

THE IMPACT OF THE MACROECONOMIC AND FINANCIAL SITUATION ON THE SUSTAINABLE DEVELOPMENT OF THE LOGISTICS SECTOR IN POLAND

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Purpose: The main aim of this paper is to assess the impact of the macroeconomic and financial situation on the sustainable development of the logistics sector in Poland from 2008 to 2020.

Design/methodology/approach: We normalize diagnostic variables into synthetic indicators to verify the hypothesis. We use the classical least squares method (OLS) and the seemingly unrelated regression (SUR) method to estimate equations.

Findings: The results indicate a positive trend in the sustainable development of the logistics sector in Poland from 2008 to 2020. Moreover, macroeconomic conditions are crucial for sustainable development, and it should be noted that the financial situation impacts the economic and social development of the sector.

Research limitations/implications: The availability of data, the choice of normalization method and the choice of estimation method for both the one-equation model and the structural equation model.

Practical implications: The research results indicate that managers of entities from the logistics sector should first analyze the macroeconomic situation and consider the financial and property situation of enterprises.

Social implications: The social development of the logistics sector is visible, and it is necessary to take further actions to improve working conditions and quality.

Originality/value: The novelty in the paper is the creation of models of the impact of macroeconomic conditions and the financial situation on the sustainable development of logistics enterprises. The paper addresses many recipients interested in developing the logistics sector.

Keywords: sustainable development, logistics sector, macroeconomic conditions, financial situation.

Category of the paper: research paper.

1. Introduction

Currently, sustainable development is the subject of a wide scientific discourse, covering various disciplines, and occupies an important place in economic practice (Dasgupta, 2007; Acosta Castellanos, Queiruga-Dios, 2022). The literature on the subject emphasizes its complex, holistic nature, which manifests itself in different approaches to its conceptualization (Mathiasson, Jochumsen 2022). The most common definition comes from the 1987 report *Our Common Future* (Brundtland Report), who pointed out that sustainable development is development that meets the needs of the present and does not jeopardize the ability of future generations to meet their needs. Sustainable development is an approach that takes into account the simultaneous fulfillment of economic, social and environmental goals. This is a long-term strategy that assumes that companies should act responsibly and with future generations in mind. Economic goals involve achieving profits and financial growth, which is essential for the operation and success of an enterprise. Sustainable development assumes that economic goals should be achieved in an ethical manner and with respect for the community in which the company operates and the natural environment. The implementation of the concept of sustainable development requires the participation of states, international institutions, and organizations as well as entire communities (Bansal, 2002; Kolk, van Tulder, 2010; Bose, Khan, 2022; Szychta, 2022).

The main aim of this paper is to assess the impact of the macroeconomic and financial situation on the sustainable development of the logistics sector in Poland from 2008 to 2020. We normalize diagnostic variables into synthetic indicators to verify the hypothesis. We use the classical least squares method (OLS) and the seemingly unrelated regression (SUR) method to estimate equations.

The study includes an introduction, materials and methods, research methodology, results, discussion, and conclusion. The review of scientific publications was based on the Scopus and Web of Science lists. The data for the analysis come from Eurostat databases. For the calculations, we used Statistica and Gretl software.

The research results indicate that managers of entities from the logistics sector should first analyze the macroeconomic situation and consider the financial and property situation of enterprises. The social development of the logistics sector is visible, and it is necessary to take further actions to improve working conditions and quality. The novelty in the paper is the creation of models of the impact of macroeconomic conditions and the financial situation on the sustainable development of logistics enterprises. The paper addresses many recipients interested in developing the logistics sector.

2. Sustainable development of enterprises- definition

Sustainable development of enterprises, also known as corporate sustainable development or business sustainability, refers to the practice of conducting business operations in a way that not only ensures financial success but also takes into account the long-term social, environmental, and economic impacts of these operations (Pieloch-Babiarz et al., 2021; Mao et al., 2018). Sustainable development for enterprises involves a commitment to responsible and ethical business practices that balance profit generation with the well-being of people and the planet (Pererva et al., 2021; Ghauri, 2022; Diaz- Sarachaga, 2021).

Key aspects of enterprise sustainable development include:

- economic sustainability - ensuring the long-term financial viability of the business by generating profits, managing costs and promoting economic growth; this can involve responsible financial management, diversification and investment in innovation (Mio et al., 2020);
- social sustainability - focusing on the well-being of employees, customers, and the enterprise's communities; this includes providing safe and fair working conditions, promoting diversity and inclusion and participating in philanthropic activities (Anh et al., 2022; Sribna et al., 2023);
- environmental sustainability - reduce the environmental impact of business operations by minimizing resource consumption, managing waste and emissions, and adopting sustainable practices (Sribna et al., 2023; Hysa, 2020);
- ethical governance - implementing ethical and transparent business practices, such as adhering to fair trade principles, ensuring ethical supply chain management and promoting corporate social responsibility (Lu et al., 2019; Fotaki et al., 2020);
- long-term perspective - embracing a long-term perspective and considering the potential impacts of business decisions on future generations; this involves risk management, scenario planning and a commitment to sustainable practices over short-term gains (Teixeira et al., 2019);
- innovation and adaptation - encourage innovation to develop more sustainable products, services and processes (Hanaysha et al., 2022; Chege et al., 2020);
- stakeholder engagement - engaging with a wide range of stakeholders, including employees, customers, investors, government agencies and civil society, to gather input and build partnerships that promote sustainable development (Wojewnik-Filipkowska et al., 2019);

Sustainable development is the subject of a wide scientific discourse covering various disciplines and occupies an important place in economic practice (Dasgupta, 2007; Acosta et al., 2022). The literature on the subject emphasizes its complex and holistic nature, which manifests itself in different approaches to its conceptualization (Mathiasson, Jochumsen, 2022).

Sustainable development is driven by ethical considerations and increasingly by market and regulatory pressures. Consumers and investors are becoming more aware of sustainability issues, and governments are enacting policies and regulations to encourage sustainable business practices (Haldar, 2019; Utting, 2000).

Implementing sustainable development requires the participation of states, international institutions and organizations, and whole communities (Bose, Khan, 2022; Szychta, 2022). A special place is occupied by companies widely recognized as the entities that have contributed the most to environmental degradation (Brzezinski, Pyza, 2021; D'Angelo et al., 2022). Therefore, they must take active measures to combat climate change and protect natural resources (Pishdar et al., 2022; Keshavarz-Ghorabae et al., 2022).

3. Sustainable development of logistics sector in Poland

Poland's transport and logistics sector is a critical and rapidly developing part of the country's economy, serving as a vital link in the supply chains of Poland and the broader European region. Sustainable development in Poland's transport and logistics sector is of paramount importance as it directly impacts the country's economy, the environment, and society (Klimecka-Tatar et al., 2021; Ogryzek et al., 2021; Sadowski et al., 2020). The selection of such a research group results from the fact that this sector is important for maintaining economic stability and social and political cohesion and is also characterized by a high negative impact on the natural environment (high greenhouse gas emissions according to Eurostat reports) (Camporek et al., 2022; Danilevičius et al., 2023; Martišius et al., 2022).

Sustainable development in the transport and logistics sector in Poland not only contributes to environmental conservation and social well-being but also improves the sector's competitiveness and resilience. It aligns with global efforts to combat climate change and positions Poland as a responsible player in the international logistics and transportation landscape. Collaboration among stakeholders, including government, businesses, and communities, is essential to drive sustainable practices and achieve long-term economic and environmental goals (Vuković et al., 2022; Jacyna et al., 2014; Przybylska et al., 2023).

The TLS sector in Poland is a vital component of the country's economy, driven by its strategic location, infrastructure development, and role in European supply chains. The sector is well-positioned to capitalize on the growth of e-commerce and increasing international trade. Poland continues to invest in its transport infrastructure to support the sector's expansion, making it an attractive destination for logistics companies and a critical gateway for goods in Europe (Brdulak et al., 2021; Camporek et al., 2021). Unfortunately, further challenges for TSL, such as the war in Ukraine, do not bode well for the future (Report "ROAD TRANSPORT IN POLAND 2021+"). Many doubts in the coming years due to the actions of the European

Union on climate policy. This is due to the draught law prohibiting the production of trucks and tractor units powered by internal combustion engines, the entry into force of which is associated with the emergence of costly transformations of entire fleets and a change in the working model of transport companies (Report "ROAD TRANSPORT IN POLAND 2021+").

4. Macroeconomic and financial conditions on the sustainable development

Enterprise value management refers to identifying, measuring, monitoring, and managing the value a company generates for its owners, investors, customers, and other stakeholders (Koller et al., 2010; Lin et al., 2023). Company value can be understood as the ability to generate financial flows, stability, market reputation, innovation, intellectual capital, and many other factors that contribute to the company's long-term success (Stubelij, 2010; Subiada et al., 2018; Putra et al., 2021).

In today's global and competitive business environment, enterprise value management is becoming indispensable for managers and business owners. It allows for making informed business decisions, optimizing resource allocation, identifying valuable areas of activity, and adapting the strategy to changing market conditions (Venkataraman, Pinto, 2023).

The interconnections between the economy and the TLS sector are rooted in fundamental macroeconomic factors that can be divided into two distinct groups (Czyżewski, 2017):

- of a real nature: about the real pace of GDP change, the real rate of change in total consumption (as a value characterizing consumption), the real pace of changes in gross fixed capital formation (as a value characterizing investments), the real pace of changes in accumulation (as a value characterizing investments);
- of a monetary nature: the consumer price index (CPI), the pace of changes in the money supply, and the real level of interest rates.

In addition, financial conditions indeed have a significant impact on sustainable development. They play a critical role in enabling or constraining sustainable development efforts. Adequate financial resources, access to capital, favourable financing terms, and a supportive financial ecosystem are essential for implementing projects that address environmental conservation, social equity, and long-term economic growth. Aligning financial systems and practices with sustainable development objectives is crucial to achieving a more balanced and equitable form of development (Tien et al., 2020; Yakovlev et al., 2019; Al Ahabbi et al., 2019; de Castro Sobrosa Neto et al., 2020).

Globalization greatly improves capital movement, abolishes customs barriers, and influences other facilitations, leading to the abolition of the phenomenon of easy capital. It can be quickly placed where a higher rate of return will be obtained. Technical and technological progress, as well as economic growth, have resulted in the emergence of more

private capital on the market, characterized by high expectations regarding the maximization of the rate of return on investment. The development of information and telecommunication technologies has created unlimited possibilities for information transfer, which greatly facilitates investment decisions and capital transactions in any market. To effectively apply this concept, it is necessary to thoroughly understand all the mechanisms and tools for evaluating the effects of the companies used in this concept. It is also necessary to implement an active corporate governance system that would allow for the creation of a mechanism that integrates the goals of managers with the goals of owners and other stakeholders (Sarbah, Quaye, 2021; Salzman, 1999; Liu et al., 2022; Khan, 2022).

Macroeconomic and financial conditions have a significant impact on sustainable development. The economic environment in a country or region can facilitate or hinder progress toward sustainable development goals (Alhadhrami et al., 2019). Macroeconomic stability, including low inflation and interest rates, can make it more attractive for governments and businesses to invest in sustainable infrastructure projects, such as renewable energy, public transportation, and green buildings. Government fiscal policies, such as tax incentives and subsidies, can promote or hinder sustainable practices (Arena et al., 2023; Jan et al., 2023). Policymakers, businesses, and civil society must work together to create an environment that supports sustainable practices, including responsible investment, resource management, and income distribution. By aligning economic policies with sustainable development goals, societies can better address the complex and interrelated challenges of environmental protection, social equity, and economic growth (Rahim, 2017; Al-Ali et al., 2021; Alhadhrami et al., 2019; Pera, 2017).

5. Research methodology

The research aims to assess the impact of macroeconomic conditions and the financial situation of the logistics sector on its sustainable development. We examined logistics companies (Section H) registered in Poland from 2008 to 2020. The research period covered the financial crisis due to the COVID-19 pandemic.

Due to this research goal, we have proposed the following hypothesis: “Macroeconomic conditions, not financial ones, have a decisive impact on the sustainable development of the logistics sector in Poland from 2008 to 2020”. This approach results from the fact that the logistics sector is largely dependent on macroeconomic conditions, as its development depends on the growth of other sectors of the economy.

Additionally, we formulated the following sub-hypotheses:

- Sustainable development of the logistics sector in Poland in 2008-2020 has a positive trend;
- Economic development shows higher growth dynamics compared to the social and environmental development of the logistics sector in Poland from 2008 to 2020;
- The impact of macroeconomic conditions and the financial situation on the three pillars of sustainable development - economic, social and environmental - varies in terms of statistical significance and the strength and direction of the influence in the logistics sector in 2008-2020.

We conducted the study in several stages:

1) We created synthetic indicators of:

- sustainable development (S) based on its three pillars:
 - economic (ED), including following stimulants: transport enterprises- number, turnover or gross premiums, production value, value added at factor cost, gross operating surplus, total purchases of goods and services, gross investment in tangible goods, investment rate;
 - social (SD): stimulants: wages and salaries, social security costs, employee-number, turnover per person employed, apparent labour productivity, gross value added per employee, growth rate of employment, investment per person employed and destimulants: personnel costs - million euro, share of personnel costs in production – percentage;
 - environmental development (EnvD), based on destimulants: carbon dioxide, methane, nitrous oxide, sulphur oxides (SO₂ equivalent), ammonia (SO₂ equivalent);
- financial situation (FS) based on its four pillars:
 - financial liquidity (FL): stimulants: classic current ratio, classic quick ratio;
 - profitability (P): stimulants: return on assets, return on sales, return on equity;
 - efficiency of operation (EO): stimulants: total asset turnover ratio and destimulants: inventory turnover ratio in days, receivables turnover ratio in days, payables turnover ratio in days, operating cycle in days;
 - debt (D): stimulants: rate of share of equity in asset financing, liability coverage ratio with tangible fixed assets and total debt ratio, debt equity ratio, long-term debt ratio;
- macroeconomic conditions (MC), stimulants: GDP, export, wages and destimulants: import, unemployment rate and HICP.

Sustainable development indicators were determined by the variable standardization method based on the following formula:

- for the stimulants:

$$Z_{ij} = \frac{x_{ij}}{\max x_{ij}}, \quad Z_{ij} \in [0; 1] \quad (1)$$

- for the destimulants:

$$Z_{ij} = \frac{\min x_{ij}}{x_{ij}}, \quad Z_{ij} \in [0; 1] \quad (2)$$

Z_{ij} - the normalized value of the j -th variable in the i -th year,
 x_{ij} is the value of the j -th variable in the i -th year.

To calculate the indicator of sustainable development of the LOGISTICS sector (S) and its components economic (E_D), social (S_D), and environmental (Env_D) we use the formula:

$$S = \frac{\sum_{j=1}^n (E_{Dij} + S_{Dij} + Env_{Dij})}{n}, \quad S_{Dij} \in [0; 1] \quad (3)$$

- 2) We created a linear equation, which we estimated using the classic least squares method, based on formula:

$$S = \alpha_0 + \alpha_1 M_{Ct} + \alpha_2 M_{C(t-1)} + \alpha_3 M_{C(t-2)} + \alpha_4 F_{St} + \alpha_5 F_{S(t-1)} + \alpha_6 F_{S(t-2)} + \alpha_7 S_{(t-1)} + \alpha_8 S_{(t-2)} + \varepsilon_i \quad (4)$$

$$s(\hat{\alpha}_0, \dots, \hat{\alpha}_5) = \sum_{i=1}^n e_i^2 = \sum_{i=1}^n (S_{Di} - \hat{S}_{Di})^2 \rightarrow \min \quad (5)$$

- 3) We created the multi-equation models and use the SUR estimation method, the structural equations have the following formula:

$$\begin{aligned} E_D &= \alpha_0 + \alpha_1 S_D + \alpha_2 Env_D + \alpha_3 F_{St} + \alpha_4 F_{S(t-1)} + \alpha_5 M_{Ct} + \alpha_6 M_{C(t-1)} + \varepsilon_i \\ S_d &= \alpha_0 + \alpha_1 E_D + \alpha_2 Env_D + \alpha_3 F_{St} + \alpha_4 F_{S(t-1)} + \alpha_5 M_{Ct} + \alpha_6 M_{C(t-1)} + \varepsilon_i \\ Env_d &= \alpha_0 + \alpha_1 E_D + \alpha_2 S_D + \alpha_3 F_{St} + \alpha_4 F_{S(t-1)} + \alpha_5 M_{Ct} + \alpha_6 M_{C(t-1)} + \varepsilon_i \end{aligned} \quad (6)$$

We use feasible generalized least squares (FGLS) to estimate the SUR model. The residuals from our regression are used to estimate the elements of matrix (Takeshi, 1985):

$$\hat{\sigma}_{ij} = \frac{1}{R} \hat{\varepsilon}_i^T \hat{\varepsilon}_j \quad (7)$$

Then, we run generalized least squares regression for using the variance matrix:

$$\Omega \equiv E[(\varepsilon\varepsilon^T|X)] = \sum \Omega \otimes I_R \quad (8)$$

$$\hat{\beta} = (X^T (\hat{\Sigma}^{-1} \otimes I_R) X)^{-1} X^T (\hat{\Sigma}^{-1} \otimes I_R) y \quad (9)$$

The formula for the SUR estimator is as follows:

$$\sqrt{R}(\hat{\beta} - \beta) \xrightarrow{d} N(0, (\frac{1}{R} X^T (\hat{\Sigma}^{-1} \otimes I_R) X)^{-1}) \quad (10)$$

6. Research results

Figure 1 shows the synthetic indicator of the sustainable development of the logistics sector in Poland from 2008 to 2020 and its pillars (economic, social and environmental). The values of indicators vary. Moreover, all indicators increased in the analyzed period, a positive phenomenon. A noticeable higher degree of enterprise involvement is in implementing economically and socially responsible tasks. The activities undertaken for sustainable development of the logistics sector in Poland from 2008 to 2020 are efficient and effective.

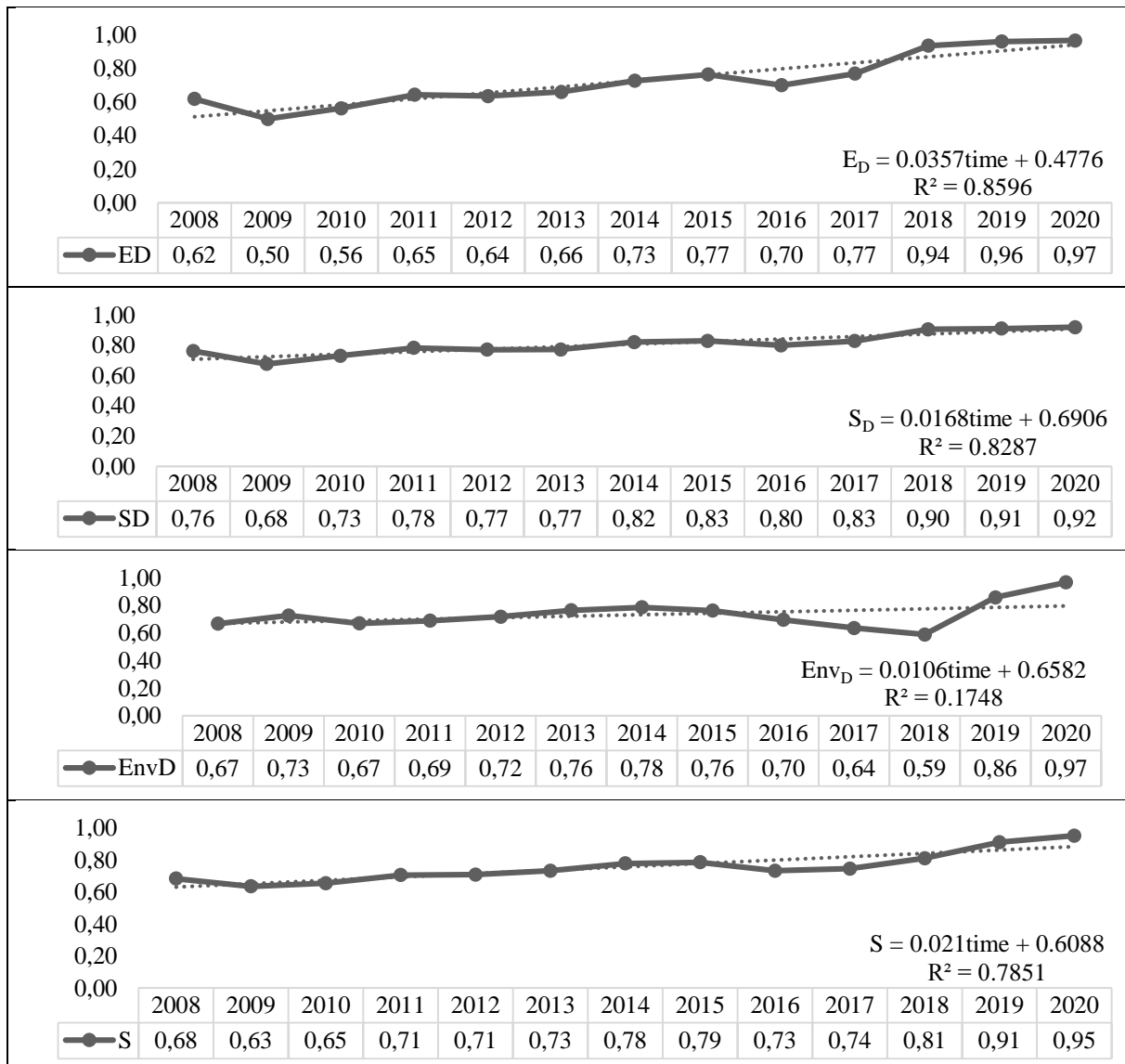


Figure 1. The synthetic indicator of the sustainable development and its pillars (2008-2020, the logistics sector).

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, 11.11.2023.

Table 1 presents the descriptive statistics of the synthetic indicator of the sustainable development of the logistics sector in Poland from 2008 to 2020 and its pillars (economic, social and environmental). During the period under review, the average level and median of indicators are relatively high. The maximum level of indicators was recorded in 2020, and the minimum in 2009 (except for the environmental indicator). Considering the years 2009 and 2020, it can be concluded that logistics sector enterprises took several actions aimed at sustainable development.

Table 1.

The descriptive statistics of the synthetic indicator of the sustainable development and its pillars (2008-2020, the logistics sector)

Country	Sector	Variable	Descriptive statistics				
			Mean	SD	Median	Max	Min
Poland	Logistic	E _D	0.73	0.14	0.70	0.97	0.50
		S _D	0.81	0.07	0.80	0.92	0.68
		Env _D	0.73	0.09	0.72	0.97	0.59
		S	0.76	0.09	0.73	0.95	0.63

Source: own study on the basis of Eurostat <https://ec.europa.eu/eurostat>, 11.11.2023.

Figure 2 shows the synthetic indicator of the financial situation of the logistics sector in Poland from 2008 to 2020 and its pillars (financial liquidity, profitability, efficiency of operation and debt). The values of indicators vary. Financial liquidity and profitability indicators increase in the analyzed period, whereas the efficiency of operation and debt decrease. However, the synthetic indicator of the financial situation of the logistics sector in Poland from 2008 to 2020 characterizes a positive trend, which should be assessed as a favourable situation. Enterprises in the logistics sector have a relatively good financial situation.

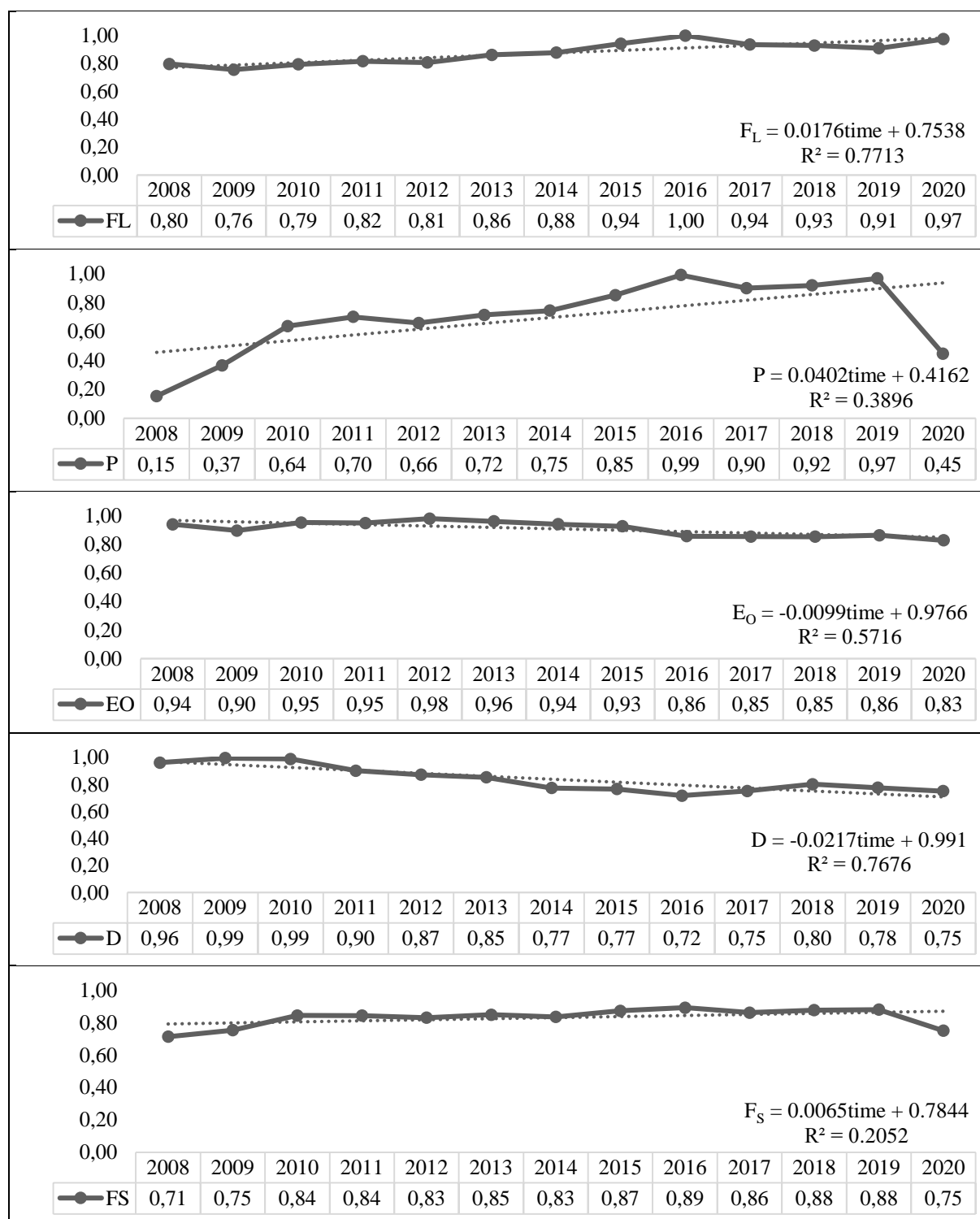


Figure 2. The synthetic indicator of the financial situation and its pillars (2008-2020, the logistics sector)

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, 11.11.2023.

Table 2 presents the descriptive statistics of the synthetic indicator of the financial situation of the logistics sector in Poland from 2008 to 2020 and its pillars (financial liquidity, profitability, efficiency of operation and debt). The average level and median of indicators are high during the analysis period. The maximum level majority of indicators was recorded in 2016, while the minimum level was recorded in various years (no connection).

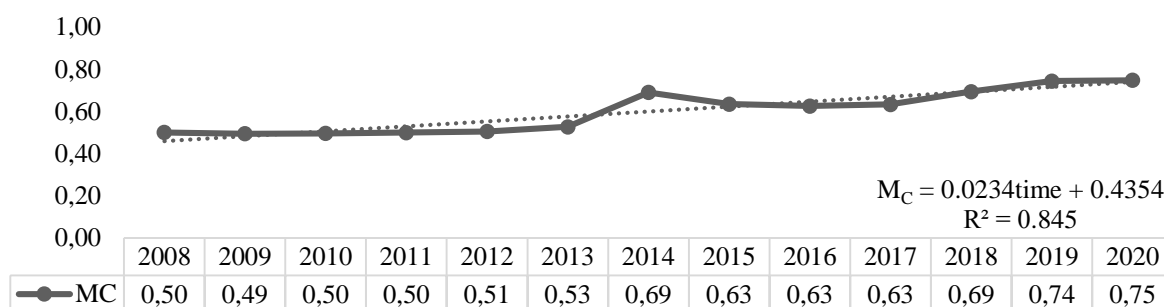
Table 2.

The descriptive statistics of the synthetic indicator of the financial situation and its pillars (2008-2020, section H)

Country	Sector	Variable	Descriptive statistics				
			Mean	SD	Median	Max	Min
Poland	Logistic	F _L	0.88	0.07	0.88	1.00	0.76
		P	0.70	0.24	0.72	0.99	0.15
		E _O	0.91	0.05	0.93	0.98	0.83
		D	0.84	0.09	0.80	0.99	0.72
		F _S	0.83	0.05	0.84	0.89	0.71

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, 11.11.2023.

Figure 3 shows the synthetic indicator of the macroeconomic conditions in Poland from 2008 to 2020. The indicator increases in the analyzed period, which should be assessed positively. It can be concluded that the macroeconomic situation in Poland improved during the period under review.

**Figure 3.** The synthetic indicator of the macroeconomic conditions (2008-2020, Poland)

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, 11.11.2023.

Table 3 presents the descriptive statistics of the synthetic indicator of the macroeconomic conditions in Poland from 2008 to 2020. During the analysis period, the mean and median of the indicator are average. The maximum indicator level was recorded in 2020, and the minimum in 2009.

Table 3.

The descriptive statistics of the synthetic indicator of macroeconomic conditions (2008-2020, Poland)

Country	Variable	Descriptive statistics				
		Mean	SD	Median	Max	Min
Poland	M _C	0.60	0.10	0.63	0.75	0.49

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, access: 11.11.2023.

Table 4 shows the results of the OLS regressions between explained variable (the synthetic indicator of the sustainable development of the logistics sector in Poland from 2008 to 2020) and explanatory variables (the synthetic indicator of macroeconomic conditions, the synthetic indicator of macroeconomic conditions $(t-1)$ in Poland from 2008 to 2020, the synthetic indicator of macroeconomic conditions $(t-2)$, the synthetic indicator of the financial situation, the synthetic indicator of the financial situation $(t-1)$, the synthetic indicator of the financial situation $(t-2)$, the synthetic indicator of the sustainable development $(t-1)$, the synthetic indicator of the sustainable development $(t-2)$ of the logistics sector in Poland from 2008 to 2020). The results

meet the OLS estimation conditions, including no collinearity, homoscedasticity, normal distribution of variables, and no autocorrelation. The synthetic indicator of macroeconomic conditions, the synthetic indicator of sustainable development ($t-1$) and the synthetic indicator of sustainable development ($t-2$) have a statistically significant impact on the synthetic indicator of sustainable development. The relationship between the examined variables is positive (without relation between the synthetic indicator of sustainable development ($t-2$) and the synthetic indicator of sustainable development), with a different level of strength. The highest level of relationship is between the synthetic indicator of sustainable development ($t-2$) and the synthetic indicator of sustainable development. The coefficient determination is 0.919, which means a very good fit of the data in the model.

Table 4.

The Results of the OLS regressions (2008-2020, the logistics sector, ($p < 0.05$))

Country	Sector	Dependent variable	Independent variable	Coefficient	Std. error	p-value	R ²
Poland	Logistic	S	Const	0.269	1.937	0.094	0.919
			M _C	0.515	2.810	0.026	
			S _(t-1)	0.872	3.363	0.012	
			S _(t-2)	-0.639	-2.089	0.075	

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, access: 11.11.2023.

Table 5 presents the results of the SUR estimation between explained variables (the synthetic indicators of the economic, social and environmental development of the logistics sector in Poland from 2008 to 2020) and explanatory variables (the synthetic indicators of the economic, social and environmental development of the logistics sector in Poland from 2008 to 2020, the synthetic indicator of the financial situation, the synthetic indicator of the financial situation ($t-1$) of the logistics sector in Poland from 2008 to 2020, the synthetic indicator of macroeconomic conditions, the synthetic indicator of macroeconomic conditions ($t-1$) in Poland from 2008 to 2020). Models show different strengths and directions of relationships between variables. The estimation indicates a strong differentiation of the impact of individual variables on the economic, social, and environmental development of the logistics sector in Poland from 2008 to 2020.

Table 5.

The results of SUR regressions (2008-2020, the logistics sector, ($p < 0.05$))

Country	Sector	Dependent variable	Independent variable	Coefficient	Std. error	p-value	R ²
Poland	Logistic	E _D	Const	-0.711	0.056	1.36E-06	0.994
			F _{S(t-1)}	-0.382	0.097	0.004	
			S _D	2.038	0.087	1.19E-08	
			Env _D	0.159	0.040	0.004	
		S _D	Const	0.349	0.030	8.65E-06	0.994
			F _{S(t-1)}	0.188	0.044	0.004	
			E _D	0.491	0.021	6.80E-08	
			Env _D	-0.078	0.022	0.010	
		Env _D	Const	0.163	0.174	0.377	0.665
			M _{C(t-1)}	-0.972	0.427	0.052	
			E _D	1.002	0.281	0.007	
			S _D	0.613	0.243	0.036	

Source: own study on the basis of Eurostat <https://ec.europa.eu/Eurostat>, 11.11.2023.

The indicator of economic development is influenced by the indicator of the financial situation ($t-1$), the social development and environmental development of the logistics sector in Poland from 2008 to 2020 (the highest is between economic development and social development). The indicator of social development is influenced by the indicator of the financial situation ($t-1$), the economic development and the environmental development of the logistics sector in Poland from 2008 to 2020 (the highest is between the social development and the economic development). The indicator of environmental development is influenced by the indicator of the macroeconomic conditions in Poland from 2008 to 2020, the economic development and social development of the logistics sector in Poland from 2008 to 2020 (the highest is between the environmental development and the economic development). The coefficient determination ranges from 0.665 (a satisfying fit of the data in the model) to 0.994 (a very good fit of the data in the model).

7. Discussion

The sustainable development of the logistics sector is important for Poland's stable and sustainable development; this is because this sector is important for developing other sectors and industries efficiently (Comporek et al., 2022; Martišius et al., 2022). Implementing the principle of sustainable development in logistics is important not only from the point of view of environmental protection but also for stable economic and social development (Jacyna et al., 2014; Brdulak et al., 2021; Przybylska et al., 2023).

The research results indicate that the central research hypothesis is true because macroeconomic conditions have a statistically significant impact on the sustainable development of logistics enterprises in Poland from 2008 to 2020. The OLS estimation results also indicate that the sustainable development of logistics is continuous, which means that the results obtained in previous periods impact current results.

Moreover, we did not record a statistically significant impact of the financial situation on the sustainable development of logistics enterprises. Therefore, this sector depends primarily on macroeconomic conditions and the situation in other sectors of the economy. The results thus confirm the results obtained by other researchers, indicating a positive relationship between macroeconomic conditions and the sustainable development of logistics (Czyżewski, 2017; Haldar, 2019; Comporek et al., 2022).

The first research sub-hypothesis is correct because, from 2008-2020, the sustainable development of logistics has a positive trend, which should be assessed positively, although it should be noted that the dynamics of development are low.

The second research hypothesis is true because the dynamics of economic development are higher compared to the dynamics of social and environmental development. Therefore, it should be noted that the logistics sector still prioritizes maximizing profits. Environmental development has the lowest growth dynamics. Therefore, it is necessary to implement new EU directives regarding environmental regulations and further reduce the sector's emission intensity.

The third sub-hypothesis is also true because the impact of macroeconomic conditions and the financial situation differ on the individual pillars of sustainable development. Therefore, economic, social and environmental development depends on financial and macroeconomic issues.

Sustainable development of enterprises requires analysis of macroeconomic conditions, ensuring correct balance sheet relations, and maintaining financial balance, which is crucial for stable operation and development.

The analysis has limitations related to the availability of data, the choice of normalization method and the choice of estimation method for both the one-equation model and the structural equation model.

8. Conclusion

The sustainable development of logistics enterprises is important for sustainable socio-economic development and the protection of the natural environment in Poland. From the financial crisis to the COVID-19 pandemic, the dynamics of sustainable development and its economic, social and environmental pillars are positive, which should be assessed positively.

The OLS estimation results indicated that macroeconomic conditions determine sustainable development. In turn, economic and social development, following the SUR estimation, is influenced by the financial situation and environmental development by macroeconomic conditions.

The results indicate that managers of business entities should analyze both macroeconomic conditions and the financial and property situation of business entities on an ongoing basis.

Our further research will be devoted to analyzing the logistics sector in European Union countries. Our goal will be to identify a group of endo and exogenous factors important for the sector's sustainable development.

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