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## RESILIENCE OF POLISH EXPORTS TO NON-ECONOMIC EXTERNAL SHOCKS

### | Abstract

- ▶ *Goal* – the paper aims to assess the resilience of Polish exports to disruptions caused by external factors of a non-economic nature, using the example of the shocks caused by the COVID-19 pandemic and the war in Ukraine.
- ▶ *Research methodology* – the author of the study uses a literature review and analysis based on official statistics. The three dimensions of export resilience were operationalized and assessed, i.e. resistance, responsiveness and adaptation. Short- and medium-term results were evaluated.
- ▶ *Score/results* – Polish exports are not completely resilient to non-economic external shocks, as there has been a short-term deterioration in performance due to the pandemic and the war in Ukraine, but taking all dimensions of resilience together and the medium-term time horizon, the resilience of Polish exports to this type of disruptions has been strongly confirmed.
- ▶ *Originality/value* – the study responds to the need to assess the economic security of economies participating in the international division of labor in connection with the emergence of non-economic external shocks negatively affecting international cooperation. The study makes an important contribution to the recognition of the resilience of Polish exports, its various dimensions and over a longer time horizon. To date, such research has not been conducted, and the issue of trade resilience, although very important for continuing to reap the benefits of international trade, is not sufficiently explained.

| **Keywords:** trade resilience, Polish exports, external shocks, pandemic, war in Ukraine, foreign trade.

## 1. Introduction

The world economy has been experiencing destabilizing phenomena and processes virtually since the outbreak of the global financial crisis in 2008. The COVID-19 pandemic, the war in Ukraine, the technology and trade war between the U.S. and China, tensions in political relations between the major powers, i.e. the U.S., China, Russia, NATO, and, in the wake of this, growing protectionist tendencies, as well as other disturbances growing in connection with climate change, have put the world economy in a state of instability and uncertainty. In particular, the pandemic has brought unprecedented disruption of global economic flows. Not only did it cause a health crisis, but it also triggered demand, supply and communication shocks due to widespread lockdowns, restrictions on the movement of people, including border closures, restrictive inspections and sanitary regime. On top of this, it occurred all of a sudden and unexpectedly, despite the fact that the phenomenon of pandemics is not entirely new and we have dealt with them many times in history. In a highly globalized world in which economies are tightly interconnected through a network of international economic relations, and there are often links in global supply chains operating on a just-in-time basis, the emergence of such constraints and uncertainties must have had far-reaching consequences [Baldwin, Tomiura, 2020]. Under conditions of shock, high uncertainty and sometimes even panic, the demand for particular types of products changed by leaps and bounds, and in this situation there were natural difficulties in meeting it, especially since similar phenomena occurred almost simultaneously in other countries. One of the acute effects of the disruption in the terms of exchange caused by the pandemic was a reduction in world trade, although the decline was not as high as during the global financial and economic crisis. This may suggest that non-economic external shocks affect international trade somewhat differently than economic crises.

Disturbances and uncertainties in the world economic system, particularly those caused by the pandemic, have clearly highlighted the dangers associated with the high degree of international trade links and their nature. As a result, these have emerged proclaiming the advent of the era of deglobalization, suggesting the need to improve economic security, increase self-sufficiency, especially in strategic sectors, and pointing to the phenomenon of reshoring as a response to the new situation in international political and economic relations [The Economist, 2020; Lee, Park, 2021]. The observed trends toward reshoring, however, may result rather from the digital transformation than from the pandemic and

efforts to increase resilience, and as the pandemic has influenced the acceleration of digitization, it has intensified reshoring through this channel, which is therefore not quite rightly directly linked to it [El-Sahli, Gullstrand, 2023]. The processes taking place in the world economy are therefore highly complex, multifaceted and dynamic. A closer and longer observation of them also points to the formation of a new configuration of international economic ties rather than to a prominent reduction in trade [Butollo, Staritz, 2022]. Suggestions are also being made to improve international cooperation and regulation with the aim of increasing resilience over the long term and building “collective” resilience [Zhang et al., 2021; Gui, 2022]. Changes in the pattern of international cooperation are significantly influenced not so much by short-term disruptions exemplified by a pandemic, but by long-term changes in the situation, shaped, for example, by persistent uncertainties related to political and climatic conditions [Di Stefano et al., 2022].

The high degree of dependence of many economies on foreign trade is very important for the resilience of entire economies, for their economic and national security. The changes that have taken place in the international environment, especially the occurrence of non-economic shocks and the challenges associated with them, give rise to the need for research on the resilience of international activities, particularly the trade. To date, this area is under-recognized, as resilience studies often focus on entire economies, regions and companies, and, to a lesser extent, on the international trade.

The purpose of the article is to assess the resilience of Polish exports to disturbances caused by external factors of a non-economic nature, using the example of the shocks caused by the COVID-19 pandemic and the war in Ukraine. These are events that have introduced serious disruption and uncertainty in the international environment, negatively affecting the possibility of cooperation and bringing the risk of a decline in trade flows, thus raising threats to the functioning of national economies. However, not all countries have experienced the same changes in export performance under these disruptions. There are economies that fare better in such a situation and may even benefit from it. This raises the question of whether Polish exports are resilient to such shocks? Studies to date have focused on short-term responses to a pandemic outbreak, and their results are inconclusive, with analyses for Polish exports in particular lacking in this regard.

The following sections of the article provide a review of the current research on trade resilience, then the adopted analysis methodology is presented and specific research questions are formulated, and the results and conclusions are submitted.

## 2. Review of the literature

Studies of the impact of the pandemic on trade during its first period indicate that the negative effects are diversified by industry, and vulnerability to such shocks is reduced by a higher share of remote work and increased by participation in global supply chains [Espitia et al., 2021; Álvarez et al., 2022]. Also, the mere presence of related industries increases vulnerability to the impact of external shocks [He et al., 2021]. These results are consistent with intuitive perceptions of pandemic effects in the subject of international trade. Similar conclusions regarding the impact of linkages occurring in supply chains on the trade effects of the pandemic in its first phase come from another study, which points to the transmission of demand and supply shocks between economies and an increase in trade vulnerability [Kejžar et al., 2022]. Also, a study of the resilience of exports to the pandemic by Bas et al. [2023] takes into account the role of product specificity from the perspective of their linkages in global value chains and the contribution of interpersonal contacts to their production. The results obtained in this study indicate that product specifics have a differential impact on export resilience in different phases of the pandemic, and that exports of products within more geographically diversified value chains and whose production is more automated are nevertheless characterized by greater resilience. In contrast, export resilience is negatively affected by the high level of concentration of foreign suppliers, especially the high share of China. It should be emphasized that the diversification of sourcing in production and the inclusion of foreign suppliers increases export resilience, which confirms the benefits of international cooperation in global supply chains, but with greater diversification in sourcing. In contrast, the complexity of products, the intensive use of low-skilled labor force in them, did not have a significant impact on the resilience of exports to pandemic disruption. The conclusions of this study support the thesis that there is a need to build resilience to external shocks based on the reconfiguration of trade links, in this case diversification of international cooperation and digital transformation in place of the pursuit of self-sufficiency and reshoring.

Studies also confirm the wide variation in the impact of pandemic on trade depending not only on industries [Vidya et al., 2023], but also on specific types of products or their transport modes [Arita et al., 2022]. In contrast, studies of trade resilience from a macroeconomic perspective conducted on the basis of a set of characteristics of economies and their anti-COVID policies indicate that the de-

gree of globalization, health care, infrastructure quality and efficiency, and high income level significantly increase trade resilience, while restrictive anti-COVID policies and high mortality have a negative impact in this regard [Mena et al., 2022]. In contrast, in developing countries, development assistance can also affect export resilience [Gnangnon, 2022].

In summary, the resilience of trade to external disturbances is determined by numerous and diverse factors, which also occur at different levels – from global, through macro and meso, to microeconomics, where a number of factors shaping the resilience of enterprises are also indicated [Cheng et al., 2022]. Moreover, dynamic changes are permanently taking place in this area. Under these circumstances, it is difficult to make conclusions based on the results of previous studies about the resilience of countries' exports to non-economic external shocks.

### 3. Export resilience research methodology

Resilience of an economic system, as a general concept, is captured in the literature in varying ways. The approach used in supply chain research is relatively widespread; its resilience is defined as the ability of a system to resist disruptions and the ability to recover after disruptions occur [Melnyk et al., 2014: 36; Mena et al., 2022: 78]. Thus, two dimensions (types) of resilience are specified here. A comprehensive review of definitions of resilience within different areas and fields of science was carried out in the publication on regional resilience [Bristow, Healy, 2020], where a total of four different types of resilience were identified. Resilience can mean, in addition to the two dimensions already mentioned above, also the ability to adapt to a new situation and the ability to transform in order to radically change the way we function to be resilient to potential new disruptions in the future. Taking all these approaches, the resilience of a system, including trade, to external shocks may include:

1. The ability to resist or tolerate disruptions in international trade, i.e. to be absorbed while maintaining normal functioning, as if the disturbances had not occurred, that is according to the path of its development as it was before the disruption occurred and without changes in the nature or structure of the system. This type of resilience for the purposes of this study has been called robustness, absorption or, alternatively, resistance.
2. The speed and extent of response to disruption, i.e. rebound, recovery, return to the pre-disruption state and development path, in a situation where

the system has experienced some negative effects of the shock. The name responsiveness or, interchangeably, reactivity, has been adopted for this dimension of trade resilience.

3. The ability to adapt to a new situation, positive reorientation, structural reconfiguration of operations in response to a shock. The term adaptability has been applied to this type of resilience.
4. The ability to change the operating model, the path of development, a transformation involving the adoption of a fundamentally new configuration of activities and functions (renewal). This dimension of resilience is called transformation.

These types of resilience can be observed in different time horizons, and so: absorption/resistance manifests itself primarily in the short term after the onset of an external shock, responsiveness/reactivity in the short to medium term, adaptability in the medium term, and transformation is a long-term process. While the first two approaches to resilience are partially taken up in research, the others are difficult to find in analyses of international trade resilience. In the study of the resilience of Polish exports, it was decided to assess the three dimensions of resilience indicated first.

Taking into account the different types of resilience, the main research question about the resilience of Polish exports to the shocks caused by the pandemic and the war in Ukraine was developed and the following specific questions were formulated:

1. Do Polish exports have absorption properties of the shocks caused by the pandemic and war in Ukraine?
2. In the absence of absorption properties, do Polish exports show responsiveness to the shocks caused by the pandemic and war in Ukraine?
3. Do Polish exports have adaptation properties to conditions determined by the disruptions caused by the pandemic and war in Ukraine?

In order to answer the posed question, the dimensions of export resilience selected for analysis were operationalized. It was assumed that export resistance/absorption would mean, in the first instance, obtaining export values during the course of a disturbance at a level at least equal to that prior to its occurrence. This type of absorption has been called resistance of the first kind. In addition, the relative absorption properties of exports will be assessed, which is understood as recording a result better than the world average and the EU average. The

primary indicator for this dimension of resilience is the volume of exports, measured by the percentage change from the same period in the previous one. Due to the fact that the course of the pandemic was not uniform, and the escalation of the disease and the restrictions put in place occurred in waves, in addition to the annual dynamics of export volume, analogous data on a monthly basis were also used for the analysis. Similarly, monthly data were also used in trade resilience studies by Lou et al. [2023] and Mena et al. [2022]. Within the first dimension of resilience, the absorptive capacity of exports of the second type will be assessed on the basis of the deviation of the value and volume of exports from the long-run development path covering a 20-year period, estimated by a linear trend function for the two time series, respectively. Export volumes are expressed in weight units due to the lack of corresponding data in constant prices.

Based on the data used for the analysis of absorption, the responsiveness of exports, understood as the speed of response to disruptions, will also be estimated, if necessary. The extent of this reactivity will be assessed based on the length of time it takes for exports to perform at least at the level of a hypothetical value estimated by a linear trend function for the value and volume of Polish exports.

Adaptability for the purposes of this study was assumed to be interpreted as changes in the product structure of exports. To assess this dimension of resilience, an indicator of the intensity of structural change was chosen using the following formula:

$$d_{t,t+\tau} = \sqrt{\sum_{i=1}^k f_{i,t+\tau} \left( \frac{f_{i,t+\tau}}{f_{i,t}} - 1 \right)} \quad 1)$$

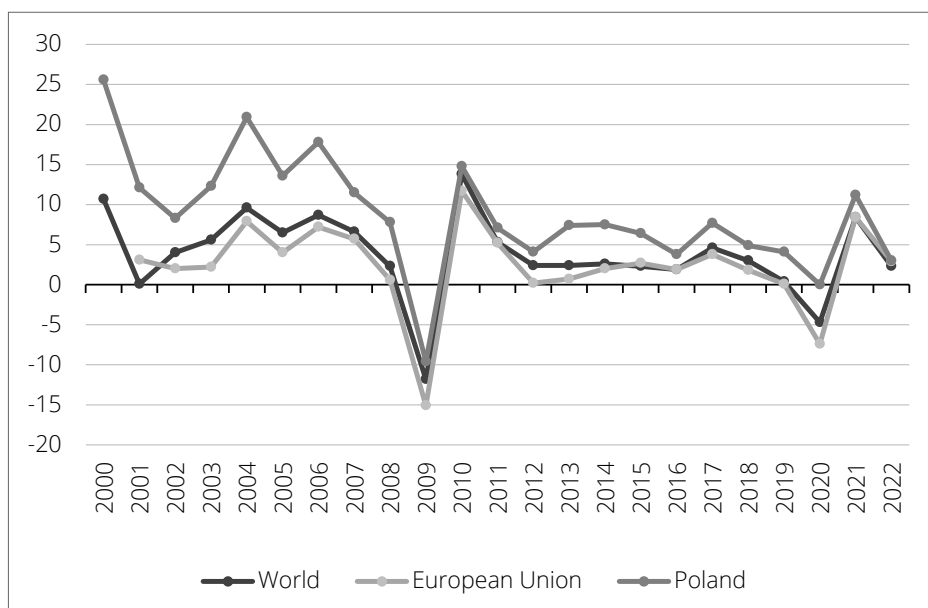
where  $f_{i,t+\tau}$  is the share of the component  $i$  of the structure in period  $t + \tau$ ;  $f_{i,t}$  – the share of the component  $i$  of the structure in period  $t$ ;  $k$  represents the number of components of the structure. This measure of the structural change was proposed by J. Rutkowski [1981], and it is adequate for comparisons of structures at different points in time. The higher the value of this indicator, the greater the changes in the structure, and it takes a value of zero when there are no changes at all. Since the structural changes are also a natural process accompanying development, more intensive changes relative to the period in which external shocks did not occur, will be considered a manifestation of adaptation to conditions determined by disruptions. Therefore, the analysis was made for the period 2016–2022, in which we can compare not only annual changes, but also separate two four-year sub-periods, the first (2016–2019) being a period

with relatively stable external conditions, and the second (2019–2022) including disturbances caused by the pandemic and the war in Ukraine. The analysis of changes in the product structure of Polish exports is carried out using the HS (Harmonized System) commodity nomenclature at the level of two-digit codes, covering a total of 96 product chapters.

#### 4. Results

On the basis of the adopted research assumptions, the absorption of the first type of Polish exports was first analyzed using volume dynamics data on an annual basis, followed by monthly data. Annual data, also taking into account the average for the world and the EU, are presented in Chart 1.

*Chart 1.* Export volume indices of the world, European Union and Poland in 2000–2022 (in % compared to the previous year)



Source: the author's own compilation based on WTO data [WTO, 2023].

In terms of annual results, Polish exports showed relative and absolute absorption to the shock of the pandemic and the war in Ukraine. Its volume did not decrease in the year of the outbreak of the pandemic and thus the condition



of resistance of the first type was met. At that time, global exports experienced a decline of 4.7%, and EU exports decreased by 7.4% (Chart 1). Moreover, in 2022, the year when the war broke out in Ukraine, the volume of Polish exports increased by 3%, while the growth rates for the world and the EU, although similar, were lower at 2.3% and 2.9%, respectively. This indicates a relatively high absorption of the war shock by Polish exports, as it should be taken into account here that both Ukraine and Russia are Poland's neighbors and were relatively important trading partners of Poland in 2021, when Russia's share in Polish exports was 2.8% and Ukraine's was 2.2% [GUS, 2023a]. One would therefore expect that the impact of the war should be relatively higher on Polish exports than the global or even European average. It is worth noting that the performance of Polish exports during the pandemic and the war is much better than in the situation of the global financial and economic crisis that began in 2008, when a very large decline was recorded, although the negative effects on global and EU trade were also more severe.

For the analysis of monthly data on the volume of Polish exports, which are included in Table 1, the period from 2016 to the most recent data as of the end of June 2023 was selected. Adopting a longer timeframe before the disruptions caused by the pandemic and the war in Ukraine serves to adequately represent the situation before the occurrence of these shocks as a reference point.

Monthly changes in the volume of Polish exports in the first year of the pandemic compared to the corresponding months of the previous year indicate a three-month period of maintaining the level of exports below the previous year's volume, with the declines being very deep in April and May. These data testify to the negative reaction of Polish exports to the outbreak of the pandemic itself and the first phase of its development. In the following months, and especially in the last quarter of 2020, the real value of exports recorded high increases. In turn, Polish exports reacted to the outbreak of the war in Ukraine on February 24, 2022 with declines in volume in the following two months, and they were much smaller than during the pandemic. The declines recorded in November and December 2022 should also be interpreted as a sign of insufficient absorption of the disruptions caused by the war, because in stable operating conditions, which were assumed to occur in the remaining months of the 2016–2020 analysis period (the unshaded area in the Table 1), there were only one-month declines and such fluctuations were considered natural for the exports analyzed here due to the generally dynamic nature of economic phenomena. The deterioration in export performance in the last two months

of 2022 may be related to the escalation of the war conflict following Russia's announcement in October of that year of its annexation of several regions of Ukraine and the subsequent introduction by the EU of another package of sanctions, as well as the adoption of legislation enforcing compliance with sanctions already introduced against Russia [European Council, Council of the EU, 2023].

*Table 1.* Dynamics of Poland's export volume in 2016–2023 (monthly data, the same period of previous year = 100)\*

Month/ Year	1	2	3	4	5	6	7	8	9	10	11	12
2016	104	108	105	112	109	108	97	114	105	104	110	105
2017	114	105	118	99	108	105	109	112	107	112	108	104
2018	108	103	98	112	107	110	109	104	107	111	106	98
2019	107	111	107	106	108	94	112	99	102	104	97	109
2020	103	107	<b>98</b>	<b>73</b>	<b>81</b>	107	98	107	110	105	114	113
2021	104	105	121	159	130	115	110	106	104	101	108	109
2022	106	103	<b>98</b>	<b>97</b>	107	101	100	108	106	103	<b>99</b>	<b>96</b>
2023	101	100	102	–	–	–	–	–	–	–	–	–

\* values marked in bold – in period of external disruptions

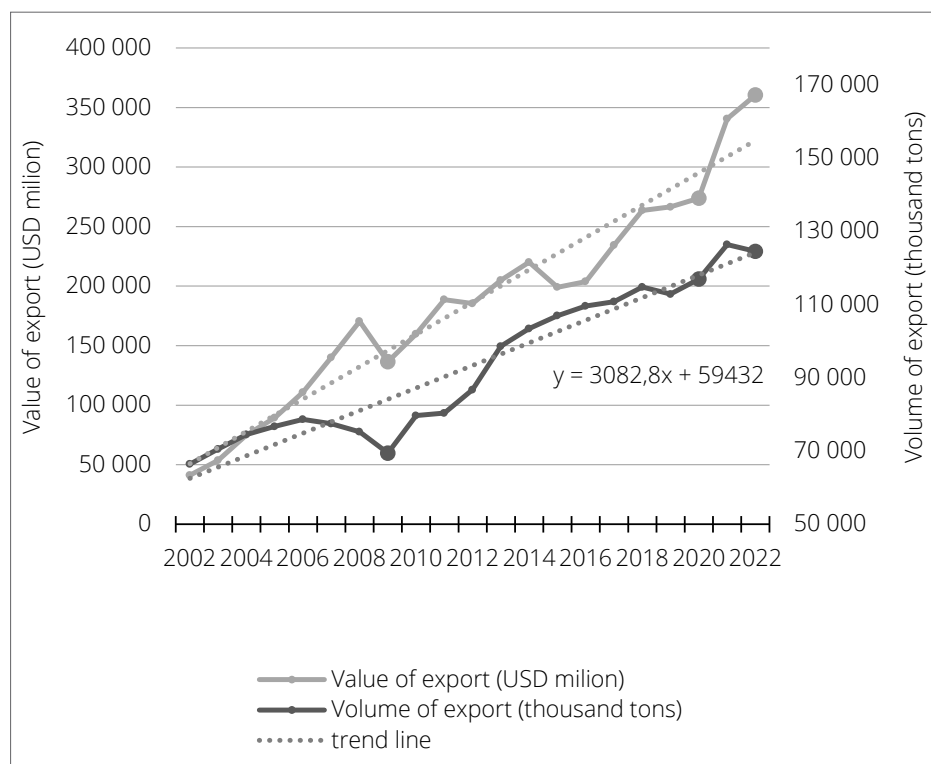
Source: the author's own work based on Statistics Poland data [Statistics Poland, 2023b].

Data for assessing the absorptive capacity of the second type of Polish exports on the basis of deviations of export performance during shocks from the long-term development trend are shown in Chart 2. Linear trend functions were determined for both analyzed time series.

A comparison of the results in Chart 2 shows that export growth on the volume side is generally characterized by greater stability than its value growth, which is undoubtedly influenced by changes in the world market prices. In 2020, the quantitative performance of exports was practically on the trend line, while its value was below this line. It is in 2019 that a slight decrease in the volume of export sales is observed, while already during the pandemic disturbances (2020) exports grew in line with the trend, and in 2021 there was a spike. In 2022, the volume of exports decreased, despite an increase in its value, which, taking into

account an additional 3% growth in export volume in that year (Chart 1), should be interpreted as the result of simultaneous changes in the product structure and price increases. However, the export sales volume obtained in the last analyzed year is within the trend line, and the decline itself can therefore be seen as a correction after a more than average increase in 2021. It should also be borne in mind that 2022 represents a period in which the outbreak of war in Ukraine is superimposed on the still ongoing pandemic.

Chart 2. Value and volume of Polish exports with a linear trend function for 2002–2022 (USD million, thousand tons)



Source: the author's own compilation based on WTO data [WTO, 2023] for the value of export and Eurostat data [Eurostat, 2023] for the volume of export.

Summarizing, the above results indicate the absorption properties of the second type of Polish exports on an annual basis, as well as at least a short-term acceleration of export sales after absorbing the disruptions caused by the initial phase of the emergence of the external shock. At this point, it is also worth emphasizing that export performance is characterized by its own dynamics, which

are influenced by many different factors, and certain fluctuations and deviations from the trend are a natural phenomenon.

Since the lack of absorption of Polish exports was revealed only in the analysis of monthly data, its responsiveness can also be assessed with reference to such a time perspective. The results in this regard indicate a rapid recovery of Polish exports after the declines in the first three months of the pandemic, as already in June the volume reached a level above that recorded in the corresponding month of the previous year (Table 1). Above-average increases were recorded in the last two months of 2020. There was also very good performance throughout the following year, with an average export volume growth of more than 11% (Chart 1). Just as in the pandemic-induced disruption, Polish exports showed responsiveness after the declines caused by the hostilities in Ukraine. After two months, export performance has returned to pre-disruption levels. However, the latest available data show some slowdown in export growth. It will therefore be interesting to see the results for the next months of 2023, which will clarify how Polish exports will cope in the long term with the uncertainty and disruption caused by the war waged in a neighboring country and the serious tensions in international political-military relations.

The results of calculating the index of intensity of structural change according to the formula (1) chosen to assess the adaptability of Polish exports are presented in Table 2. The variable of the value of Polish exports was used to calculate the product structure.

*Table 2.* Intensity of changes in the product structure of Polish exports at the level of HS nomenclature divisions in 2016–2022

Index / Year	2016	2017	2018	2019	2020	2021	2022
In relation to the previous year	0.125	0.119	0.073	0.096	0.141	0.125	0.209
Over the period 2016–2019	0.170			:			
Over the period 2019–2022	:			0.262			

Source: the author's own compilation based on Eurostat data [Eurostat, 2023].

Analyzing the value of the index of structural change in annual periods, it should be noted that there was a marked increase in 2020 compared to the results obtained for the previous years of the analyzed period (Table 2). However,

particularly intensive changes in the commodity structure occurred in 2022. In turn, in 2021, changes were also high, but already comparable with other years in which there was no external disturbance. The calculation of the index for four-year periods, which eliminates two-way changes in consecutive years, also confirms the higher variability of the structure of Polish exports under external shocks, i.e. in the period 2019–2023. This demonstrates the high adaptability of Polish exports to such disruptions.

## 5. Conclusions

The study of each selected dimension of resilience to non-economic external shocks allows us to conclude that Polish exports are characterized by:

- relative absorptivity of disruptions caused by the pandemic and by the war in Ukraine, recording significantly better results compared to the world average and for the EU,
- relatively higher absorption of non-economic external shocks compared to the absorption of disruptions caused by economically motivated crisis phenomena, which we faced in connection with the outbreak of the global financial crisis in 2008,
- the absolute absorptivity of shocks caused by the pandemic and the war in Ukraine on an annual basis,
- the lack of absorption of non-economic external shocks in the short term, lasting for 2–3 months after the onset of the disruption or its exacerbation,
- responsiveness that allows export performance to quickly return to pre-disruption levels and even above the long-term upward trend line,
- adaptability of the product structure to conditions shaped by the pandemic and the war in Ukraine.

While answering the main research question, it should be pointed out that, on the one hand, Polish exports are not completely resilient to non-economic external shocks, as there is a short-term performance deterioration in relation to these disruptions, and, on the other hand, taking all dimensions of resilience together and the medium-term time horizon, the resilience of Polish exports to this type of disturbance should be strongly confirmed. It can also be assumed that the rapid response of Polish exports to non-economic external shocks (responsiveness) is primarily related to their high adaptability to conditions shaped by

disruptions and uncertainty. This is also indicated by the difficulty of explaining the above-average good performance of Polish exports in terms of their resilience with other properties that are mentioned in studies of the determinants of pandemic resilience, among which are, for example, effective containment measures, high income levels or the speed of vaccination introduction [Luo et al., 2023]. The results obtained in this study may also fit in with the development of a multipolar system of production centers and the formation of regional supply chains, along with the declining role of China as the “world’s factory” [Chen et al., 2022].

Despite the fact that the analysis made quite a large contribution to explaining the resilience of Polish exports to the current non-economic disturbances, there are still questions to be answered and further research in this area is therefore advisable. These are, in particular, questions about the need to transform Polish exports and possibly the desired shape of a new model of trade and international relations in a long-term and holistic perspective. The present study also has its limitations, among which there are shortcomings in the conceptualization of the notion of ‘trade resilience’, manifested in the multidimensional definition of this term and ways to measure it. In addition, it remains a challenge to define the relationship of the concept of export resilience with other economic categories, such as competitiveness, value-added, innovation or efficiency. The lack of availability of absolute data on the value of exports in constant prices, which would better eliminate the impact of price changes on the results of the resilience assessment, is also an important limitation.

Building export resilience to external shocks and disruptions will minimize risks while preserving the ability to reap the benefits of specialization and international trade. It should also be expected that adjustments to carry on foreign trade in the new volatile environment will be crucial for economic development in the long term. In this context, current external conditions are favorable for Polish exports.

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