia	48,10	776,59	-5,26	-64467,81	339100,68	4156098526,20	27,67
	∑ 267	**∑ 326222**	**X**	**X**	**7395354,87**	**76065981686,77**	**1359,03**

Source: own elaboration and calculations.

Mean values

$\bar{y}=(\sum y_i)/N = 267/5 =$ **53,36**

$\bar{x}=(\sum x_i)/N = 326222/5=$ **65244,4**

Standard deviations

*Sy = √(∑ ⟦(y_i-ȳ)⟧ ^2/N) = √(1359,03/5)=√271,81=***16,49**

Sx = √(∑ ⟦(x_i - x̄)⟧ ^2/N) = √(76065981686,77/5)= √15213196337,35 = **123341,79**

Covariance

cov*(y,x) = (∑ ⟦(y_i - ȳ)(x_i - x̄) ⟧)/N =* 7395354,87/5 = **1479070,97**

Correlation coefficient

*r_yx=(cov(y,x))/(S_y*S_x)=1479070,97/(16,49*123341,79)=* **0,73**

Table 5. The relationship between public debt and R&D expenditure in the Visegrad Group countries and the EU-27 in 2020

Country	Public debt Y_i	R&D expenditure X_i	$Y_i - \bar{Y}$	$X_i - \bar{X}$	$(y_i-\bar{y})(x_i-\bar{x})$	$(X_i - \bar{X})^2$	$(y_i-\bar{y})^2$
UE-27	90	311 149,57	25,18	245 996,85	6194200,633	60514449226	634,0324
The Czech Republic	37,7	4 285,86	-27,12	-60 866,86	1650709,297	3704774890	735,4944
Hungary	79,6	2 196,41	14,78	-62 956,31	-930494,2914	3963497221	218,4484
Poland	57,1	7 292,84	-7,72	-57 859,88	446678,289	3347765945	59,5984
Slovakia	59,7	838,93	-5,12	-64 313,79	329286,615	4136263841	26,2144
	∑ 324,1	**∑ 325763,61**	**X**	**X**	**7690380,543**	**75666751123**	**1673,788**

Source: own elaboration and calcuations.

Mean values

$\bar{y} = (\sum y_i)/N = 324,1/5 =$ **64,82**

$\bar{x} = (\sum x_i)/N = 325763,61/5 =$ **65152,72**

Standard deviations

$Sy = \sqrt{(\sum [(y_i-\bar{y})]^2/N)} = \sqrt{(1673,79/5)} = \sqrt{334,76} =$ **18,30**

$Sx = \sqrt{(\sum [(x_i-\bar{x})]^2/N)} = \sqrt{(75666751123/5)} = \sqrt{15133350225} =$ **123017,68**

Covariance

$\text{cov}(y,x) = (\sum [(y_i-\bar{y})(x_i-\bar{x})])/N =$ 7690380,54/5= **1538076,11**

Correlation coefficient

$r_{yx} = (\text{cov}(y,x))/(S_y * S_x) = 1538076,11/(18,30*123017,68) =$ 0,68

The correlation coefficient between the amount of public debt and R&D expenditure in 2019 was *r* = 0.73. Thus, the correlation turned out to be positive. The relationship, on the other hand, was very strong. The analysis carried out on the data from 2020 showed that *r* = 0.68. There was also a positive correlation in this case, and the relationship between the studied variables should be considered strong. This shows how the pandemic situation influenced the relationship between public debt and R&D expenditure in the Visegrad Group countries and the EU-27.

3.2. The public debt relation to the number of employees employed in R&D

The next stage of the research was devoted to examining the relationship between the value of public debt and the number of employees with higher education employed in research and development activities in the Visegrad

Group countries and the EU-27 in 2019, i.e. before the start of the COVID-19 pandemic (Table 6) and in 2020 ie after the outbreak of the pandemic (Table 7).

Table 6. Relationship between public debt and the number of employees with higher education employed in research and development in the Visegrad Group countries and the EU-27 in 2019

Country	Public debt	Number of employees with higher education employed in R&D	$Y_i - \bar{Y}$	$X_i - \bar{X}$	$(y_i-\bar{y})(x_i-\bar{x})$	$(X_i - \bar{X})^2$	$(y_i-\bar{y})^2$
	Y_i	X_i					
UE-27	77,50	93 491,00	24,14	72 344,98	1746407,817	5233796131	582,7396
The Czech Republic	30,10	2 093,40	-23,26	-19 052,62	443163,9412	363002328,9	541,0276
Hungary	65,50	1 716,30	12,14	-19 429,72	-235876,801	377514019,3	147,3796
Poland	45,60	7 429,30	-7,76	-13 716,72	106441,7472	188148407,6	60,2176
Slovakia	48,10	1 000,10	-5,26	-20 145,92	105967,5392	405858092,6	27,6676
	∑ 267	**∑ 105730**	**X**	**X**	**2166104,2**	**6568318980**	**1359,032**

Source: own elaboration and calculations.

Mean values

$$\acute{y} = \frac{\sum y_i}{N} = \frac{267}{5} = 53{,}36$$

$$\acute{x} = \frac{\sum x_i}{N} = \frac{105730}{5} = 21146{,}02$$

Standard deviations

$$S_y = \sqrt{\frac{\sum(y_i-\bar{y})^2}{N}} = \sqrt{\frac{1359{,}032}{5}} = \sqrt{271{,}81} = 16{,}49$$

$$S_x = \sqrt{\frac{\sum(x_i-\bar{x})^2}{N}} = \sqrt{\frac{6568318980}{5}} = \sqrt{1313663796} = \mathbf{36244{,}5}$$

Covariance

$$cov(y,x) = \frac{\sum(y_i-\acute{y})(x_i-\acute{x})}{N} = \frac{2166104{,}24}{5} = 433220{,}85$$

Correlation coefficient

$$r_{yx} = \frac{cov(y,x)}{S_y * S_x} = \frac{433220{,}85}{16{,}49 * 36244{,}5} = 0{,}72$$

Table 7. Relationship between public debt and the number of employees with higher education employed in research and development activities in the Visegrad Group countries and the EU-27 in 2020

Country	Public debt	Number of employees with higher education employed in R&D	$Y_i - \bar{Y}$	$X_i - \bar{X}$	$(y_i-\bar{y})(x_i-\bar{x})$	$(X_i - \bar{X})^2$	$(y_i-\bar{y})^2$
	Y_i	X_i					
UE-27	90	94 371,00	25,18	73 007,90	1838338,922	5330153462	634,0324
The Czech Republic	37,7	2 117,00	-27,12	-19 246,10	521954,232	370412365,2	735,4944
Hungary	79,6	1 783,60	14,78	-19 579,50	-289385,01	383356820,3	218,4484
Poland	57,1	7 521,30	-7,72	-13 841,80	106858,696	191595427,2	59,5984
Slovakia	59,7	1 022,60	-5,12	-20 340,50	104143,36	413735940,3	26,2144
	∑ 324	**∑ 106816**	**X**	**X**	2281910,2	6689254015	1673,788

Source: own elaboration and calculations.

Mean values

$\bar{y} = (\sum y_i)/N$ = 324/5 = **64,82**

$\bar{x} = (\sum x_i)/N$ = 106816/5 = **21363,1**

Standard deviation

$Sy = \sqrt{(\sum [(y_i-\bar{y})]^2/N)} = \sqrt{(1673,788/5)} = \sqrt{334,7576}$ = **18,29638**

$Sx = \sqrt{(\sum [(x_i - \bar{x})]^2/N)} = \sqrt{(6689254015/5)} = \sqrt{1337850803}$ = **36576,64**

Covariance

$\mathrm{cov}(y,x) = (\sum [(y_i - \bar{y})(x_i - \bar{x})])/N$ = 2281910,2/5 = **456382,04**

Correlation coefficient

$r_{yx} = (\mathrm{cov}(y,x))/(S_y * S_x) = 456382,04/(18,29638*36576,64)$ = **0,68**

The correlation coefficient between the value of public debt and the number of employees with higher education employed in research and development in the Visegrad Group countries and the EU-27 in 2019 was y = 0.72. The correlation turned out to be positive in this case as well. The relationship, however, should be interpreted as very strong. The analysis carried out on the data from 2020, i.e. after the outbreak of the pandemic, shows that r = 0.68. This should be seen as a positive correlation, and the relationship between the variables studied turned out to be strong again.

Conclusions

The constantly increasing public debt must be properly managed and controlled. Such actions can lead to certain situations that the ordinary citizen may not feel, but can experience significant economic and social consequences in the long run.

If the specified ceiling is exceeded, there is a real risk of a financial crisis, which will result in an increase in unemployment and reduction of expenditure (e.g. in the area of education, research subsidies, etc.). Such an approach may lead not only to the fact that a given country will not be able to compete on the market, but it will also stop developing, the GDP (Gross Domestic Product) will fall and the economic growth will slow down.

During the research procedure, the following research hypotheses were identified:

- Hypothesis (H1) assumed that public debt has a significant impact on the R&D expenditure of the EU-27 and V4 countries before and during the COVID-19 pandemic.
- Hypothesis (H2) assumed that there is a relationship between the number of employees with higher education employed in R&D and the public debt of the EU-27 and V4 countries, before the pandemic begins and also in the first year of its duration.

Basing upon the research presented above the following conclusions can be drawn:

1. Along with the increase in public debt, R&D expenditures increased both before and in the first year of the COVID-19 pandemic in the Višegrad Group countries and the EU-27.
2. Along with the increase in public debt, there was observed an increase in the number of employed workers with higher education in research and development activities before and in the first year of the COVID-19 pandemic in the V4 and EU-27 countries.

Considering the above, it can be concluded that the empirical analysis made it possible to achieve the assumed research goal and also to positively verify both research hypotheses. However, the considerations as proposed should be considered only as pilot ones. Numerous research limitations did not allow us to propose final recommendations. The conducted research is only a contribution to further in-depth analyzes in the future.

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ARTICLES

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Actions of government administration focused on prevention of tax crime in Poland

Abstract

Economic crimes generates losses both for state budget and private sector. Losses for state budget are primarily reducing revenues, obtaining undue revenues, and phishing subsidies. In private sector losses are connected to lowering income and decrease of competitiveness. Honest entrepreneurs have difficulties staying on market, because prices of their products cannot compete with the prices of goods by criminal groups, which does not pay taxes allowing them to offer lower prices. Economic crime concerns not only security and public order, but also state economic safety connecting to business profitability and security. Economic crime is multifaceted, including lowering of public law climes, capital, banking and insurance market crimes, as well as public procurement crimes, copyright law and all profit-oriented crime taking into account market mechanisms. This article presents the problems of tax crime in Poland and the results of police activities in counteracting this crime.

***Keywords*:** tax crime, economic crime, state budget

***JEL clasification*:** G29, K49

***Paper type*:** Theoretical research article

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Introduction

Tax is defined by public law as not refunded, obligatory funding for State Budget, voivodeship, poviat or commune on tax regulation law. (Dz.U. 2021, poz. 1540 – ze zm.). Polish tax law also defines the term "tax" as "tax advances", "tax instalments if the tax law provides for the payment of tax in instalments", as well as "fees and non-taxable budgetary charges" (Dz.U. 2018, poz. 106 – ze zm.). The tax crime is situation when taxpayer is avoiding taxation, which stands in opposition to the tax law. (M.P. 2015, poz. 1069). The State has privilege of setting taxes and creating law regulations, including amount, execution and way of repressions. It allows execution, when the taxpayer is avoiding taxations or commits tax crime. Due to the obligatory system is secured by criminal and tax penalties. It secures realization of state tasks, financed by state or regional government budget income (Krzywoń, 2011).

Tax crimes are not only commited by people with specialistic knowledge of law, economy, banking or accountancy (*white collar staff*). The crimes are connected to people of different social environments, commited by individual perpetrators or organized crime groups. Cooperating on different levels crime groups are characterizing by avoiding stated by law regulations of conducting business activity aimed at obtaining economic profit *(grey area).* Due to the research conducted by GUS, the share of grey area in Poland was estimated on 12,3% in the years 2016-2019 (Fundowicz, Łapiński, Wyżnikiewicz, Wyżnikiewicz, 2022), the lost income created by the grey area and other phenomenons generating gap in the VAT taxation was estimated on 42,5 bn PLN (Raport Global Compact Network Poland). Additional difficulty in preventing the crime are connections with legal economic entities, which significantly limits the possibility of determining the nature of participation of individual in crime or even the scale of phenomenon. In crime proceeding in order to hide perpetrators economic entities are created only for performing a specific transaction or recruited person performing in transaction chains (front man). If evidence of criminal activity is presented, they impede the performance of fiscal control or investigative activities to make it more difficult to determine the actual organizers of the fraud (Nowak, 2014). Common way of fraud to reduce taxes is creating invoices, which not document actual economic events, presented inflating tax deductible costs of economic entity. The scale of the practice indicates that organized criminal groups are participating.

Taking the above into consideration, the aim of the project was to present typical methods of tax crime and activities of public administration authorities aimed at preventing and fighting this form of crime, as well as to analyse the results of police activities in this area.

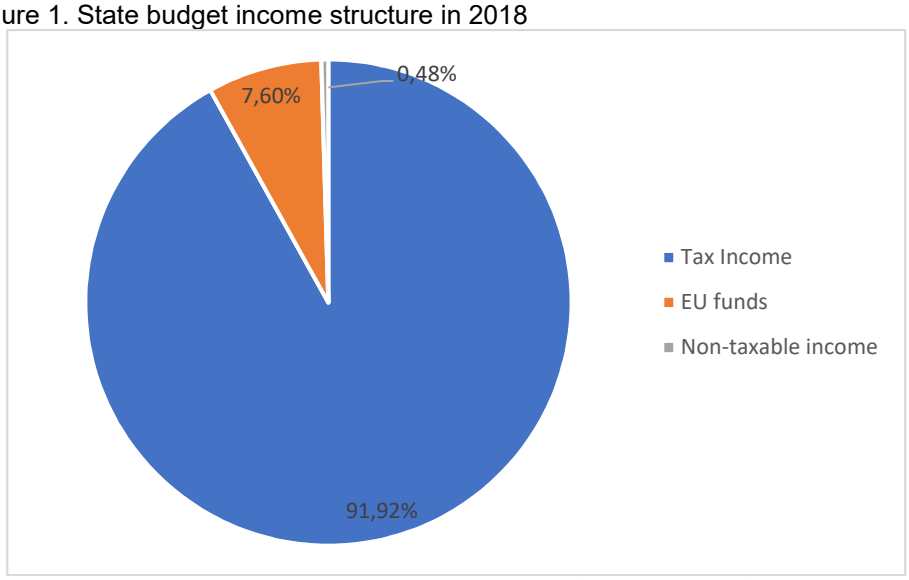
Statistical data from a period of long-term, solid economic growth was used to test the effectiveness of the implementation of the above activities. The socio-economic situation triggered by the COVID-19 pandemic and restrictions on the conduct of certain types of economic activity, as well as obstacles to control by the authorities, encouraged incentives to act aggravating the *grey area*.

Tax income of State budget

The most significant function of taxes is fiscal function, because taxes are the main source of state income. They are also important tool of economic and social policy, as they perform redistributive function in the field of GDP, stimulating economic processes and information function of their course. Polish tax system includes basic and supplementary taxes (Pach,2017). Basic taxes contains income taxes of individualities (PIT) and legal entities (CIT), goods and services tax (VAT) and excise duty. The taxes affects the widest group of taxpayers, including entrepreneurs, have the highest budget income share and have the strongest influence on entrepreneurs decisions. Supplementary taxes have the function of sealing the tax system and are connected to different events and tax situations, including inheritance and donation tax, property tax, agricultural tax, forest tax, gambling tax, tax on mean of transport, tax on civil law transaction, tonnage tax, tax on extraction of certain minerals (Wolański, 2009).

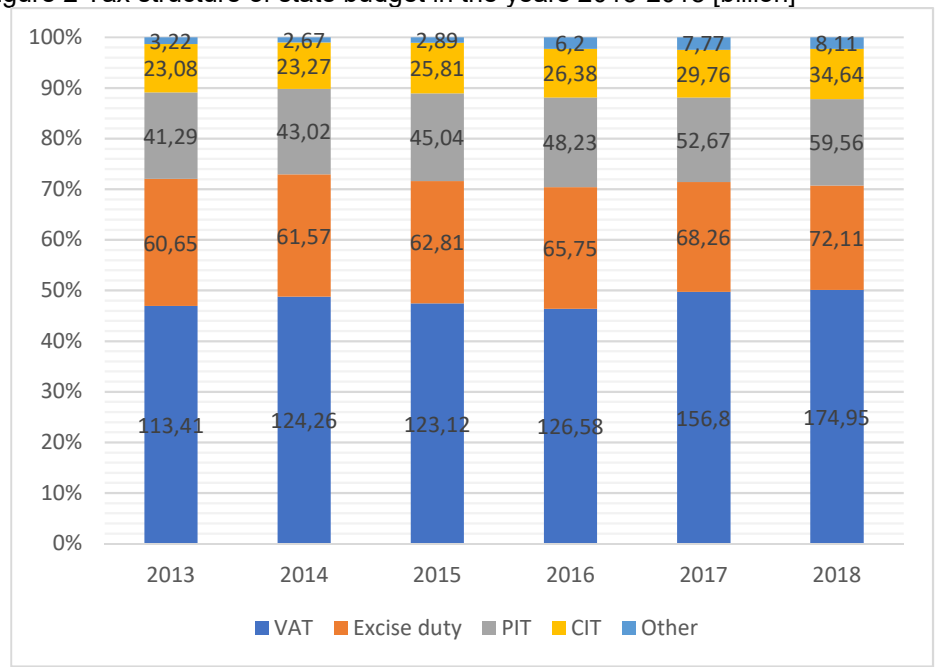
State Budget income in 2018 was estimated on 380,05 bn PLN and was stated as 92% of total income (30 bn PLN growth comparing to previous year and 65 bn PLN growth comparing to 2016). It funded 93,3% of expenses. The highest share of state budget income (90%) was tax income, estimated on 349,37 bn PLN and was 34,11 bn PLN higher comparing to 2017 and 107,72 bn PLN higher comparing to 2013. Tax income has been presented on Figure 1. (Sprawozdanie RM).

Figure 1. State budget income structure in 2018



Source: Report of state budget implementation for 1st January – 31st December 2018

Figure 2 Tax structure of state budget in the years 2013-2018 [billion]



Source: The Council of Ministers Report of state budget implementation for 1st January – 31st December 2018.

VAT tax in 2018 was estimated on 174,95 bn PLN, which states as 46,03% share of total state budget income (50,08% of total tax income). Including share of excise duty – 18,97% (20,64% of total tax income), this two taxes state as 65% share of total budget income (Informacja MF). Due to the data, interior and economic safety of the state is based on the taxes. Only flexible and tight tax system, which is taxpayer friendly and ruthless towards tax frauds is basics, necessary for creating financial and economic safety of the state (Bełdzikowski, 2015).

Crimes and offences against tax obligations in polish fiscal criminal law

Tax fraud is defined as avoiding tax obligation by taxpayer, which directly and explicitly violates tax law (Kalinowski, 2001). The main legal act, protecting protecting the fiscal interests of the state is the Fiscal Penal Code (k. k. s.). In the first atrticle have been presented terms of crime, including crime penalty for fiscal crimes and offences (Wilk, 2006). Tax crime is action penalized by threat of a fine in daily rates, or a penalty of restriction or deprivation of liberty, offence is penalized by threat of a fine only (t.j. Dz. U. 2022, poz. 859).

Fiscal crimes and offences against tax obligation are in polish Fiscal Penal Code are one of four categories of fiscal crimes and offences. First category includes crimes and offences against tax obligation due to subsidies. Another contains: customs duties and rules of foreign trade in goods and services, foreign exchange turnover, organization of gambling games.

Tax crime contains not only avoiding timely or full payment of taxes, but also obtaining undue tax refunds. Due to the scale of planned tax income, a particular threat is crime in the area of goods and services tax (VAT) and excise duty. In the field of VAT, tax crime are connected trade in products subject to excise duty (excise goods are often at the same time the subject of offenses related to non-payment of excise duty and extortion of undue VAT refund); understating VAT for payment as a result of an unjustified increase in input tax, e.g. by issuing fictitious invoices or including taxable expenses not related to the business, or lowering the tax due (Górczak, 2017); avoiding the payment of tax due e.g. not taxifying interunion goods purchases, avoiding anti-dumping prices and extorting VAT refunds connected with the fictitious performance of actions entitling to claim refunds. An increased risk of committing crimes involving the avoiding of paying excise duty is connected with illegal production of excise goods exemption or reduced rates of excise duty, and smuggling and trade of tobacco and tobacco products, spirits and motor fuels (Wolański, 2009). The most common category of tax crime

in Poland is “tax carousels”, crimes connected with circulation of lubricating oils, decolorization of diesel fuel and fuel smuggling. The carousel mechanism is based on a "disappearing taxpayer", also known as a "pillar". The entity doesn’t run a business and is created to be active VAT taxpayer, issuing invoices not connected to real economic events, disappearing, leaving unregulated amounts of tax due. The goods are part of transaction chain. The goods, in turn, go through subsequent transaction chains to an entity with an appropriate history of operations (buffer) in order to give credibility to invoiced transactions. The last entity (broker) is responsible for the sale of goods outside the country and as part of interunion goods delivery and applies for VAT refund (Pach, 2018).

The example of “carousel” method in Poland was electronic market in the years of 2012-2015. Due to the Association of Importers and Producers of Electrical and Electronic Equipment in the RTV and IT Industry associating main manufactures, importers and distributors the serious irregularities in the market are related to discrepancies between import and export of electronic equipment in Poland, especially mobile phones, computers and game consoles. The difference was estimated on 2,3 bn PLN in 2013. It can be said that not only phones are not sold in Poland, but that their production is at a high level. The looses were estimated on 1,8 bn PLN (Binda, Bełdzikowski, 2015). The perpetrators' system of operation consisted of not settling VAT on equipment purchased outside Poland, and then selling these articles, including other entities in the price of this tax. In this way, these entities could export legally and then apply for a refund of this tax.

Tax crime of lubricating oils trade is caused by high indirect taxes (VAT, excise duty, fuel charges) included in price of the product, which can be omitted with a profit by criminal groups. The component of lubricating oil used for wetting and removing heat from friction places is diesel oil, which can constitute about 90% of the entire product. Diesel fuel is subject to an excise duty rate of PLN 1,171 / 1000 liters (MP 2018, poz 1189), whereas lubricating oils are exempt from excise duty if they are intended for purposes other than e.g. diesel oil (Dz.U. 2020, poz. 544). In European Union, these oils have 0 rate. The criminal mechanism is based on the fictitious supply of lubricating oil to one of the European Union countries, and in fact it is poured directly into the tanks of gas stations and used as diesel oil. This is done by means of a "pillar" which issued "empty invoices" and transport companies that pretend to export oil to another country, and after receiving forged documentation proving that it is diesel fuel they deliver to filling stations for sale as full-fledged fuel. By acting in this way, criminals try to bypass excise duty, VAT and the fuel charge. A great help for perpetrators acting

in this way are very similar parameters of diesel lubricating oil, which is why it was practically enough to change the documentation.

The next method of reducing the state's revenues is decolorization of heating oil. Diesel fuel which is colored red and intended for heating is a product on which a preferential tax rate of 232 PLN / 1000 liters (t.j. Dz.U. 2022, poz. 143 – ze zm.). The difference between the tax imposed between diesel used as fuel for cars and heating fuel is 939 PLN/1000 liters. For marking products, an indelible marker is used, which is a chemical substance N-ethyl-N- [2 - (- isobutoxy-ethoxy) ethyl] asbenzene-4-amine (solvent Yellow 124) (Dz.U. 2020, poz. 722 – ze zm.). Preparators of the crime taking advantage of the different tax rates for products of identical chemistry composition, discolor it and then bring it to the wholesalers or directly to the gas station with the help of "pillars" who legalize it by issuing false invoices. This method, due to the rather complicated discoloration procedure requiring large rooms that do not arouse suspicions is rarely used.

The methods of preventing tax crime in Poland

The strategic document “Program for preventing and combating economic crime”, allowing identification and coordination of implementation of state policy strengthening mechanism of preventing the crime. Document is attempt of implementation of concept of integrated approach to the crime phenomenon, with is emphasized on the European Union forum. In the subjective scope, an integrated approach means strengthening cooperation between services, bodies and institutions involved into preventing crimes with central and local government administration and private sector representatives, which means on operational and reconnaissance, investigative or control activities, as well as other legal and administrative instruments that can be used in a given case (M.P. 2015, poz, 1069).

In 2017, a wide range of changes were introduced to seal tax collection, in particular including VAT sealing package, criminal law regulations preventing VAT frauds, obligation to provide tax data in the form of a uniform control file, fuel and transport packages, solutions aimed at reducing irregulaties of gambling games and reducing from 15k€ to 15k PLN of value of transactions between entrepreneurs carried out without a payment account (RM report), (Modzelewski, 2018). The National Tax Administration was established, which included Tax Chambers, the Customs Service, the Tax Audit Office (t.j. Dz.U. 2022, poz. 813 – ze zm.) and penalties of economic crimes and offences have been toughened (implementation of karnego articles 270a, 271a and 277a in Crime Law Code). IT tools have been implemented allowing

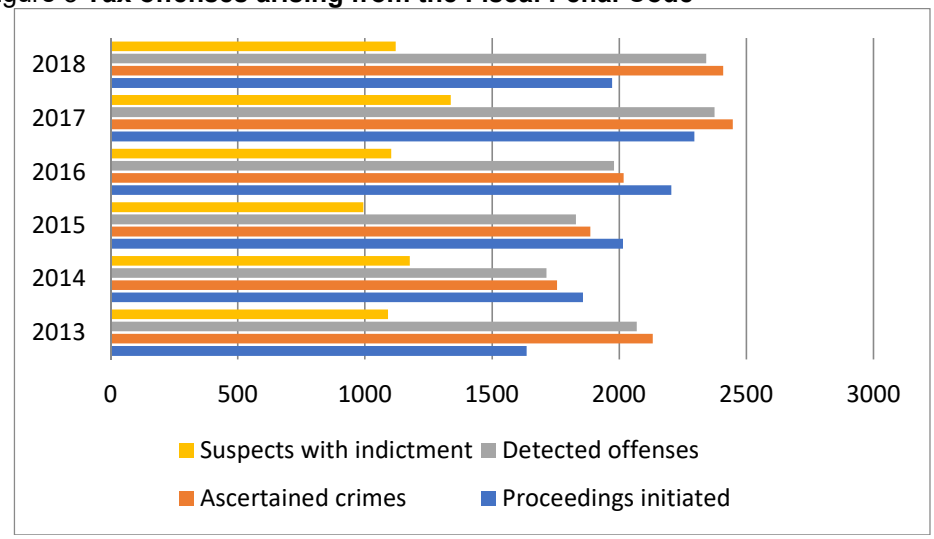
tax administration authorities more efficient verification at central and local level data provided by taxpayers in purchase and sale records and VAT declarations (Sprawozdanie RM). The changes These changes will help law enforcement agencies, including the Police, to prosecute economic crimes by giving the opportunity to act faster against tax crimes. The police conduct activities in areas of economic crime, using offensive methods of operational work. Organization units of Police preventing economic crime, supported by Central Police Investigation Bureau have key role in the process.

Police actions preventing tax crimes

In different to casual crimes against property, most of economic crimes which size recorded in statistics depend on the detection activity of control and law enforcement agencies. Proceedings connected with specified category of economic crimes are usually initiated not on the basis of reports of victims, but on the basis of the information of the state authorities obtained as a result of their activities.

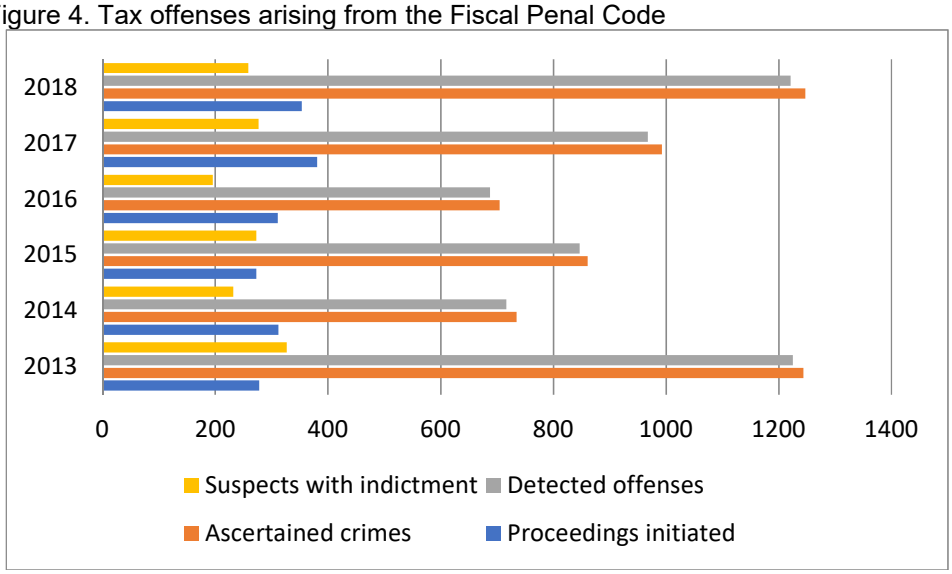
In 2018, officers of organizational units of Police to prevent Economic Crime and the Central Investigation Bureau detected 2343 crimes violating provisions of The Fiscal Penal Code (Dz. U. z 2022 r., poz. 859), almost half of which (1221) was tax crimes (figure 3 and 4). Losses resulting from this type of crime in 2018 were estimated on 262,90 mln PLN. Carried out activities secured 11,33 mln PLN and 30% (3,16 mln PLN) has been recovered (Policja).

Figure 3 **Tax offenses arising from the Fiscal Penal Code**



Source: Own research based on Police data

Figure 4. Tax offenses arising from the Fiscal Penal Code



Source: Own research based on Police data

The biggest losses for the state budget caused by tax crime are connected with VAT fraud, excise tax and tax on trade in fuels and alcohol products. The total value of losses due to these three categories in 2018 was PLN 578.87 million. The value of secured and recovered property in 2018 was PLN 49.3 million and PLN 6.32 million accordingly. Detailed data are presented in Table 1.

Table 1 Activities of the Police authorities in the field of recovering property from tax crime [million PLN]

Specification		2013	2014	2015	2016	2017	2018
VAT tax	Value of secured property	3,70	17,98	30,37	4,33	13,95	28,04
	Tax depletion	69,12	174,84	410,16	149,16	372,47	258,83
	Total losses	69,12	181,98	410,27	149,90	662,32	374,87
	Value of recovered property	2,26	0,27	1,80	1,04	0,86	4,21
Excise tax	Value of secured property	7,78	10,64	3,85	17,67	16,91	10,17
	Tax depletion	47,19	81,02	446,60	291,26	132,92	90,36
	Total losses	47,19	81,02	446,60	291,26	132,92	90,36
	Value of recovered property	3,50	3,89	1,62	6,88	8,53	1,05
Fuel trade tax and alcoholic products	Value of secured property	8,01	12,11	4,37	24,65	20,89	11,09
	Tax depletion	47,56	83,14	464,99	302,01	134,13	113,64
	Total losses	47,56	83,14	464,99	302,01	134,13	113,64
	Value of recovered property	3,51	4,21	1,81	11,61	8,53	1,06

Source: Own research based on Police data

Summary

Common market of Europan Union, allowing free transfer of people and goods, service and capital leads to life quality improvement due to facilitating the circulation or availability of goods. However, creates risk of crimes of obtaining undue tax refunds, especially tax on goods and services. Possibility of 0% tax value for interunion goods delivery allow creating fictitious transactions, and undue tax refund resulting from the difference between input and output tax. Preventing mentioned threats is difficult and requires thorough checking. It is result of specialist tax law knowledge of entities taking part in practice and creating credibility of performed actions.

With reference to the objective presented in this paper, in the part concerning the activities of state administration organs aimed at preventing

and fighting tax crime, as well as analysing the results of police activities in this area, it should be stated that since 2017 there has been a dynamic growth of state budget revenues. Between 2016 and 2018 it grew by PLN 65.37 billion to PLN 380.05 billion. Such a large increase in budget revenues was possible due to growing tax revenues. During this period, VAT revenues increased by almost 30%, and their record growth was noted in 2017, when a wide range of changes were introduced to ensure tightening of tax collection, including criminal law regulations to prevent VAT fraud.

In 2018, the value of property secured by the Police authorities was record high, amounting to 28.04 million PLN, while the value of recovered property - 4.21 million PLN.

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Manufacturing Offshoring and Reshoring in Poland. Evidence from the Fashiom and Electromechanical Meta-Sectors

Abstract:

After decades of offshoring, in recent years, companies have sometimes revised their location decisions implementing one of the three alternatives of the so-called "relocations of the second degree". More specifically, they have relocated manufacturing activities either in their home country (back-shoring), in their home region (near-shoring), or in a further away location (further offshoring). While offshoring and relocations of the second degree have been heavily analysed in US and Western European countries, there is no evidence regarding companies in Central and Eastern Europe. This paper focuses on Polish companies belonging to the fashion and electromechanical meta-sectors. More specifically, it investigates the relocation of both manufacturing and supply activities. Based on 602 questionnaires collected during 2020-2021, it emerges that Polish companies rarely offshored their production activities in both the investigated industries. This is mainly explained by concerns in terms of reduced responsiveness, higher coordination and quality appraisal costs, and patriotism. Finally, some differences emerged in terms of geographical location between the two meta-sectors, inducing speculation that fashion companies were mainly boosted by efficiency-seeking aims, while electro-mechanical companies by market-seeking aims. Due to scant evidence of offshoring strategies, relocations of the second degree are very few. However, differences emerge between the two investigated meta-sectors. More specifically, when considering "relocations of the second degree", fashion companies

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preferred to back-shore, while electromechanical companies decided to relocate to a second host country.

***Keywords*:** Reshoring, Offshoring, Relocation of the second degree, Poland, Manufacturing

***JEL classification**:* F23, L23

***Paper type*:** Theoretical research article

Introduction

In the last three decades, Central and Eastern European (CEE) countries have experienced several extensive transformations which have greatly reduced the cost of international trade and Foreign Direct Investments (FDIs). Moreover, such countries have become members of both the World Trade Organization and the European Union. The combined effects of such factors have allowed such countries to become an integral part of so-called Global Value Chains (GVCs) (Dabic and Lamotte, 2017). In this respect, it is worth noting that the European Commission recently classified Poland in the "forward GVC integration group", since it received huge FDIs but is still characterized by more limited internationalization of domestic firms. In other words, Poland is a "net sender" within GVCs (Comotti et al., 2020). Other CEE countries, meanwhile, have emerged as net FDI recipients (Ipsmiller and Dikova, 2021) since local companies rarely implement internationalization strategies. In this respect, Schuh (2014) defines the very few internationalizers as "local heroes", that is well managed medium-sized firms with a strong position in their local markets and a relevant presence in foreign ones. Moreover, they generally own a leading technology/innovation position in their business, and implement low-cost or hybrid strategies.

More recently, FDIs by CEE countries have been increasing at a higher rate than those of other emerging countries. As a consequence, an increasing number of local companies have expanded their activities abroad, also due to the small size of their internal markets. Such firms are generally medium-sized; therefore they are underrepresented in the Financial Times Top 500 Emerging markets ranking of firms (Dabic and Lamotte, 2017).

Growing evidence on the internationalization strategies implemented by CEE companies induced several scholars to focus their attention on this phenomenon, as clearly shown by literature reviews published in recent years (see, among others, Ipsmiller and Dikova, 2021; Jaklič, 2020; Caputo et al., 2016). However, the extant literature was mainly focused on exporting activities, while the internationalization process

of other value chains has generally been neglected. Following the suggestion of Dabic and Lamotte (2017) to enlarge the scope of research on the internationalization process of CEE firms, in this contribution we focus our attention on location decisions regarding production and supply activities. More specifically, we investigate two different phenomena for both activities, namely offshoring strategies and "relocations of the second degree" (Barbieri et al., 2019). By the term offshoring, we refer to a firm's decision to locate production activities in a foreign country - either within the firm's plant or to local contractors (production offshoring) - and/or supply activities (supply reshoring). Meanwhile, by "relocations of the second degree" we refer to any change of previously implemented offshoring strategies. More specifically, three alternatives have been proposed in the extant literature (Fratocchi et al., 2014a): a) back-shoring - when production and/or supply activities are relocated to the firm's home country; b) near-shoring – when the investigated activities are relocated to the home region; c) further offshoring, when the relocation is to a foreign country further away.

Our research aims may be summarized as follows:

a) Have CEE companies offshored their production or supply activities?
b) After their initial offshoring decision, have CEE companies relocated their offshored production or supply activities?

In order to investigate such two innovative research questions, we adopted an explorative approach focusing on a set of Polish companies. Poland was chosen as the home country due to its high embeddedness in GVCs (Comotti et al. 2020). Moreover, it is the most investigated country in the extant literature on the internationalization process of CEE firms (Ipsmiller and Dikova, 2021). However, almost none of these specifically address the internationalization strategies of either manufacturing or supply activities.

In terms of industry, our attention was focused on two meta-sectors, namely the fashion industry (NACE codes C14 and C15) and the electromechanical industry (NACE codes C25, C28, C29). The latter was chosen since it is the most important for the Polish economy, accounting for 27.4% of the total production of Polish industry and 45.82% of total exports (Statistics Poland 2020). Moreover, in the automotive sector, Poland has one of the highest percentages of forward linkages within the EU. The same feature is shared by the fashion industry (Comotti et al., 2020), which is also characterized by a large degree of offshored manufacturing activities on a global scale, but also accounts for a large number of back-shoring decisions at the European level (Eurofound, 2019).

Our findings show that Polish companies rarely offshored manufacturing activities, while supply offshoring was less infrequent. At the same time, while fashion companies implementing manufacturing offshoring sometimes

relocated production activities in their home country, electromechanical firms preferred to implement relocations to a third country (either near-shoring or further offshoring). Finally, a small but not negligible percentage of supply offshoring firms relocated purchasing activities in Poland.

The rest of the paper is organized as follows: the next section is devoted to presenting the theoretical background on offshoring and relocations of the second degree. The second section summarizes the adopted research methodology, while the third presents the research findings. Conclusions, limitations and implications for scholars, managers and policymakers are proposed in the last section.

1. Theoretical framework

In this section, the extant literature on offshoring and relocations of the second degree will be briefly summarized in order to define what issues have mainly been investigated by scholars. Such variables will be then adopted in the empirical section to discuss findings related to the offshoring and relocation of the second degree strategies implemented by the Polish companies studied.

Since the early 1980s, manufacturing companies (especially ones headquartered in Western countries) have offshored their production/supply activities to low-cost countries (Mukherjee 2018; Theyel, Hofman, and Gregory 2018). The phenomenon was generally boosted by an efficiency-seeking approach (Dunning 1988) which led to the so-called ‘smile curve’ (Mudambi, 2008), according to which high-value activities (e.g. R&D and marketing) are located in the home country, while low-skilled jobs (such as assembling and/or manufacturing) are moved to low-cost countries.

Within the extant literature regarding offshoring (for a structured literature review, see Schmeisser, 2013), several theoretical perspectives have been adopted to investigate such a phenomenon. Among them are the Internationalization Process Model (Johanson and Vahlne, 1977; Johanson and Wiedersheim-Paul, 1975); the Resource Based View (RBV) (Barney, 1991; Wernerfelt, 1984); Dynamic Capabilities (Teece et al., 1997; Teece, 2007); Transaction Cost Economics (TCE) (Williamson, 1975); Dunning's “eclectic paradigm” (1988); Resource Dependence Theory (RDT) (Pfeffer and Salancik, 1978); and Contingency theory (Lawrence and Lorsch, 1967; Pennings, 1992). Based on these theories and concepts, scholars identified a large set of offshoring drivers for both offshore outsourcing – when production activities are managed by a contractor - and captive offshoring – when manufacturing is performed within the firm’s plants. More specifically, Di Mauro et al. (2018) found 24 offshoring motivations,

among which lower costs and higher labour productivity in the host country are the most often cited.

However, a growing number of companies have experienced certain hidden costs pf offshoring, in other words, the costs associated with producing/supplying abroad were higher than originally calculated (Larsen, Manning, and Pedersen 2013). Moreover, firms faced other negative effects such as the low quality of offshored production, reduced customer responsiveness, and delivery times higher than expected (Fratocchi et al., 2016). This evidence induced them to revise their earlier decision to offshore production/supply activities, and implement a relocation of the second degree strategy. As recently pointed out by Merino et al. (2021), in the extant literature scarce attention has been paid to the near-shoring and further offshoring phenomena, while the backshoring alternative has attracted several scholars (for a structured literature review, see Barbieri et al., 2018).

Within the extant back-shoring literature, scholars mainly investigated the drivers behind the decision to revise the earlier decision to offshore production/supply activities. In this respect, Di Mauro et al. (2018) found 42 different reshoring motivations within the extant literature and when these were compared with the ones belonging to the offshoring phenomenon, a certain overlapping was found. This induced the authors to suggest that some companies reshore since the expected offshoring benefits were not forthcoming, partially confirming the idea that back-shoring decisions are a type of correction of a previous managerial mistake (Kinkel and Maloca, 2009). However, other back-shoring motivations also support the idea that relocation to the home country is due either to a change in the external environment (Martínez-Mora and Merino, 2014), or changes in the firm's strategy (Baraldi et al., 2018).

Another issue adopted to characterize backshoring strategies concerns barriers, that is factors hindering the relocation of production/supply activities in the home country. To the best of our knowledge, only Engström et al. (2018a, b) have offered a list of such elements, classifying them in terms of the home country, host country and the firm's specificity. However, Boffelli and Johansson (2020) recently stated that barriers are among the most relevant issues for adequately investigating the back-shoring decision.

As far as reshoring strategies specifically regarding CEE countries are concerned, Fratocchi et al. (2014b) pointed out that "these countries are currently facing the challenge to attract the relocation of activities previously off-shored by European companies to farther away countries, while they simultaneously face the risk of losing foreign investment due to back-reshoring to the company home country" (2014, 103). At the same time, Stępień and Młody (2017) examined the economic and political grounds for reshoring activities in the Polish apparel

and footwear industry. According to the authors, backshoring activities are still lagging behind when compared to more developed countries. In fact, at least in the fashion industry, Poland serves as a near-shoring location as it attracts foreign (mostly EU) premium and luxury brands aiming to relocate production within Europe. While investigating the potential impact of Industry 4.0 on the reshoring phenomenon in Hungary, Éltető (2019) also found no evidence of backshoring strategies implemented by local companies due to the adoption of such innovative technologies. However, he found evidence of nearshoring to Hungary by foreign companies. Finally, Młody and Stępień (2020) examined the possibilities for developing reshoring activities in the luxury goods sector, noting that they are spread unevenly regarding the luxury pyramid tiers. They show that near-shoring to CEE countries is a more frequent phenomenon in this sector than backshoring to more developed EU countries. Near-shoring strategies are mainly bolstered by a reduction of supply chain risk, improvement of quality, and prevention of brand infringement and image downgrading.

2. Methodological issues

In order to shed new light on the research questions described earlier, we adopted a quantitative approach, since such a methodology is consistent with the explorative aim of our research. When designing the quantitative survey, we decided that it should be descriptive as we rely on perceptual data reported by respondents, and this approach allows for the appropriate collection, analysis and interpretation of the results (Brians, 2011). We have fully accepted the fundamental assumptions and principles of quantitative research, including a clearly defined research question for which objective answers are sought. Data was collected using structured research instruments and tools, and all aspects of the study were carefully developed and tested before starting the actual research, thus the same study can be duplicated or repeated at different times and locations (Babbie, 2010).

Survey design

The survey contained 30 questions divided into four sections 1) general information about the company and its internationalization strategy, 2) offshoring of manufacturing activities, 3) re-location, and 4) offshoring and relocation of supply. In the first part, the respondents were asked, *inter alia*, about the intensity and directions of exports and the location of production activities. This evidence supported the authors in defining the internationalization strategies implemented by companies in the two investigated meta-sectors. The second part of the survey focused on manufacturing offshoring activities, investigating motivations for either locating production abroad or “staying in the home country”. The companies

involved in offshoring activities were requested to specify the scope, the adopted governance mode (e.g., captive offshoring and offshore outsourcing), the timeframe, and the chosen host country. The third part was related to the relocation decision; thus the motivations, scope and global evaluations of such decisions were investigated. The last part of the survey concerned offshoring and relocation of supply activities, with analysis of their motivations.

Sampling method and data collection

The sampling procedure included the identification of the units that make up the population, determining the size of the desired sample, and developing an appropriate course of action in the research process (Mukherjee, 2020, 78-80). Concerns about both coverage and non-response motivated us to use non-probability sampling, taking into consideration its limitations and advantages (Wolf et al., 2016, p. 321).

Our target population consisted of companies classified under the following NACE codes: C14 and C15 (for the fashion industry) and C25, C28, C29 (for the electromechanical industry). To create our population frame, we used a comprehensive and up-to-date database of firms operating in Poland, namely the Emerging Market Information System (EMIS). This electronic source provides access to macroeconomic statistics, forecasts and analyses on emerging markets. To extract our sample, we used non-proportional quota sampling as we intended both groups to be adequately represented in the study sample (Mohsin, 2016). Thus we specified the minimum number of sampled units in the two meta-sectors investigated: at least 300 companies for each meta-sector. The data was gathered between October 2020 and August 2021 by conducting direct interviews (CATI method) with 602 representatives, 301 in each of the two meta-sectors.

Sample structure

In order to verify the consistency of the distribution of companies in our sample, we compared it with one of the entire Polish population in the selected meta-sectors according to *Statistics Poland* (2020), that is the national Annual Statistics Report.

The distribution of the sample is largely similar to the distribution of the entire population in terms of industry classification (according to Statistics Poland 2020 data). Therefore, the collected data enables a detailed study of the behaviour of Polish companies in the field of international location and relocation of production activities.

Table 1 summarizes the main characteristics of the two meta-sector samples, and shows that fashion companies are generally smaller, both in terms of the number of employees and total sales. This may

be explained, at least partially, by the lower vertical integration within such a meta-sector when compared to the electromechanical industry. At the same time, the two meta-sectors also differ in terms of the percentage of foreign sales to total sales, with the electromechanical industry more open to exports. This is consistent with data at the national level, where the electromechanical meta-sector accounts for 45.8% of total exports, while the fashion sector accounts for only 2.3%.

Finally, as our contribution focuses on supply and manufacturing issues, it is also useful to characterize the two subsamples in terms of production plants. In this respect, the two meta-sectors are quite homogeneous since more than 90% of the sampled companies have only one factory.

Table 1. Characterisation of meta-sector samples (N= 602)

Number of employees	*Fashion*	*Electromechanical*	***Total sales (M €)***	*Fashion*	*Electromechanical*
10-49	81.4	55.2	less than 2	71.1	31.9
50-249	15.6	35.9	2-9	24.3	47.8
more than 250	3.0	9.0	10-250	4.3	19.9
			more than 250	0.3	0.3
Total	100.0	100.0	**Total**	100.0	100.0
Percentage of foreign sales	*Fashion*	*Electromechanical*	**Number of plants in Poland**	*Fashion*	*Electromechanical*
no export	15.0	15.9	1	95.0	92.0
0-9%	42.2	26.9	2	2.7	5.6
10-24%	17.6	17.3	3	1.7	1.7
25-49%	7.3	15.9	4	0.0	0.3
50% and more	17.9	23.9	5	0.0	0.3
			more than 5	0.3	0.0
Total	100.0	100.0	**Total**	100.0	100.0

Source: Survey data

Findings

Offshoring strategies

The first research aim of our contribution was to verify if Polish companies belonging to the two meta-sectors offshored their production and/or supply activities. Below, the implementation of the two internationalization strategies will be discussed by comparing evidence from the two meta-sectors.

Manufacturing offshoring

Our data clearly shows that the sampled companies rarely offshored production activities. In total, only 7 companies out of 301 in the fashion sector (2.3%) decided to offshore production abroad, either through in-sourcing or outsourcing. In the electromechanical sector, the corresponding data is 10 (3.3% out of 301). However, the total number of offshoring decisions is larger (29), since the 7 fashion companies implemented 17 different relocation decisions (with an average of 2.4 decisions per company) while the 10 electromechanical firms offshored 12 times (1.2 decisions on average).

In order to understand this reluctance to internationalise manufacturing, the survey also allowed us to investigate drivers motivating a firm's decision not to produce or supply abroad (Table 2). When analysing the weighted arithmetic means, one can perceive that only one variable (loyalty/patriotism), has a value higher than 3, but only for the fashion meta-sector. The importance of loyalty/patriotism is consistent with previous research carried out by Stępień and Młody (2017), who indicated that the majority of Polish companies in the clothing sector believe that their activity in Poland shows a kind of patriotism, and that they are forced to use overseas subcontractors only because they operate in a very competitive market. What is more, the local manufacturing and purchases *of products* "made in Poland" are also regarded by consumers as a patriotic act. This suggests the significant importance of consumer ethnocentrism (Shimp and Sharma 1987), also regarding strategic decisions on manufacturing locations.

At the same time, around half of the drivers had a value higher than 2.5 but lower than 3 for both meta-sectors. Among them, the proximity to customers is one of the most relevant; in this respect, it is interesting to note that Moradlou et al. (2017) found that this was the most important driver for backshoring decisions by UK companies.

Table 2. Motivations not to offshore, weighted arithmetic mean (N=585)

Motivation	*Fashion (N=294)*	*Electromechanical (N=291)*
Loyalty/Patriotism	3.14	2.61
Staying close to customers	2.98	2.59
Costs of product quality appraisal in the foreign country	2.87	2.64
Economic and financial risk	2.80	2.67
Extension of delivery time	2.77	2.52
Costs for coordination/communication with foreign units (firm's plant/contractors)	2.73	2.68
Intellectual property (brand, patent) risk - Counterfeiting risk	2.63	2.48
Small production runs	2.62	2.43
Negative effect on the firm's/product's brand (e.g. made-in effect)	2.60	2.20
Poor expected product quality offshore	2.49	2.12
Low skills of foreign human resources/Need to invest in training for them	2.42	2.09
Host country social and political risks	2.24	2.17
Lack of skilled contractors abroad/Availability of skilled contractors at home	2.22	2.15
Cultural and linguistic differences	2.05	1.95

Source: Survey data

The costs of product quality appraisal are another important motivation for domestic production. This evidence may be at least partially explained by the small size of the sample companies. In effect, while large companies can afford to maintain an organizational unit abroad devoted to outsourced production control, for smaller entities this approach may be too expensive. It is also worth noting that cultural and linguistic differences are of no relevance. These may be more important in the case of captive offshoring, as it is associated with a greater commitment to financial and human resources. When comparing the two meta-sectors, notable differences can be seen in the case of expected product quality offshore, the effect of offshoring on the firm's/product's brand, and the skills of foreign human resources; however, each of these drivers is of greater importance for the fashion meta-sector.

Even though very few Polish companies belonging to the two selected meta-sectors decided to offshore their manufacturing activities, it would be useful to better understand the main characteristics of the ones that decided to offshore production. In this respect, a first interesting insight emerges when considering the drivers of manufacturing offshoring (Table 3). This element is quite homogeneous between the two meta-sectors; moreover, seven out of 11 offshoring drivers reached a weighted value higher than 3 for both sectors. In this respect, the unavailability of further production capacity emerges as the most relevant, even more

than ones traditionally related to efficiency goals (labour costs reduction) and market-seeking aims (access to the local market). Finally, the availability of skilled contractors and/or employees abroad is a relevant offshoring driver, while trade barriers are negligible.

Table 3. Motivations for offshoring decisions (Weighted arithmetic mean on a Likert scale)

Motivations for offshoring decisions	***Fashion (N=7)***	***Electromechanical (N=10)***
Unavailability of further production capacity at home	4.7	3.7
Reduction of labour costs	4.0	3.5
Access to the local market	3.5	3.0
Availability of skilled employees in the host country	3.4	3.3
Availability of skilled contractors in the host country	3.4	3.2
Access to product/production technology in the host country	3.4	3.1
Reduction of other production costs (e.g. power)	3.15	3.6
By request of your main customer(s)	2.7	3.3
Availability of raw materials in the host country	2.4	2.8
Host country government incentives	1.7	2.3
Trade barriers (e.g. duties)	1.7	2.2

Source: Survey data

Other interesting evidence emerges when considering the geographical locations and governance modes adopted by the sampled companies (Table 4). In this respect, the two meta-sectors are somewhat more heterogeneous, especially in terms of the foreign countries targeted. More specifically, while electro-mechanical companies mainly offshored in the European Union (including very high-cost countries such as Germany, Italy, France and Sweden), fashion companies preferred low-cost destinations like China and other Asian countries, but also in the European region, e.g. Portugal and the Czech Republic. Therefore, it may be speculated that while fashion companies mainly offshored production due to efficiency-seeking aims, electro-mechanical firms were prompted by market-seeking goals.

Table 4. Geographical locations and governance modes

	Fashion	***Electromechanical***
Governance mode (N=17)	7/7 outsourcing	6/10 outsourcing 3/10 insourcing 1/10 mixed approach
Number of foreign countries (N=17)	4/7 only one country 3/7 more than one country	8/10 only one country 2/10 more than one country
Targeted host country (N=17)	Asia: China - 4, Bangladesh -1, India - 1, Myanmar - 1 European Union: Portugal - 1, Czech Republic - 1 Other European countries (outside the EU): Ukraine - 3, Belarus 1 Africa and the Middle East: Turkey - 2, Morocco - 1	Asia: China - 3 European Union: Italy - 2, Finland - 1, Sweden - 1, Czech Republic - 1, Germany - 1, France - 1 Other European countries (outside the EU): Ukraine 2

Source: Survey data

A final insight regarding the manufacturing offshoring strategy emerges when considering the problems experienced by the sampled companies (Table 5.). More specifically, the only critical issue that emerged with a weighted value higher than 3 is related to "Effective delivery time", and this only for the fashion meta-sector. This evidence would induce us to assume that offshored companies did not implement a strategy of relocations of the second degree as their offshoring experience was not so negative.

Table 5. Problems after offshoring implementation (weighted arithmetic mean on a Likert scale 1-5) (N=17)

Problems during offshoring	***Fashion***	***Electromechanical***
Effective delivery time	3.1	2.6
Actual logistic costs higher than planned	2.7	2.0
Human resources skills	2.3	2.5
Minimum quantity/batch to be bought/produced	2.1	2.4
Coordination of local employees/contractors	1.9	1.6
Actual production costs higher than planned	1.9	2.5
Infringement of patents and trademarks	1.9	2.2
Loss of manufacturing competence since the off-shoring decision	1.4	1.7

Source: Survey data

Supply offshoring

When considering supply offshoring, it emerges that the sampled Polish companies initiated commercial relationships with foreign suppliers quite intensively, since a large majority of the companies are supplied, at least in part, by foreign partners (Table 6). Comparing the two meta-sectors, the results show that the fashion industry is more open to global sourcing

since more than 44% of firms offshored at least 50% of their purchasing, compared to 22.6% of electromechanical companies.

Table 6. Decisions regarding supply offshoring

Supply strategy	*Fashion (N=301)*		*Electromechanical (N=301)*	
	Frequency	*%*	*Frequency*	*%*
All materials are bought from Polish suppliers	48	16	75	24.9
All materials are bought from foreign suppliers	6	2	3	1
Less than 50% of total supplied materials come from foreign suppliers	114	37.9	155	51.5
More than 50% of total supplied materials come from foreign suppliers	133	44.1	68	22.6
Total	301	100	301	100

Source: Survey data

To sum up, Polish manufacturing companies from the two sampled meta-sectors implemented very different approaches in terms of manufacturing and supply offshoring. More specifically, while they rarely offshored production activities, they largely made imports of materials. Such evidence seems to confirm the growing integration of Poland in so-called Global Value Chains, as shown by the country's top-ranking position among those exporting automobiles (Fernandes et al., 2020). At the same time, it confirms Poland's classification as a "forward GVC integration group" (Comotti et al., 2020). In this respect, Gradzewicz and Mućk (2020) showed "a fall in markups for Poland which can be explained by rising dependence on imported intermediates in export-oriented production and fiercer competition of domestic firms on export markets" (2020).

Relocations of the second degree

Manufacturing relocations of the second degree

Among the 17 enterprises that offshored some manufacturing activities, five (accounting for 29.4% of the total) made subsequent decisions to relocate, with notable differences between the two meta-sectors. In the fashion sector, 2 companies out of the 7 (28.5%) decided, at least partially, to backshore their production activities to Poland. However, the number of back-shoring decisions is a little higher, since one of the fashion companies back-shored from both China and Myanmar. The relocations to the home country implemented in the clothing and footwear industries are related to high-value business segments, such as premium clothing and special-purpose clothing (protective clothing). In terms of governance mode, while both companies outsourced to foreign contractors when offshoring, one of them (producing protective clothing) decided to re-insource production to its plant.

When considering the host country, it emerges that one company (premium clothing) relocated in 2017 from Asian countries, while the second did so in 2020 from Ukraine. In this respect, it is worth noting that while the two back-reshoring decisions from Asia were boosted primarily by logistics costs, the one from Ukraine was also driven by difficulties in the coordination of outsourced and offshored activities and operative flexibility. Moreover, decisions regarding repatriation from Myanmar and Ukraine were also motivated by political instability in the two foreign countries. Finally, both companies expressed quite a low level of satisfaction with the backshoring decisions. With specific respect to the company backshoring in 2020, further criticalities emerged while implementing the relocation.

In contrast, 3 out of the 10 companies belonging to the electromechanical sector (30% of total offshoring ones) relocated to a new host country, that is they implemented a relocation to a third country (Barbieri et al., 2019). More specifically, they had previously offshored both in EU countries (Italy, Sweden, Czech Republic) and in China.

Supply relocations of the second degree

When considering relocations of the second degree regarding supply activities, our findings show that a total of 63 companies out of the 479 that conducted offshoring relocated them at least partially (13.1%). However, the data is somewhat different when considering the two meta-sectors (Table 7). More specifically, supply reshoring was mainly implemented by fashion companies (15.41% of total offshoring companies) rather than the electromechanical firms (10.61%). This finding is quite relevant since fashion companies were the ones that offshored more of their purchasing activities. Therefore, it seems they were proportionally more disappointed by their earlier location decision.

Table 7. Decision to relocate supply of materials from foreign to Polish suppliers (last 5 years)

Supply relocation	*Fashion N=253*		*Electromechanical N=226*	
	Frequency	*%*	*Frequency*	*%*
Decision to relocate	*39*	*15.41*	*24*	*10.61*

Source: Survey data

When considering motivations that prompted the relocation of supply activities, it clearly emerges that several drivers obtained a weighted arithmetic mean higher than 3 (Table 8). More specifically, longer than expected delivery times were the main problem companies experienced. Following this, while higher logistics costs were relevant

for both subsets of companies, fashion firms pointed to the problem of minimum quantity orders while electromechanical companies indicated the increased costs of materials. Other main differences between the two meta-sectors regard the quality of suppliers' materials and environmental sustainability. The latter only assumed a certain relevance (3.2 out of 5) for electromechanical companies, while the corresponding value for the fashion industry was 2.2. This finding is somewhat unexpected given the growing attention of fashion customers and brands to sustainability issues (Thomas, 2020; Choi and Yongjian, 2015). Finally, it is worth noting that the made-in effect was not a relevant issue for both subsets. This is consistent with Poland's lack of comparative advantage in the investigated meta-sectors.

Table 8. Motivations for supply back-shoring (weighted arithmetic mean on a Likert scale 1-5) (N=17)

Motivations	***Fashion (N=39)***	***Electromechanical (N=24)***
Effective delivery time higher than expected	4.3	4.0
Minimum quantity/batch to be bought	4.1	3.3
Effective logistic costs higher than planned	3.7	3.8
Difficulties in coordinating foreign suppliers	3.7	3.4
Increased costs of materials from host country suppliers	3.5	3.6
Availability of skilled suppliers in the home country	3.4	3.3
Supplier materials of poor quality	3.0	2.5
Duties and commercial rules	2.4	2.6
Environmental sustainability issues (e.g., reduction of CO2 emissions)	2.2	3.2
Impossibility to use "Made-in" labels since materials were imported	2.1	1.9

Source: Survey data

Concluding remarks

Our paper aimed to shed new light on the internationalization processes of Polish companies operating in the fashion and electromechanical meta-sectors. More specifically, attention was focused on production and supply internationalisation strategies, since the study of these is still in its infancy and previous research does not offer definitive insights. In order to offer a more complete overview of the two internationalisation phenomena, we analysed the strategies of both offshoring and relocation of the second degree.

Our findings offer several contributions to the academic debate. First of all, they clearly show that Polish companies, at least in the two analysed meta-sectors, do not have a high propensity to internationalise their manufacturing activities. This finding confirms the classification

of Poland as a “forward GVC integration country” and as a “net sender” within GVCs (Comotti et al., 2020). Moreover, our findings clearly show very few motivations that contribute to explaining the tendency to retain production in the home country. Among them, sociological (patriotism) and marketing (proximity to customers and quality issues) emerged as somewhat relevant, coupled with the perceived high economic and financial risk. The latter issue may be explained, at least in part, by the small size of the companies investigated, especially those in the fashion industry.

However, when considering supply activities, a completely different scenario emerges, with very few companies buying only from national suppliers (16% of fashion companies and 24.9% of electromechanical firms). Moreover, 44.1% of the former and 22.6% of the latter import more than 50% of the required materials from foreign countries.

A third relevant finding regards relocation strategies implemented after the initial offshoring decision. Notwithstanding the limited number of offshoring companies, evidence of relocations of the second degree regarding manufacturing activities account for a notable amount in terms of both total offshoring companies (namely, 2 out of 7 in the fashion meta-sector and 3 out of 10 in the electromechanical sector) and implemented offshoring decisions (respectively, 3 out of 16 and 3 out of 12). However, while companies in the fashion industry revised their offshoring decisions in order to reduce the degree of their manufacturing internationalization– since they back-shored in Poland, those belonging to the electromechanical industry either maintained such internationalization (implementing near-shoring decisions), or even increased it (further off-shoring ones).

However, the most innovative contribution of our findings regards the back-shoring of supply activities. These were implemented by a significant percentage of companies (13.1%), even if the data is somewhat different when considering the two meta-sectors (15.41% of total offshoring companies in the fashion industry and 10.61% in the electromechanical industry). Considering that the former were more inclined to offshore supply activities, it seems they were proportionally more disappointed by the earlier offshoring decision. In this respect, several criticalities mainly related to logistics issues reinforced the relocation decision (delivery time, minimum quantity order, transportation costs). Moreover, it is worth noting that the availability of skilled suppliers in the home country was a somewhat relevant motivation for relocating supplies to the home country for both the sampled meta-sectors. On the contrary, environmental issues were, quite unexpectedly, relevant only in the electromechanical industry. Finally, the data collected shows several differences between the industries studied, confirming the need for multi-industry studies as suggested by Barbieri et al. (2018).

The current study has some limitations, mainly due to its explorative nature due to the infancy of studies on the production and supply internationalization process in CEE countries. First of all, the sampled data refers to only one country in the region, even if it is the most investigated and has a relevant position in GVCs. Secondly, it is focused on only two meta-sectors, even though one accounts for almost half of total production in the Polish manufacturing sector. Consequently, future research should broaden the analysis to include other CEE countries, and also consider other meta-sectors. Moreover, a comparison with other European countries, especially Western ones, would be valuable.

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ARTICLES

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Miroslaw Moroz*

Determinants of maintaining the development of an small online store in the conditions of economic slowdown in Poland

Abstract

Since its inception, the sector of companies selling on the Internet in Poland has been undergoing a process of continuous growth. Even the crisis of 2008 - 2009 did not negatively affect the development of e-commerce in Poland. However, due to the stage of development of the sector, as well as the current macroeconomic conditions, the question of maintaining the development trend under the conditions of economic slowdown arises.
The aim of the article is to identify and assess factors that may support its further development (or at least the maintenance of its position) at the level of an online shop operating in Poland under the conditions of the economic downturn.
The results of the analysis indicate that standard actions taken in favorable market conditions must be modified during a slowdown. Those activities that allow reducing costs and/or reaching a wider audience with an offer (e.g. performance marketing) need to be strengthened.

Keywords: economic downturn, e-commerce, development of enterprise, Poland

JEL classification: L81, M21, O21

Paper type: Theoretical research article

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Introduction

One of the booming industries is online sales. E-commerce offers many benefits for both consumers and businesses. From the customer's point of view, these include convenience, a wide range of products, easy comparability of the offer, attractive prices. Businesses will benefit from the introduction of a new distribution channel, reduced transaction costs, access to customer data, etc. These conditions reinforce each other, leading to an increase in turnover in the sector. In the United Kingdom, for example, average annual growth between 2008 and 2021 was over 20% (Statista, 2022).

In Poland, the e-commerce sector has also undergone a process of multifaceted development. In quantifiable terms, the value of sales, the number of customers buying online, the number of companies selling via the Internet increased year after year. In qualitative terms, there were changes in customer awareness and buying habits, delivery payment methods evolved, customer service in virtual channels professionalized. A factor singularly strongly influencing the development of e-commerce was the SARS-CoV-2 pandemic. The COVID-19 pandemic further strengthened the trends indicated above.

At the same time, 2022 is characterized by an economic slowdown (OECD, 2022). Looking through the prism of GDP growth, inflation levels, retail sales levels (at constant prices), and weakening consumer sentiment, the world, including Poland, must prepare for an economic slowdown. There are also more pessimistic predictions of recession (BIEC, 2022). According to preliminary data, the value of sales in stationary channels has declined in 2022 (Mazurkiewicz, 2022a; Mazurkiewicz, 2022b; Mazurkiewicz, 2022c), and there are also indications of a decline in demand in the virtual channel as well (Duszczyk, 2022a; Duszczyk, 2022b). This raises questions about the further development of the e-commerce sector, which, since its inception in the early 2000s, has operated under positive macroeconomic conditions. Even the crisis of 2008 - 2009 was not too much of a challenge for Polish e-commerce stores, because firstly, the Polish economy as a whole passed through the crisis relatively painlessly. Secondly, the e-commerce sector had been developing in Poland since the early 2000s , so the crisis of 2008 - 2009 occurred during a period of rapid growth in the sector. Thus, in 2022 - 2023, for the first time, online sales face the unpredictable predictions of macroeconomic conditions.

1. Development of e-commerce sector in Poland

Online sales involve commercial transactions in virtual space via a website, mobile application, marketplace or social media (Laudon, Traver, 2007, p. 10). E-commerce is therefore one of the types of trade, next to stationary trade, carried out through physical distribution channels (face-to-face). E-commerce,

on the other hand, is remote in nature, without the simultaneous presence of websites in the same place.

E-commerce is a complex economic subsystem. This is because it uses and appeals to interdisciplinary resources of knowledge and skills, among which are technological (data processing, programming languages, content representation and visualization), social (purchasing behavior, fashions and trends, self-presentation, techniques for dealing with information overload) and managerial (effectiveness of business models used, efficiency of particular IT tools, management of limited resources) issues. From the point of view of managers, e-commerce, compared to stationary commerce, is characterized by the following advantages (Falk, Hagsten, 2015):

- reliance on data on actual purchasing behavior
- reliance on up-to-date data (in part on real-time data)
- ability to automate operations
- speed of response to changes on the part of customers
- reduction of transaction costs
- expansion of markets.

From a retail customer's perspective, the advantages of using e-commerce include (Gemius, 2021):

- multiplicity of product information
- the ability to return in 14 days
- ease of finding rare products
- multiplicity of delivery methods
- the possibility to choose various forms of payment
- very wide assortment (large selection of products)
- ease of comparison
- often there are attractive prices
- unlimited time to make a purchase decision
- there is no need to drive/go to the store
- online store is available non-stop.

The data indicated above confirms the existence of a number of advantages, both on the supply and demand sides. For managers, the most important issues concern knowledge of purchasing behavior (scope and timing of receipt) and the possibility of automating marketing, sales and administrative activities. For customers, the main rationale for online shopping concerns the convenience of purchase (time, place, information), attractive prices and a large selection of assortments.

Of course, e-commerce generates certain disadvantages or barriers. For companies, these will primarily be the full symmetry of information and the ease of moving to another store (the customer is literally just a click

away from the next e-shop), resulting in a reduction in average margins. From the customer's point of view, the drawbacks relate to issues of personal data protection, the difficulty of decision-making under conditions of information overload, and exposure to online fraud (Ingaldi, Ulewicz, 2018). However, market data indicates that the advantages outweigh the risks, which is fueling the growth of e-commerce, both quantitatively and qualitatively. In qualitative terms, there is the emergence of more business models (e.g. group buying), professionalization of customer service, mergers and acquisitions, international expansion (cross-border trade), tax and legal optimizations.

The quantitative growth of e-commerce can be captured in two synthetic measures: the volume of the value of turnover generated by the sector, and the number of companies that have undertaken distance selling business. The above measures reflect changes in a number of other factors affecting the e-commerce sector (e.g., profitability, competition, demand) in an outcome-based manner.

Table 1 summarizes publicly available data on the volume of e-commerce sector turnover in Poland.

Table 1. Polish e-commerce turnover in the period from 2010 to 2021

Year	Revenues [billions of PLN]	Dynamics [%, year-over- year]
2010	15,5	---
2011	17,5	12,90
2012	21,5	22,86
2013	23,8	10,70
2014	27,3	14,71
2015	33	20,88
2016	35,8	8,48
2017	44	22,91
2018	53	20,45
2019	61	15,09
2020	83	36,07
2021	93	12,05

Source: Own elaboration based on PMR (2014); Rynkiewicz (2014); Golatowski (2016); Wyszyński (2016), PwC (2022)

From a methodological point of view, the various research companies present non-overlapping estimates of online sales volumes. The sales volumes presented in the table are in the middle range of sales values reported by various sources. Over 10 years, there was a double-digit growth

rate in the scale of turnover in annual comparison (except in one case), and taking 2010 as the basis for calculations, the volume of turnover increased 6 times. It proves the enormous success of the sector - the growing demand is matched by the increased scale of supply by sellers.

Another "hard" measure of e-commerce growth in Poland is the number of companies engaged in online sales. In the terms of Polish national statistics, the category of companies selling at a distance (class 4791Z of the REGON register) is taken into account. As digitalization proceeds, it should be estimated that almost all entities recorded in this class are engaged in e-commerce. Table 2 shows the number of e-commerce enterprises against the total number of all registered enterprises in the Polish economy at the end of a given year (data for the fourth quarter).

Table 2. Number of registered e-commerce enterprises and all enterprises.

Year	Number of e-commerce companies	Dynamics [%, year-over- year]	Number of all companies (countrywide, all sectors)	Dynamics [%, year-over- year]
2010	23595	---	3646694	---
2011	25989	10,15	3545838	-2,77
2012	28518	9,73	3551193	0,15
2013	32240	13,05	3590428	1,10
2014	36486	13,17	3800942	5,86
2015	36003	-1,32	3772931	-0,74
2016	36926	2,56	3828687	1,48
2017	38498	4,26	3901469	1,90
2018	40210	4,45	3935158	0,86
2019	43048	7,06	4014354	2,01
2020	49555	15,12	4103598	2,22
2021	54155	9,28	4225921	2,98

Source: Own elaboration based on Moroz (2017), REGON (2022)

The number of companies selling online has more than doubled over a 10-year period, to more than 54,000. However, it is worth pointing out that in addition to officially registered companies, unregistered entities (gray and black market) also sell online. Individuals selling in the c2c model are also not included in the quoted number. The growth rate of the number of companies trading online is positive (again, except for one period). The data presented confirms that the SARS-CoV-2 pandemic accelerated

the dynamics of business establishment in the sector. However, not only 2020 was characterized by a double-digit growth rate in the number of companies selling online - it was similar in a total of 4 years out of the 10 analyzed. Also, a comparison of the growth rate of the number of e-commerce companies in relation to the total number of companies confirms the significantly higher growth rate.

2. Signs of a slowdown in the Polish economy

The economic downturn brings numerous challenges for businesses. An interrelated set of factors is tightening business conditions. Declining GDP, rising inflation, and depreciation of the national currency translate into rising costs of day-to-day operations (including wage costs). Demand is also declining with declining real income. Also, decreasing consumer sentiment indicators do not inspire optimism. Shrinking demand leads to increasing competition, leading to an erosion of margins (Czerwińska-Lubszczyk, Michna, 2013). After all, many companies fail or have to close down (Pońsko, 2010).

The question arises to what extent the scenario of economic slowdown materializes in the conditions of the Polish economy in 2022. The level of Poland's GDP expressed in constant prices (2015 = 100%) and the level of consumer inflation (as of January 2020) are presented below.

Table 3. Changes in Poland's GDP in constant prices

Date	GDP level
4Q15	101,455
4Q16	106,397
4Q17	111,839
4Q18	118,019
4Q19	121,096
4Q20	119,73
4Q21	130,702
1Q22	127,957

Source: Puls Biznesu 2022a

Table 4. Changes in Consumer Price Inflation on monthly basis

Date	CPI level
01.01.2020	0,9
01.02.2020	0,7
01.03.2020	0,2
01.04.2020	-0,1
01.05.2020	-0,2
01.06.2020	0,6
01.07.2020	-0,2
01.08.2020	-0,1
01.09.2020	0,2
01.10.2020	0,1
01.11.2020	0,1
01.12.2020	0,1
01.01.2021	1,3
01.02.2021	0,5
01.03.2021	1
01.04.2021	0,8
01.05.2021	0,3
01.06.2021	0,1
01.07.2021	0,4
01.08.2021	0,3
01.09.2021	0,7
01.10.2021	1,1
01.11.2021	1
01.12.2021	0,9
01.01.2022	1,9
01.02.2022	-0,3
01.03.2022	3,3
01.04.2022	2
01.05.2022	1,7
01.06.2022	1,5
01.07.2022	0,5
01.08.2022	0,8

Source: Puls Biznesu 2022b

Over the analyzed 5 years, Poland generally records an increase in GDP, although a decrease in the measure is visible as a result of the SARS-CoV-2 pandemic. A decline in GDP is also visible in 2022. The consumer inflation rate has reached high levels in recent years (2021-2022). The significance of the above-mentioned macroeconomic measures indicates the formation of a new trend - the slowdown trend.

Confirmation of the above findings is the consumer sentiment index, presented comparatively on a monthly basis (Table 5).

Table 5. Consumer sentiment on monthly basis

Date	CS level
01.01.2020	3,7
01.02.2020	1,3
01.03.2020	1,3
01.04.2020	-36,4
01.05.2020	-15
01.06.2020	-30,1
01.07.2020	-19,4
01.08.2020	-13,4
01.09.2020	-15,2
01.10.2020	-20
01.11.2020	-29,2
01.12.2020	-24,9
01.01.2021	-25,1
01.02.2021	-25,2
01.03.2021	-23
01.04.2021	-22,5
01.05.2021	-13
01.06.2021	-14,6
01.07.2021	-14,8
01.08.2021	-13,5
01.09.2021	-14,6
01.10.2021	-17,8
01.11.2021	-23,3
01.12.2021	-27,3

cd. Table 5

01.01.2022	-29,2
01.02.2022	-27,7
01.03.2022	-39
01.04.2022	-37,2
01.05.2022	-38,4
01.06.2022	-43,8
01.07.2022	-41,7
01.08.2022	-44,9

Source: Puls Biznesu 2022c

This indicator carries the greatest negative charge. Consumers' moods indicate with what optimism / pessimism they look to the future and how willingly they will make purchases. Of course, there is a category of fixed expenses, but for various e-commerce segments (and commerce in general), the dropping level of the measure is a strong concern. The above picture is confirmed by the forecast sales volumes (for the entire trade), which are also at negative levels (Puls Biznesu, 2022d).

To sum up - most of the current data shows a greater or lesser regress. Advance (forecast) economic data predict an even greater slowdown in the near future. of the economic situation predict an even greater slowdown in the near future.

3. Research design

The two resulting indicators of the e-commerce sector's health presented in the article (turnover generated and the number of companies in the sector) reflect the positive trends taking place in the sector by the end of 2021. Entrepreneurs and managers were increasing the scale of operations and/or establishing more companies. All this was happening on the basis of a positive perception of the state of the sector in terms of demand, profitability, level of competition (Porter, 1999, p. 22). However, the coming economic downturn, or as some want recession or stagflation, will challenge the sector to continue growing. The data in Tables 1 and 2 are for 2010 and later, so they do not apply to the crisis of 2008 - 2009. However, this crisis, although devastating for many economies, went relatively smoothly in the Polish economy (Nazarczuk, 2013). Secondly, the e-commerce sector in Poland has not encountered a period of slowdown during its operation since 2002. It resulted from the initial stage of the sector's functioning, which in 2008 was at the stage of dynamic growth. The question is how to prepare for the upcoming slowdown.

The analysis of the literature in the field indicates that the issue of activities that may maintain the market position and financial condition of an online store in slowdown conditions is rarely undertaken. The conducted query in bibliographic databases (Scopus, ScienceDirect, Google Scholar) indicated a significant number of articles devoted to the issue of setting up companies selling on the Internet in crisis conditions. In addition, the issues of adaptation or, more broadly, flexibility of an e-commerce enterprise should be taken into account. Nevertheless, this publication aims to fill a gap in the area of practical measures that do not deteriorate the market position of an online store of a small size. As research shows, in Polish conditions, stores employing up to 5 people are the most numerous (REGON 2022).

The research problem resulting from the above premises is as follows: what actions can lead to maintaining or improving the market position and financial condition of a small online store in an economic downturn. The idea is to identify activities that meet the following conditions together: they are not too costly, they can be carried out with the staff of the e-store, and they have a bearing on the market position and financial condition of the company. Thus, the subject area is concerned with companies already in operation, that is, with a certain market position, customer base, developed procedures, etc.

The aim of the article is to identify and assess factors that may support its further development (or at least the maintenance of its position) at the level of an online shop operating in Poland under the conditions of the economic downturn.

The research method that will be used to achieve the goal is a case study and desk research. The rationale for using a case study is the nature of the research problem adopted: concerning real management problems that are poorly recognized and unstructured. R. Yin (2018) in situations where we are looking for answers to "how", "what" questions recommends choosing the case study methodology. Also, studying specific industries or sectors provides a rationale for using a case study (Naoui, 2014). The object of the research was a small online store operating since 2002. The object of the business is the sale of accessories and materials for artistic painting. The operation of the store, its day-to-day management and customer service are handled by one owner. The owner did not agree to disclose the name of the business.

The research data was collected in September 2022.

4. Case study analysis

The interview with the owner of the online store took place in the second half of September 2022, so in a situation of strong cost growth for the analyzed enterprise, and due to the nature of the operation, the owner's attention is primarily absorbed by two types of costs: energy costs and the rising exchange rate of the USD against the PLN.

Like any online store, an important cost component is the cost of purchasing electricity. Functioning in a virtual space, as well as the requirement for a constant online presence 24 hours a day, means that all electrical and electronic equipment (computers, printers, labeling machines, cash register, etc.) must be constantly powered. In absolute terms, expenses are not high, while the owner's concern is the scale of increases. Added to this is the uncertainty about the levels of increases next year - it is known for now that they will be significant, but it is not known exactly by how much.

The second, even more noticeable cost, is the depreciation of the domestic currency PLN significantly weakened against the USD (from the beginning of 2022 about 20%). Since the vast majority of the assortment the entrepreneur imports from abroad (USA, China), automatically their price expressed in PLN should also increase by 20%. However, this is not entirely possible due to limited demand in the market niche in which the company operates. Poor consumer sentiment is making itself felt in the company's current operations. The company is currently experiencing stagnant sales, customers are uncertain about what will happen in the future and have cut back and some have even stopped making hobby purchases. The situation is slightly better for the segment of companies or professionals using devices sold by Store X. Moreover, the company operates in a competitive environment. The competition is not only from Poland, but also from abroad (European countries, USA). Taking these considerations into account, the owner has not decided to pass on cost increases on a 1:1 basis for each product. In this regard, it is possible to differentiate margins depending on the type of assortment present in the company's offer. The so-called "top shelf" allows higher increases in margins and prices to make up for the aggregate margin volume.

Another cost-cutting factor is more precise management of inventory levels. There are several thousand items in the company's product line. Not all of them are in the company's warehouse, for an obvious reason: there are products that sell more frequently (the so-called category killer), and products whose sale may occur once a year or even less frequently. In this respect, an online store differs from a stationary store, as the virtual presentation can be for up to tens of thousands of stock-keeping items (SKUs), which do not have to be physically in the company's possession. Inventory control is a necessity for trade not only in a slowdown or crisis (Chodak 2007). However, it is under such conditions that one needs to think more precisely about what will actually be a fast-moving

product. And this is where stores where the person making the buying decision is in close contact with customers have an advantage. Real knowledge of the customer's needs (not just estimated in calculating programs or imagined) allows better planning of the necessary inventory.

Another issue that allows the owner to reduce costs, in the assumption, is to track exchange rates and order larger (or smaller) batches of equipment or materials in tact with fluctuations in the exchange rate. In reality, this is a rather risky move. It happened that the owner waited for a lower dollar exchange rate, which, however, did not happen within the accepted time horizon and the purchase had to be made at a higher rate.

Other costs are under the control of the entrepreneur. In particular, this includes the rapidly increasing costs of wages, real estate fees and financial costs (loans) in the economy. The store is run individually, without hiring employees. In the past, the owner made such attempts, but could not find a person with broad competence. In the current situation, he has also held off on hiring an employee due to the level of salary costs and the anticipated reduction in the workload of the e-store. The business is run from the owner's own home, which does not cause problems with the rapidly increasing rent. Finally, in addition to trade credit, the owner does not have business credit obligations. It is also worth mentioning that the rising transportation costs have been passed on to customers. In this regard, most online stores, led by the largest, have gone this way.

The second stream of activities that have been implemented in the analyzed company are customer acquisition activities. In terms of assortment, we are dealing with a classically conceived market niche. On the one hand, this means a limited target group in terms of numbers, but on the other hand it reduces the intensity of the competitive struggle. What matters in this situation is reaching the right people with a precisely targeted marketing message. The owner has experimented with various types of online marketing, from display marketing to social media marketing. However, with the upcoming economic downturn and a specific target audience, the intention is to conduct performance marketing. The planned marketing activities will focus on increasing user conversions and at the same time the advertiser pays only for the effect of the advertising campaign (e.g., making a purchase) (Khamaludin et al. 2022). In such an advertising billing model, the cost is directly related to the effects achieved. Thus, the anticipated types of advertising campaigns will be through search systems, affiliate programs, social media. However, the owner does not intend to run campaigns based on banner ads.

Measures that will allow faster adaptation to changes in the market are also being considered to change the software of the online store. The owner has so far changed the main software four times, due to the ease of implementing changes (e.g. adding new payment methods, integration with courier service providers), convenience, level of reliability. With the upcoming

slowdown, a review of available software solutions is planned on a cost-effectiveness basis. This raises the danger of proper data migration, proper integration with other systems (cash register, partners, accounting, etc.). However, the owner is open to change, has done major software replacements in the past, and hopes that the slowdown will bring down the cost of acquiring the system.

Similarly, cooperation with contractors (courier service providers, payment integrators, companies that take care of the provisions of the sales regulations, suppliers of office supplies) will be reviewed. Again, this will happen according to the cost-effectiveness principle. This does not mean that currently the entrepreneur does not carry out such calculations. It's more about managing to get cheaper service/supply contractors in a downturn. There is one permanent element in this puzzle. The owner does not intend to change the accounting firm, because it has demonstrated professionalism in tax settlements and assertiveness in dealing with the tax office.

5. Discussion and conclusions

An analysis of the actions taken or planned by the owner of a small online store lead to the conclusion that in the conditions of the slowdown, the rationalization of business activities is moving further. Until now, the entrepreneur was guided by cost accounting, paid attention to the efficiency of his business. However, information about deteriorating macroeconomic data coming from the media, as well as one's own observations, conversations and feelings in contacts with customers and clients, as well as calculations based on current data from the enterprise, prompts an even more measured look behind the principles, tools and procedures of doing business. At the same time, it is worth mentioning that data from one's own company is not as alarming as macroeconomic data. However, this does not put the entrepreneur's vigilance to sleep, as he realizes that a slowdown can still manifest itself suddenly with full force.

On the basis of the analyzed case, two main paths of adapting to the anticipated slowdown can be identified: cost reduction and review of activities, procedures and solutions in the most cost-effect manner. Table 6 summarizes the desired actions synthetically.

Table 6. Measures to prepare a small online store for the economic downturn

Areas of action	Priority measures
Reducing operating costs	– Reducing energy, administrative, holding costs through economical and rational management of resources – Reduce transaction costs by switching to paperless trading, finding a bank with spread-free foreign currency account service – Analyzing and possibly renegotiating counterparties' handling costs – Rational reduction of inventory in the warehouse – Maintain positive cash flow by meticulously monitoring the collection of receivables and activating a low-cost source of financing (leasing, factoring, working capital credit) – Holding off/in-depth analysis of starting a larger investment
Increasing efficiency of operations	– Making greater use of cost-effect analysis in every cross-section of the business – Switching to performance marketing solutions in advertising campaigns – Analyze the offer of contractors (store software provider, payment integrator, courier service provider, etc.) for opportunities to reduce costs – Sell assets that are unnecessary at the current stage of development
Customer-oriented activities	– Improving the level of customer service (time, satisfaction, empathy) – Diversifying the ways of contacting the customer (making greater use of social media) – Launching sales in more channels, especially in new marketplaces – Reviewing the company's existing offerings in terms of breadth and depth of assortment (paying attention to budget products)

Source: Own elaboration

The proposed solutions are tailored to the small scale of operations, small financial resources and individual work of the entrepreneur. On the other hand, they take into account the peculiarities of e-commerce functioning at the current stage of development in Poland.

The effectiveness of the proposed measures will depend on matching the choice of individual measures to the individual market and financial situation of the enterprise, as well as the consistency of the measures taken. This is because there are tensions between some of the proposed actions - for example, most of the recommendations lead to a reduction in costs while improving the quality of customer service may involve more time or the need to purchase a CRM module/software.

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