




Adrian Sadłowski



Cardinal Stefan Wyszyński University in Warsaw, Poland,

 <https://orcid.org/0000-0003-2969-4926>,  email: a.sadlowski@uksw.edu.pl**Arkadiusz Kijek**

University of Maria Curie-Skłodowska in Lublin, Poland,

 <https://orcid.org/0000-0001-5595-7449>,  email: arkadiusz.kijek@mail.umcs.pl**Adam Zajac**

Cardinal Stefan Wyszyński University in Warsaw, Poland,

 <https://orcid.org/0000-0002-8511-8117>,  email: a.zajac@uksw.edu.pl

Impact of Russian Invasion of Ukraine on the Polish Transport Sector

Wpływ rosyjskiej inwazji na Ukrainę na polski sektor transportowy

Streszczenie

This study aims to examine how Polish transport companies perceive changes in their economic condition and the state of their microenvironment compared to the period before the Russian invasion of Ukraine. It also aims to identify the relationships between self-assessment of changes in the economic situation and the perception of transformations in the immediate environment. Besides methods of statistical description, econometric modeling was employed in the research. It was found that Polish transport companies that provide services linked to trade with Ukraine consider their overall economic situation to be better and perceive changes in demand for their services more positively than the surveyed transport companies in general; the changes that the companies perceive in the economic situation are determined to a significant extent by the changes they feel in certain areas of their microenvironment; for companies that have noticed changes in their immediate economic environment, such as increased availability of workers on the labor market, increased domestic demand for transport services, and reduced competition from foreign carriers, there is a higher probability of economic improvement.

Keywords: Economic Condition of the Company, Economic Effects of the War in Ukraine, Logit Model, Microenvironment, Transport Industry.

JEL: L91, R40, R41

Streszczenie

Celem artykułu jest rozpoznanie postrzegania przez polskie przedsiębiorstwa transportowe zmian – względem okresu poprzedzającego inwazję Rosji na Ukrainę – kondycji ekonomicznej i stanu mikrootoczenia gospodarczego, jak również zidentyfikowanie zależności między postrzeganiem przeobrażeń w bliższym otoczeniu a samooceną zmian sytuacji ekonomicznej. Poza metodami opisu statystycznego, posłużono się modelowaniem ekonometrycznym. Stwierdzono, że polskie przedsiębiorstwa transportowe, które uczestniczą w obsłudze obrotu towarowego z Ukrainą, lepiej oceniają swoją ogólną sytuację ekonomiczną i pozytywniej postrzegają zmiany popytu na świadczone przez siebie usługi niż ogół badanych przedsiębiorstw; postrzegane przez przedsiębiorstwa zmiany sytuacji ekonomicznej w istotny sposób determinowane są odczuwanymi przez te przedsiębiorstwa zmianami w niektórych obszarach ich mikrootoczenia; w odniesieniu do przedsiębiorstw, które odnotowały zmiany w swoim bliższym otoczeniu, polegające na wzroście dostępności pracowników, wzroście popytu krajowego oraz osłabieniu konkurencji ze strony zagranicznych przewoźników, można mówić o większym prawdopodobieństwie wystąpienia poprawy sytuacji ekonomicznej.

Słowa kluczowe: kondycja ekonomiczna przedsiębiorstwa, gospodarcze skutki wojny w Ukrainie, model logitowy, mikrootoczenie, branża transportowa.

JEL: L91, R40, R41



Licencje Creative Commons 4.0

1. Introduction

The Russian invasion of Ukraine, which began on February 24, 2022, has significantly altered geopolitical and economic conditions (Ciuriak, 2022; Krzykowski, 2022; Gurbala, 2023; Nekhai et al., 2024), especially in Central and Eastern Europe. The war in Ukraine has led to substantial structural changes in demand and supply, and has had a major impact on the production and service sectors, including the transport and freight forwarding industries. Therefore, the war in Ukraine largely determines the directions and rate of change in the Polish Transport–Shipping–Logistics (TSL) sector (SpotData, 2023).

A major challenge for this sector, resulting from the war on the other side of the eastern border, was the sudden increase in fuel prices (Dzieniszewski, 2022; Mróz & Niedziółka, 2023; Zaid & Farooque Khan, 2023), leading to a sharp rise in the operating costs of transport companies. Additionally, changes in the availability and safety of existing transport routes (Cudziło, 2022) and the reconstruction of logistics processes of companies handled by this sector have necessitated the development of new transport routes. This results in reconfiguring of existing logistical connections (Doński-Lesiuk, 2022; Guenette et al., 2022). Further challenges faced by this sector include adapting to functioning under the conditions caused by the sanctions imposed on Russia and Belarus (Śliwińska, 2022; Olszyk, 2024; Stępień et al., 2024) and adjusting to legislative developments affecting this sector, introduced to mitigate the indirect effects of the invasion. Polish carriers are also forecasted to increasingly feel competition from foreign carriers, especially Belarusian and Ukrainian (Banaszyk et al., 2024).

Poland's membership in the group of countries supporting Ukraine with humanitarian, military, and economic aid involves numerous measures involving various types of resources. Also, delivering material aid requires logistical support. Due to the supply needs of the war-torn country (besides humanitarian aid and arms supplies, meeting Ukraine's material demands related to current reconstruction works in construction, as well as its autonomous demand in areas where domestic production is insufficient due to war damage), there is an increased demand for transport services. Poland's proximity to Ukraine means that it has a predisposition for establishing supply centers, an example of which is the creation of an international hub in Rzeszów-Jasionka (Deni & Aronsson, 2024). Infrastructure investments and organizational improvements create favorable conditions for the transport and freight forwarding industry to develop. The growing demand for transport services may encourage Polish carriers to invest in their fleets and expand their service networks. Simultaneously, trade liberalization between the European Union and Ukraine and the creation of solidarity routes facilitate the flow of goods, promoting an increase in trade (Mulyk & Mulyk, 2022; Sadłowski, 2023). This presents another opportunity for the Polish transport sector. In particular, alternative routes are being developed due to the blockage of traditional export routes for Ukrainian agricultural products (Bezpartochnyi et al., 2023; Taran, 2023), including a transit route through Poland to the Baltic ports (Sadłowski & Zajac, 2024). Ukraine is a global potentate in agricultural production (Shubravska & Prokopenko, 2022;

Lin et al., 2023; Teixeira da Silva et al., 2023), and thus involvement in handling large goods flows can prove to be a profitable venture, although the peripheral location of Baltic ports relative to traditional markets for Ukrainian grain is a limitation upon the route through Poland (Sadłowski et al., 2023). According to Fernandes et al. (2023), the use of alternative transport routes, compared to traditional export routes, has led to a doubling of direct transport costs as well as external costs in the form of increased greenhouse gas emissions.

Taking advantage of the emerging opportunities amidst the numerous adverse factors demonstrates the high level of Polish transport companies' capacity to adapt and for innovativeness, and international cooperation. This is particularly reflected in the upward trend in the number of kilometers traveled in recent years by Polish road carriers, despite temporary downturns caused by the Covid-19 pandemic (Rokicki et al., 2022; Banaszyk et al., 2024), by the regulations introduced under the Mobility Package and by the war in Ukraine (Banaszyk et al., 2024).

The aims of this study are (i) to examine how Polish transport companies perceive changes – compared to the period before the Russian invasion of Ukraine – in their economic condition and the state of their microenvironment, and (ii) to identify the relationships between the characteristics of the companies and self-assessment regarding changes in economic situation, as well as between the perception of transformations in their immediate environment and self-assessment regarding changes in economic situation.

2. Data sources and research methods

The method used to collect information was questionnaires. The questionnaire is attached as appendix I. Using the Computer Assisted Telephone Interviewing (CATI), structured interviews were conducted with representatives of transport companies based in Poland that began operations no later than 2018. Therefore, at the time of the interviews, the companies had at least three years of experience operating on the market in peaceful conditions beyond Poland's eastern border. The survey covered 102 companies. The information collection period was one month, and interviews were conducted from March 16 to April 15, 2024. This meant that carriers included in their assessment more than two years of experience operating in wartime conditions beyond Poland's eastern border.

The study focused on transport companies' perceptions of changes – compared to the period before the Russian invasion of Ukraine – in their overall economic situation and external conditions constituting the company's market microenvironment. The elements of the company's immediate environment considered in the study are:

- availability of workers on the labor market,
- domestic demand for the company's transport services,
- foreign demand for the company's transport services,
- transport business risks,
- competition from domestic transport companies,
- competition from foreign transport companies.

The overall economic situation and the aforementioned elements of the company's microenvironment are variables for which a balanced (symmetric) five-point Likert scale was applied, adopting the company's perspective when assigning conventional numerical values. This means that the more adverse the changes from the company's point of view, the greater the negative value, and the more positive the changes from the company's point of view, the greater the positive value. The response options for the variables measured on the Likert scale and their corresponding conventional numerical values are listed in Table 1.

Table 1.

Response variants for variables measured on the Likert scale and corresponding conventional numerical values

Variable measured on the Likert scale				Conventional numerical value
General economic situation of the enterprise Availability of workers in the labor market	Domestic demand for the enterprise's transport services Foreign demand for the enterprise's transport services	Transport business risks	Competition from domestic transport companies Competition from foreign transport companies	
definite deterioration (by more than 30%)	definite decrease (by more than 30%)	definite increase (by more than 30%)	definite intensification (by more than 30%)	-2
moderate deterioration (by 5–30%)	moderate decrease (by 5–30%)	moderate increase (by 5–30%)	moderate intensification (by 5–30%)	-1
slight (less than 5%) decrease or increase or no change	slight (less than 5%) decrease or increase or no change	slight (less than 5%) decrease or increase or no change	slight (less than 5%) decrease or increase or no change	0
moderate improvement (by 5–30%)	moderate increase (by 5–30%)	moderate decrease (by 5–30%)	moderate weakening (by 5–30%)	1
definite improvement (by more than 30%)	definite increase (by more than 30%)	definite decrease (by more than 30%)	definite weakening (by more than 30%)	2

Source: author's own study based on the original survey questionnaire constituting Appendix I.

The questionnaire also included a specification section. The company attributes considered in the study are:

- market experience, measured by the number of years in business (discrete quantitative variable),

- organizational and legal form (response options: sole proprietorship / cooperative / civil partnership / partnership / capital company),
- workforce size (response options: up to 9 employees / from 10 to 49 employees / from 50 to 249 employees / 250 or more employees, which – according to the EU nomenclature (European Commission, 2003) – corresponds to micro, small, medium-sized, and large enterprises, respectively),
- binary variable indicating whether providing transport services is the company's main activity,
- types of transport,
- binary variable indicating whether the company provides or has provided transport services linked to trade with Ukraine.

The analysis of transport companies' perceptions of changes in their overall economic situation and market conditions compared to the pre-war period beyond Poland's eastern border (the starting point being the date of the Russian invasion of Ukraine) was conducted using statistical description methods. To identify elements of the companies' microenvironment that have a statistically significant impact on the change in their overall economic situation, econometric modeling was used, also employing empirical data collected through the conducted questionnaire. Since the dependent variable (the overall economic situation of the company) was measured using a Likert scale, an ordered logit model was applied. This model is widely regarded as a standard tool for analyzing ordinal response variables due to its robustness and interpretability (Long & Freese, 2014). The application of ordinary least squares to ordinal data is inappropriate, as it can yield biased parameter estimates and unreliable hypothesis tests, thereby compromising the validity of inferences drawn from the model (Peel et al., 1998).

To ensure the robustness of the analysis, the ordered logit model results were compared with those obtained from an ordered probit model, which assumes a different error distribution. Additionally, a review was conducted of the validity of the proportional odds assumption, a key requirement of the ordered logit model. In cases where this assumption is violated, alternative models, such as the generalized ordered logit model or the partial proportional odds model, may offer more appropriate frameworks for analysis.

Table 2.
Features and variables included in the logit model

Group of features	Feature	Variable			
		Type	Symbol	Measurement method	
Characteristics of the enterprise	General economic situation of the enterprise	dependent variable	ECO	five-point Likert scale	
	Market experience	independent variable	EXP	number of years in business	
	Organizational and legal form	independent variable	COM	1 – sole proprietorship 0 – others	
		independent variable	SMA	1 – small enterprise 0 – others	
	Workforce size	independent variable	MED	1 – medium-sized enterprise 0 – others	
		independent variable	LAR	1 – large enterprise 0 – others	
	Type of main activity	independent variable	TRA	1 – transport services 0 – others	
		independent variable	AUT	1 – road transport 0 – none	
	Types of transport	independent variable	RAI	1 – rail transport 0 – none	
		independent variable	SEA	1 – sea transport 0 – none	
		Provision of transport services linked to trade with Ukraine	independent variable	UKR	1 – yes 0 – no
	Market conditions	Availability of workers in the labor market	independent variable	EMP	five-point Likert scale
		Domestic demand for the enterprise's transport services	independent variable	DDO	five-point Likert scale
Foreign demand for the enterprise's transport services		independent variable	DFO	five-point Likert scale	
Transport business risks		independent variable	RIS	five-point Likert scale	
Competition from domestic transport companies		independent variable	CDO	five-point Likert scale	
Competition from foreign transport companies		independent variable	CFO	five-point Likert scale	

Source: author's own study based on the original econometric model.

As mentioned, the dataset collected in the questionnaires pertains to many features, some relating to the company's attributes and others to the attributes of the company's microenvironment. Therefore, based on the criterion of relation to

the object of study, the features considered in the study can be divided into a group describing the internal properties of the object of study (enterprise characteristics) and a group describing the properties of the company’s microenvironment (market conditions). Each of these features – apart from two features being the carrier’s attributes (workforce size and generic scope of transport services), which were decomposed into several lower-level variables – corresponds to one variable in the model. This decomposition involved converting the multi-variant qualitative features into binary variables, without loss of information. The variables used in the study are listed in Table 2.

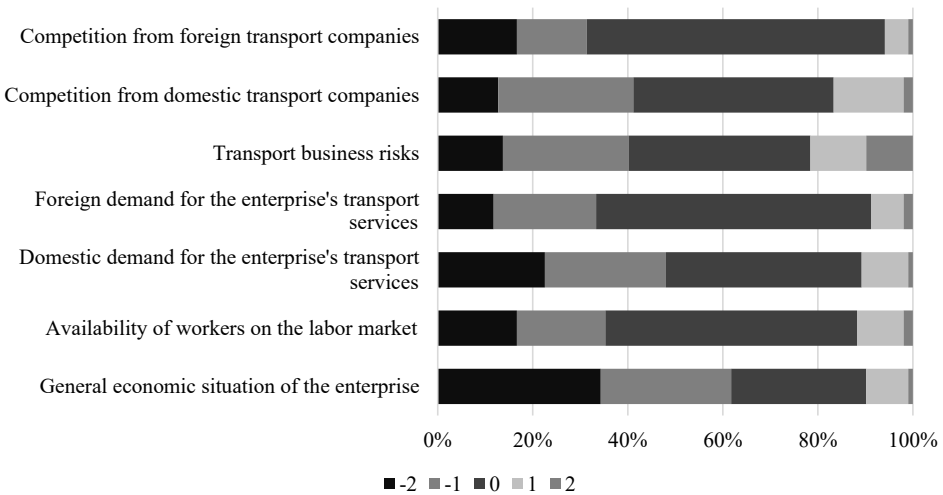
3. Results and discussion

3.1. Analysis of how the surveyed enterprises perceived changes in their economic condition and key microenvironment elements

The structure of enterprises based on their perception of changes – compared to the period before the Russian invasion of Ukraine – in their overall economic condition and key areas of their microenvironment is presented in Figure 1.

Figure 1.

Transporters’ perception of changes in their economic situation and key microenvironment parameters compared to the period before the Russian invasion of Ukraine



Source: author's own study based on the results of our own survey research.

The majority (63%) of the surveyed enterprises stated that their overall economic situation had definitely (35%) or moderately (28%) deteriorated compared to the period before the Russian invasion of Ukraine. Only 10% of enterprises assessed their economic situation after the outbreak of the war in Ukraine as moderately (9%)

or definitely (1%) better than previously. Strong economic interdependencies between countries mean that the situation of Polish enterprises is largely determined by factors external to the national economy (Gorynia & Trąpczyński, 2023; Zare Askary & Jafari Far, 2024). This is particularly evident in highly internationalized sectors, such as the TSL sector.

The external factor that nearly half (49%) of the enterprises perceived as having worsened after the Russian invasion of Ukraine was domestic demand for transport services. 23% of the surveyed enterprises stated that the decline in domestic demand was definite (over 30%), and 26% experienced a moderate (5–30%) decrease in demand for their services from domestic customers. Conversely, 11% of enterprises perceived an increase in domestic demand. According to 10% of the surveyed transporters, the increase was moderate (5–30%), and only 1% of enterprises described the increase as definite (over 30%).

The fraction of enterprises that noted definite (13%) or moderate (29%) intensification of competition from domestic transporters, compared to the period before the Russian invasion of Ukraine, was 42%. Meanwhile, 17% of the surveyed enterprises felt that competition from domestic transporters had moderately (15%) or definitely (2%) decreased.

A similar fraction of enterprises (41%) assessed that the risk connected with conducting transport operations had definitely (14%) or moderately (27%) increased. At the same time, 22% of the surveyed transporters felt that this parameter of the company's microenvironment had moderately (12%) or definitely (10%) decreased. Research by Zbroińska (2024) indicates that the predominant view of Polish enterprises is that there has been an increase in financial risk, the source of which is the macro-environment. The growing sense of a security threat due to Russia's invasion of Ukraine and geopolitical tensions is playing an increasingly important role (Stańczyk, 2022).

With respect to availability of workers on the labor market, 36% of the surveyed enterprises noticed a definite (17%) or moderate (19%) improvement. On the opposite end, 12% of enterprises perceived a moderate (10%) or definite (2%) deterioration in this area.

Foreign demand for transport services definitely (12%) or moderately (22%) decreased according to 34% of the surveyed enterprises. At the same time, 9% of the surveyed transporters felt that there had been a moderate (7%) or definite (2%) increase in this parameter.

Among the elements of the environment considered in the study, the area in which the surveyed transporters observed the greatest stability was competition from foreign enterprises. The largest portion of enterprises (64%) believed that changes in this area were negligible or non-existent. 32% of the surveyed transporters observed a definite (17%) or moderate (15%) increase in foreign competition, while 6% of surveyed enterprises reported a moderate (5%) or definite (1%) decrease.

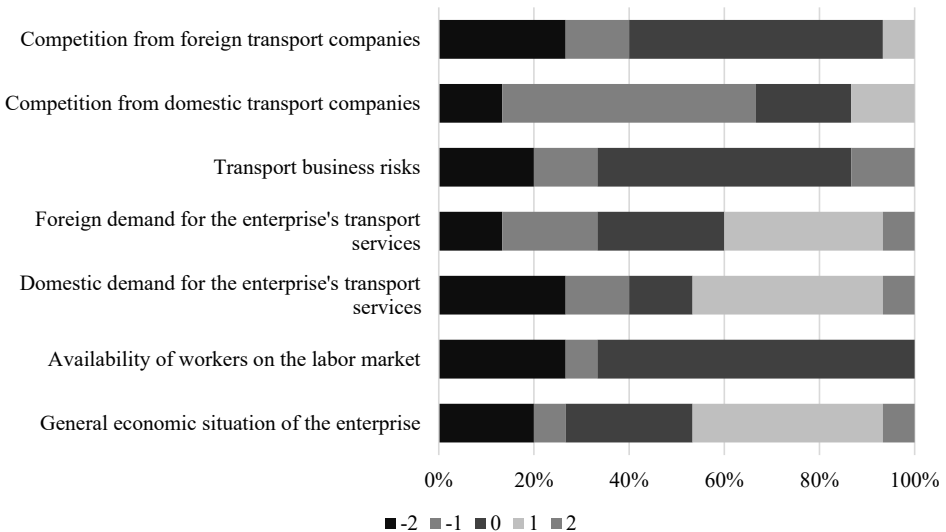
The results of the study are consistent with the scientific literature concerning economic activity during the war. The war in Ukraine reversed the announced post-pandemic growth trends and significantly contributed to the growth of uncertainty and reduced business sentiment in the eurozone countries, as confirmed by the business confidence indicators (Prohorovs, 2022; Zelek, 2022). Similar conclusions regarding the impact of the war on transport and logistics were noted in

studies on the resilience of logistics systems in Ukraine and the EU, which identify key challenges such as disruptions in supply chains, damage to infrastructure, and the need for intergovernmental cooperation to adapt and rebuild transport systems (Lebedeva & Shkurovadska, 2024). The Russian-Ukrainian war significantly affected the existing economic and logistics links in Central and Eastern Europe, leading to far-reaching changes in international supply chains. Political and economic decisions taken in response to the conflict led to changes in the structure of logistics links, the consequences of which are felt not only in Central and Eastern Europe but also on a global scale (Doński-Lesiuk, 2022; Orhan, 2022; Bodan, 2023).

Overall, the surveyed enterprises perceive negative changes in their general economic condition to be greater than in the case of any of the examined microenvironment parameters. Moreover, in both their self-assessment regarding economic condition changes and their opinions on the direction and intensity of changes in the analyzed areas of their immediate environment, negative opinions from the perspective of the enterprise dominated over positive opinions. This means that from the perspective of the participating transport companies, the economic condition of the transport sector, as well as the key parameters of its microenvironment, have deteriorated compared to the period before the Russian invasion of Ukraine. This is consistent with global trade trends. In 2022, compared to the previous year, a slowdown in trade growth was observed in all regions of the world, except the Middle East (Jędrzejowska & Wróbel, 2022).

Figure 2.

How enterprises providing transport services linked to trade with Ukraine perceive changes in their economic situation and key microenvironment parameters compared to the period before the Russian invasion of Ukraine



Source: author's own study based on based on the results of our own survey research.

In turn, Figure 2 presents analogous data for a subset of the surveyed enterprises engaged in trade with Ukraine. A comparison of the graph shown in Figure 2 with the one in Figure 1 reveals the following:

1. There is a greater concentration of responses around the middle values in the entire sample (which can be seen as a natural consequence of the larger sample size compared to the subset).
2. The subset of transporters providing services linked to trade with Ukraine rated their economic condition significantly better compared to the period before the Russian invasion of Ukraine than the surveyed transport companies overall.
3. Unlike the surveyed enterprises overall, the subset participating in transport linked to trade with Ukraine rated the change in their economic condition more favorably than the change in any of the microenvironment parameters taken into account in the study.

3.2. Determinants of enterprises' economic condition

As mentioned in section 2, factors influencing the change in the overall economic condition of enterprises were identified using an ordered logit model, containing the variables presented in Table 2. To ensure the robustness of the analysis, an ordered probit model was used. The calculation results are summarized in Table 3. They pertain to the full model, containing all independent variables (Table 3, columns 2 and 4), and the reduced model, obtained by sequentially eliminating insignificant variables from the full model at a significance level of 0.10 (Table 3 columns 3 and 5).

Table 3.

Order logit and probit model estimates

ECO	Logit 1 (full)	Logit 2 (restricted)	Probit 1 (full)	Probit 2 (restricted)
EXP	-0.006		-0.005	
COM	0.434		-0.200	
SMA	0.665		0.378	
MED	0.454		0.249	
LAR	0.924		0.643	
TRA	-0.630		-0.383	
AUT	-3.413*		-1.971	
RAI	-0.961		-0.573	
SEA	1.483		0.846	
UKR	2.261***	2.437***	1.288***	1.294***
EMP	0.436	0.450*	0.224	
DDO	1.096***	1.180***	0.659***	0.815***
DFO	0.209		0.112	

ECO	Logit 1 (full)	Logit 2 (restricted)	Probit 1 (full)	Probit 2 (restricted)
RIS	-0.369*		-0.217*	-0.193*
CDO	-0.411	-0.491**	-0.247	-0.254**
CF0	1.018***	1.065***	0.616***	0.613***
/cut1	-5.496	-1.809	-3.192	-1.021
/cut2	-3.633	-0.098	-2.094	-0.006
/cut3	-0.626	2.659	-0.412	1.600
/cut4	2.893	6.080	1.656	3.586
LR test (p-value)	79.68 (0.000)	69.29 (0.000)	81.30 (0.000)	71.35 (0.000)
Brant test (p-value)		11.58 (0.711)		9.35 (0.859)
Pseudo R2	0.2917	0.2537	0.2976	0.2612

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels.
 Source: author's own study based on the original econometric model.

The findings from both the logit and probit models exhibit consistent directions of influence for the explanatory variables on the dependent variable, particularly in the restricted models that include only statistically significant predictors. A minor discrepancy is noted for the EMP and RIS variables, which is due to p-values approaching the 0.1 significance level. This slight variation suggests that while the overall model directions align, the significance of these specific variables should be interpreted with caution. The Brant test, conducted to verify the parallel lines assumption, confirms that the restricted models do not violate the proportional odds assumption. The results show that the ordered logit model is an appropriate choice for analyzing these relationships.

The parameter estimation results of the reduced logit model lead to several conclusions about the factors influencing the economic condition of the surveyed transport enterprises. Attributes such as market experience, organizational and legal form, the size of the workforce, the role played by transport services in the enterprise's activities, or the types of transport used for providing services, do not explain the changes in the economic condition of transport enterprises. Thus, internal factors (enterprise characteristics) fundamentally do not significantly impact the dependent variable, although providing transport services linked to trade with Ukraine increased the likelihood of an improvement in the enterprise's economic situation.

The impact of exogenous factors from the enterprise's perspective, namely the market conditions constituting its microenvironment, is different. Four out of the six examined explanatory variables describing the company's immediate environment had a statistically significant impact. For three variables – availability of workers on the labor market, domestic demand for the company's transport services, and competition from foreign transporters – the direction of influence on the dependent variable is positive (meaning these variables are stimulants), while for one variable – competition from domestic transport enterprises – the direction of influence is negative (meaning this variable is a destimulant). Given

the conventional values for individual response variants (table 1), this indicates that changes in the immediate environment noted by the surveyed enterprises compared to the period before the Russian invasion of Ukraine, involving increased availability of workers on the labor market, increased domestic demand for transport services, and reduced competition from foreign transporters, translated into a higher likelihood of an improvement in the enterprise's economic condition. The study, conducted using an econometric model, also demonstrated a statistically significant relationship between the perceived increase in competition from domestic transporters and the improvement in the economic condition, which is difficult to interpret. Generally, increased competition implies pressure to reduce margins, thereby negatively impacting the economic situation of enterprises operating in a given sector. However, increased competition, resulting from the expansion of enterprises already operating in a given sector and the entry of new entities into this industry, that the sector is commercially attractive. Under conditions of increasing demand, the expansion of activities by enterprises in a given industry and/or the increase in the number of enterprises operating in that industry, which enterprises in that industry would perceive as an intensification of competition, does not necessarily have to be accompanied by a reduction in margins.

4. Conclusions

The Russian invasion of Ukraine was a pivotal event in recent years, significantly impacting Poland's economy, including the transport sector. The substantial supply needs of war-torn Ukraine and the need to reconstruct logistic connections and transport routes according to new geopolitical conditions are factors greatly influencing the volume and structure of demand for transport services.

Research shows that Polish transport enterprises providing services linked to trade with Ukraine assess their overall economic situation more favorably and perceive changes in domestic and foreign demand for their services more positively (compared to the period before the war beyond the eastern border) than the surveyed transport enterprises as a whole. Furthermore, the perceived changes in the economic situation of enterprises relative to the period before the Russian invasion of Ukraine were significantly influenced by changes in certain areas of their immediate environment. However, no statistically significant relationship was found between selected enterprise characteristics (market experience, individual or collective business operations, enterprise category by workforce size, the role played by transport services in the enterprise's activities, and the generic scope of provided transport services) and changes in economic condition. For enterprises that noted changes in their economic microenvironment, such as increased availability of workers on the labor market, increased domestic demand for transport services, and weakened competition from foreign transporters, there is a higher likelihood of an improvement in the economic situation.

The negative effects of the war in Ukraine, indirectly felt by the Polish transport sector, can therefore be mitigated to a greater extent by the broader involvement of

this sector in meeting the increased transport needs. These needs arise, on the one hand, due to the Western countries' supply of military supplies and humanitarian aid. On the other hand, this is due to an increase in trade and in the scale of transit transport following the liberalization of trade relations between the European Union and Ukraine, as well as the forceful reconfiguration of existing logistical connections due to the new geopolitical situation and security concerns. Expanding areas of cooperation and deepening economic relations between Poland and Ukraine, including those related to freight transport, are of great long-term significance – this increases the chances for Polish enterprises to play a crucial role in the post-war reconstruction of Ukraine.

The above considerations lead to the recommendations for economic policy aimed at enhancing the role of the Polish transport sector in handling trade and aid for Ukraine. In particular, efforts should focus on further investments in border infrastructure and the transport network, as well as on creating favorable conditions for the development of logistics hubs. This requires greater cooperation with Ukraine to overcome administrative and procedural difficulties in the flow of goods between the countries, making organizational improvements at border crossings, and coordinating investment initiatives.

The ordered logit model developed to examine the impact of the Russian invasion of Ukraine on the Polish transport sector provides a robust analytical framework for evaluating sector-specific challenges and deriving policy implications. The model demonstrates potential for application in other Eastern European countries with analogous economic linkages, provided it is adapted to account for country-specific factors such as energy policies or trade structures. Its implementation in the coming years would also facilitate a long-term evaluation of the conflict's impact on the transport sector. This approach establishes the model for analyzing and addressing the economic impacts of geopolitical conflicts.

One limitation affecting the study is that it was not conducted on the entire population but on a statistical sample. However, this sample included over 100 companies, which makes it relatively large compared to other similar studies. The random method of selecting the sample and the methodical conduct of the study allow tentative generalizations to be made. Moreover, assessing the economic situation using continuous variables, such as changes in revenue values, could provide a more precise evaluation of the impact of the Russian invasion of Ukraine on transport sector performance.

Funding

This article was produced as part of the research and educational project entitled *The Role of Economic Analysis in Shaping Public Policy – Youth Education on the Example of the Issue of Transit of Ukrainian Agricultural Produce through Poland*, financially supported by the Alior Bank Foundation (<https://fundacja-alior.pl/>).

References

- Banaszyk, P., Konecka, S., & Maryniak, A. (2024). Determinants of Competitiveness of Polish Road Carriers. In E. Mińska-Struzik & B. Jankowska (Eds), *Is There Any "New Normal"? Economics of the Turmoil* (pp. 129–151). Poznań University of Economics and Business Press. <https://doi.org/10.18559/978-83-8211-217-7/7>
- Bezpartochnyi, M., Britchenko, I., & Prylutska, L. (2023). Research on Export Logistics of Agricultural Products in Ukraine During Martial Law and Ensuring Food Security. In *Current Issues of the Management of Socioeconomic Systems in Terms of Globalization Challenges* (pp. 479–498). University of Security Management in Košice. <https://doi.org/10.5281/zenodo.7798978>
- Bodan, K. (2023). Impact of Russia and Ukraine War on the Global Economy. *Journal of International Relations*, 3(1), 29–39. <https://doi.org/10.47604/jir.1867>
- Ciuriak, D. (2022). *The Economic Consequences of Russia's War on Ukraine*. Verbatim, C.D. Howe Institute. <http://dx.doi.org/10.2139/ssrn.4067766>
- Cudziło, M. (2022). Logistyka w czasie kryzysu. *Logistyka*, 2, 28–32.
- Deni, J. R., & Aronsson, L. A. (2024). *The Role of America's European Allies in the Russia–Ukraine War, 2022–24*. US Army War College Press. Available at: <https://press.armywarcollege.edu/monographs/972>
- Doński-Lesiuk, J. (2022). Geopolitical Changes in Central and Eastern Europe after February 24, 2022 – a Logistics Perspective. *Material Economy and Logistics Journal*, 6, 20–28. <https://doi.org/10.33226/1231-2037.2022.6.3>
- Dziesięzowski, G. (2022). Zarządzanie logistyką paliw w sytuacjach kryzysowych. *Gospodarka i Finanse*, 11, 59–78.
- European Commission (2003). *Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small, and Medium-sized Enterprises (OJ L 124)*. Retrieved May 20, 2003 from <http://data.europa.eu/eli/reco/2003/361/oj>
- Fernandes, G., Teixeira, P., & Santos, T. A. (2023). The Impact of the Ukraine Conflict in Internal and External Grain Transport Costs. *Transportation Research Interdisciplinary Perspectives*, 19, 1–12. <https://doi.org/10.1016/j.trip.2023.100803>
- Gorynia, M., & Trąpczyński, P. (2023). Wybrane problemy gospodarcze Polski – perspektywa wewnętrzna i perspektywa międzynarodowa. *Kwartalnik Nauka*, 1, 59–76. <https://doi.org/10.24425/nauka.2023.144946>
- Guenette, J. D., Kenworthy, P. G., & Wheeler, C. M. (2022). *Implications of the War in Ukraine for the Global Economy*. Washington, World Bank. Available at: <http://documents.worldbank.org/curated/en/099616504292238906/IDU00bdb5a770659b04adf09e600a2874f25479d>
- Gurbała, M. (2023). Konsekwencje geopolityczne wojny w Ukrainie a globalny układ sił. In D. Niedziółka & M. Próchniak (Eds), *Ekonomia wojny. Skutki społeczne, ekonomiczne i geopolityczne wojny w Ukrainie* (pp. 11–28). Oficyna Wydawnicza Szkoły Głównej Handlowej w Warszawie.
- Jędrzejowska, K., & Wróbel, A. (2023). Gospodarka światowa 2022–2023: Czas niepewności, niepokoju i postępującej fragmentacji. *Rocznik Strategiczny*, 28, 171–196. Available at: https://wnpism.uw.edu.pl/wp-content/uploads/2023/06/08_Gospodarka_KJedrzejowska_AWrobel.pdf
- Krzykowski, P. (2022). Konsekwencje wojny na Ukrainie w wymiarze żywnościowym, ekonomicznym i energetycznym. *Roczniki Nauk Społecznych*, 50(4), 93–113. <https://doi.org/10.18290/rns22504.4>
- Lebedeva, L., & Shkuropadska, D. (2024). Resilience of Transport Logistics in EU and Ukraine. *Foreign Trade: Economics, Finance, Law*, 135(4), 108–127. [https://doi.org/10.31617/3.2024\(135\)07](https://doi.org/10.31617/3.2024(135)07)
- Lin, F., Li, X., Jia, N., Feng, F., Huang, H., Huang, J., Fan, S., Ciais, P., & Song, X. P. (2023). The Impact of Russia–Ukraine Conflict on Global Food Security. *Global Food Security*, 36, Article 100661. <https://doi.org/10.1016/j.gfs.2022.100661>
- Long, J. S., & Freese, J. (2014). *Regression Models for Categorical Dependent Variables Using Stata*. Stata Press.
- Mról, M., & Niedziółka, D. (2023). Handel surowcami energetycznymi. In D. Niedziółka & M. Próchniak (Eds), *Ekonomia wojny. Skutki społeczne, ekonomiczne i geopolityczne wojny w Ukrainie* (pp. 137–156). Oficyna Wydawnicza Szkoły Głównej Handlowej w Warszawie.
- Mulyk, T., & Mulyk, Y. (2022). Exports of Ukrainian Agricultural Products to the European Union: Analytical Assessment, Problems and Prospects. *Three Seas Economic Journal*, 3(3), 49–57. <https://doi.org/10.30525/2661-5150/2022-3-8>
- Nekhai, V., Melnyk, Y., Vyshnivska, B., Bilyk, O., Akimova, L., & Akimov, O. (2024). Economic Consequences of Geopolitical Conflicts for the Development of Territorial Communities in the Context of Economic and National Security of Ukraine. *Economic Affairs*, 69(1), 551–563. <https://doi.org/10.46852/0424-2513.2.2024.17>
- Olszyk, S. (2024). Państwa Grupy Wyszehradzkiej (V4) wobec wojny w Ukrainie. Dyplomacja obronna podczas pierwszego roku wojny. *Nowa Polityka Wschodnia*, 1(40), 32–59. <https://doi.org/10.15804/npw20244003>
- Orhan, E. (2022). The Effects of the Russia–Ukraine War on Global Trade. *Journal of International Trade, Logistics and Law*, 8(1), 141–146. Available at: <https://www.jital.org/index.php/jital/article/view/277>

- Peel, M. J., Goode, M. M. H., & Moutinho, L. A. (1998). Estimating Consumer Satisfaction: OLS Versus Ordered Probability Models. *International Journal of Commerce and Management*, 8(2), 75–93. <https://doi.org/10.1108/eb047369>
- Prohorovs, A. (2022). Russia's War in Ukraine: Consequences for European Countries' Businesses and Economies. *Journal of Risk and Financial Management*, 15(7), 1–15. <https://doi.org/10.3390/jrfm15070295>
- Rokicki, T., Bórawski, P., Bełdycka-Bórawska, A., Szeberényi, A., & Perkowska, A. (2022). Changes in Logistics Activities in Poland as a Result of the COVID-19 Pandemic. *Sustainability*, 14(16), 1–24. <https://doi.org/10.3390/su141610303>
- Sadłowski, A. (2023). Ekonomiczno-prawne aspekty kryzysu zbożowego w Polsce. *International Journal of Legal Studies*, 14(2), 267–282. <https://doi.org/10.5604/01.3001.0054.2715>
- Sadłowski, A., & Zajac, A. (2024). Export of Ukrainian Agricultural Products Through Poland – Route Restrictions. *Agricultural and Resource Economics: International Scientific E-Journal*, 10(4), 29–46. <https://doi.org/10.51599/are.2024.10.04.02>
- Sadłowski, A., Brdulak, J., & Budzyńska, A. (2023). The Transport of Ukrainian Grain Through Poland and the Domestic Grain Market. *Humanities and Social Sciences*, 30(2), 109–119. <https://doi.org/10.7862/rz.2023.hss.19>
- Shubravskaya, O., & Prokopenko, K. (2022). The Agricultural Sector of Ukraine in the Global Food Market: Pre-war State and Post-war Prospects. *Research on World Agricultural Economy*, 3(4), 1–11. <https://doi.org/10.36956/rwae.v3i4.693>
- SpotData (2023). *Transport drogowy w Polsce 2023*.
- Stańczyk, J. (2022). Zarządzanie złożonymi zagrożeniami geopolitycznymi we współczesnym świecie. *Przegląd Nauk o Obronności*, 13, 1–27. <https://doi.org/10.37055/pno/152385>
- Stępień, B., Early, B. R., Grauvogel, J., Preble, K. A., & Truskolaski, S. (2024). The Impact of External Pressure on Companies' Responses to Sanctions – an International Comparative Study. *European Journal on Criminal Policy and Research*, 30, 1–26. <https://doi.org/10.1007/s10610-024-09576-y>
- Śliwińska, M. (2022). Fair Trade a nowa rzeczywistość pocovidowa trzeciej dekady XXI w. *Ekonomista*, 3, 326–348. <https://doi.org/10.52335/ekon/153437>
- Taran, S. (2023). *EU-Ukraine Wartime Trade: Overcoming Difficulties, Forging a European Path*. European Policy Centre, Discussion Paper.
- Teixeira da Silva, J. A., Koblanska, I., & Kucher, A. (2023). Agricultural Production in Ukraine: An Insight Into the Impact of the Russo-Ukrainian War on Local, Regional and Global Food Security. *Journal of Agricultural Sciences*, 68(2), 121–140. <https://doi.org/10.2298/JAS2302121T>
- Zaid, M., & Farooque Khan, M. (2023). Russian-Ukrainian War and its Economic Implications on the Prices of Strategic Commodities. *Studies in Economics and Business Relations*, 3(2), 1–16. <https://doi.org/10.48185/sebr.v3i2.738>
- Zare Askary, A., & Jafari Far, E. (2024). The Consequences of the War in Ukraine War on Global Trade. *European Studies*, 5(1), 1–21. Available at: https://www.ijoes.ir/article_195573.html?lang=en
- Zbroińska, B. A. (2024). Ryzko identyfikowane przez polskich przedsiębiorców w warunkach zmian otoczenia w latach 2020–2023. *Optimum. Economic Studies*, 3(117), 23–37. <https://doi.org/10.15290/oes.2024.03.117.02>
- Zelek, A. (2022). Między recesją a stagflacją – oblicza nadchodzącego kryzysu. *Firma i Rynek*, 2(62), 7–18. Available at: https://www.zpsb.pl/wp-content/uploads/2022/12/1-FIR_20222_02_62_A_Zelek.pdf