

THE IMPACT OF ENVIRONMENTAL TAXES ON THE FINANCIAL SECURITY OF THE LOGISTICS SECTOR

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Purpose: The main aim of this paper is to assess the impact of environmental taxes on the financial security 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).

Findings: The results indicate a positive trend in the financial security of the logistics sector in Poland from 2008 to 2020. However, in 2020, there was a certain breakdown in financial security caused by the outbreak of the COVID-19 pandemic. Moreover, environmental taxes statistically significantly impact the logistics sector's financial security ($p < 0.05$).

Research limitations/implications: The availability of data, the choice of normalization method and the estimation method for the model.

Practical implications: The research results indicate that the logistics sector should analyze regulations in shaping the EU environmental protection policy, including, above all, environmental taxes.

Social implications: Environmental taxes are an important element influencing the development of the logistics sector, including issues related to residents' quality and living conditions.

Originality/value: The novelty in the paper is the creation of models of the impact of environmental taxes on the financial security of the logistics sector. The paper addresses many recipients interested in the logistics sector's financial situation and environmental taxes.

Keywords: environmental taxes, financial security, logistic sector.

Category of the paper: research paper.

1. Introduction

Environmental taxes play a key role in the broader sustainability strategy, encouraging a shift to greener practices and technologies. The effectiveness of these taxes depends on their design, enforcement and the broader regulatory framework that supports environmental protection.

Meanwhile, a company's financial security is a continuous process that requires strategic planning, adaptability and a proactive approach to risk and opportunity management. Companies that make financial security a priority are better prepared to withstand economic fluctuations and ensure long-term success.

The impact of green taxes on the financial security of the logistics sector depends on how well companies adapt to changing regulations and market dynamics. While there may be initial challenges, there are opportunities for innovation and efficiency gains that can contribute to the long-term stability and financial security of the logistics industry. Successful adaptation may require strategic planning, investment in sustainable technologies and a commitment to meeting changing environmental standards.

The main aim of this paper is to assess the impact of environmental taxes on the financial security 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).

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 the logistics sector should analyze regulations in shaping the EU environmental protection policy, including, above all, environmental taxes. Environmental taxes are an important element influencing the development of the logistics sector, including issues related to residents' quality and living conditions. The novelty in the paper is the creation of models of the impact of environmental taxes on the financial security of the logistics sector. The paper addresses many recipients interested in the logistics sector's financial situation and environmental taxes.

2. Environmental taxes – definition

Environmental taxes are a category of taxes designed specifically to address environmental issues and encourage sustainable practices. These taxes aim to internalize the external costs of

environmental degradation and promote a more environmentally friendly environment. The main objectives of environmental taxes are to reduce pollution, protect resources, and promote the efficient use of natural resources (Hakonsen, 2001; Turner et al., 1998). Their main group are the so-called Pigovian taxes. These environmental taxes are often inspired by the Pigovian economic concept of taxes, named after economist Arthur Pigou. Pigovian taxes aim to correct market failures caused by externalities, such as environmental pollution. By taxing activities that generate negative externalities (e.g., air and water pollution), governments can encourage businesses and individuals to consider the environmental costs of their actions (Fleischer, 2015; Sandmo, 1978; Lange et al., 2000).

Below are some other examples of environmental taxes.

- Carbon taxes – taxing the carbon content of fossil fuels to discourage greenhouse gas emissions. The goal is to reduce carbon dioxide emissions and combat climate change (Metcalf et al., 2020; Zhou et al., 2021; Laeven et al., 2023).
- Eco Taxes, taxes levied on products or activities that have a significant impact on the environment, such as plastic bags or hazardous chemicals (Barde et al., 1996; Runst et al., 2022).
- Landfill waste taxes to encourage recycling and waste reduction (Martin et al., 2003; Lee, 2023).
- Water use taxes, taxes levied on excessive use of water resources to promote water conservation (Wang et al., 2023).
- Congestion Charges for Congested Urban Areas - charges imposed on vehicles entering congested urban areas to reduce traffic and air pollution (Shatanawi et al., 2020; West et al., 2020; Bernardo et al., 2021).

While green taxes can generate revenue for governments, their main purpose is often to change behavior and encourage environmentally sustainable practices. The revenue generated can be used to finance environmental projects or offset other taxes (Kasayanond et al., 2019). The implementation and enforcement of environmental taxes can be complex and requires effective monitoring and enforcement mechanisms (Steinebach, 2022). Many environmental problems, such as climate change, require global solutions. Unilateral environmental taxes in one country may have limited impact without international cooperation. Environmental taxes are just one tool in a wider spectrum of environmental policy measures. They can be effective if carefully designed and implemented, taking into account economic, social, and environmental considerations (Najarzadeh et al., 2021; Fu et al., 2020; Ferrari et al., 2021).

The European Union (EU) is actively engaged in developing and implementing a comprehensive environmental policy. Environmental policy aims to address various environmental challenges, promote sustainable development, and ensure the well-being of present and future generations. It covers a wide range of issues, including air and water quality, waste management, biodiversity, climate change, and more (Burns et al., 2020; Camilleri, 2020). The EU adopts directives and regulations that set environmental standards and

requirements for its member states. These legal instruments aim to achieve specific environmental objectives and ensure consistency across the EU (Tankosić, 2023). The EU itself has set ambitious goals to combat climate change. This includes reducing greenhouse gas emissions, increasing the share of renewable energy, and improving energy efficiency. The European Green Deal, announced in 2019, sets out the EU's strategy to become the world's first climate-neutral continent by 2050. The EU places great emphasis on protecting biodiversity. Efforts are underway to protect and restore ecosystems, combat biodiversity loss, and promote sustainable land use practices (Fetting, 2020; Sikora, 2021). A key initiative in this regard is the EU 2030 Biodiversity Strategy (Hermoso et al., 2022). The EU has established air and water quality standards to protect human health and the environment. This policy includes measures to reduce air pollutants, improve water management, and prevent water pollution (Kuklinska et al., 2015; Tankosić, 2023; Kehinde et al., 2023). The Regulation on the Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) is an important part of the EU's chemicals management policy (Ingre-Khans et al., 2019; Széchy, 2011). The purpose of this is to ensure the safe use of chemicals and to protect human health and the environment. The EU requires member states to carry out environmental impact assessments on certain projects to assess their potential impact on the environment before approving them (Jagadeeswaran et al., 2022). The EU has established waste management targets and regulations to promote waste reduction, recycling, and proper disposal. The key initiative in this area is the closed circuit arks economic action plan (Chioatto et al., 2023; Rezania et al., 2023). The EU provides funding and support for environmental projects and initiatives through programmes such as LIFE (Rigo et al., 2022). These funds contribute to projects focussing on nature conservation, climate action, and environmental innovation. The EU is also committed to international cooperation to address global environmental challenges. This includes participating in international agreements and cooperation to address issues such as climate change and loss of biodiversity (Andriollo et al., 2023; Rodríguez-Pérez et al., 2023).

3. Financial security of the enterprise

The financial security is a key aspect that affects its stability, ability to function, and development. There are many factors that affect the financial security of a company (Shkolnyk et al., 2020; Alnadhhar, 2023; Bolek et al., 2021). Regular financial analysis is crucial to monitoring the company's financial health. It is worth analyzing the balance sheet, profit and loss account, and cash flows (Palepu et al., 2020; Aziz et al., 1980). Appropriate management of financial liquidity is very important, especially in the case of companies operating in very volatile economic conditions. The company should be able to meet its current liabilities and also be able to deal with sudden financial needs (Nasihin et al., 2022; Bolek et al., 2023).

Monitoring debt levels and leverage ratios is important in assessing debt risk. Cost control, on the other hand, is crucial to maintaining profitability. The company should regularly analyze and optimize its costs and look for ways to reduce them (Hussain et al., 2022; Hasanudin, 2023). Diversifying your business can help minimize the risk associated with one sector or market. The diversity of products, services, or geography of operation may be beneficial in terms of the occurrence of various shocks in individual markets (James et al., 2022). The company should identify and manage various types of risk, such as market, operational, and credit risk. Compliance with legal regulations and the application of accounting standards is the key to avoiding legal problems and maintaining financial credibility (Ko et al., 2019; Gallati, 2022; Abdullah et al., 2023). Investments in research and development, new technologies, and innovations can contribute to the long-term profitability of a company. A conscious approach to dividend policy, i.e. the distribution of profits between shareholders and reinvestment in the company's development, affects relations with investors. A good image in the eyes of investors and lenders can make it easier to raise capital and use various forms of financing (Kilincarslan, 2021; Abdullah et al., 2023; Ahmed et al., 2023).

A company's financial security depends on a complex combination of the above-mentioned factors. Regular monitoring and adaptation of the company's management strategy to changing market conditions are key elements of maintaining financial stability (Vovchenko et al., 2017; Delas et al., 2015).

4. Research methodology

Financial security is extremely important for market survival, investment and development of the corporate sector. Financial security is influenced by several factors, both from the company's environment and company managers' skills and operational efficiency.

The primary aim of the research is to assess the impact of environmental taxes on the financial security of the logistics sector from 2008 to 2020. Environmental taxes include energy taxes, pollution taxes, resource taxes, and transport taxes, the role of which is to reduce the negative impact of business on the natural environment.

The main research hypothesis is as follows: "Environmental taxes significantly impact maintaining financial security in the logistics sector from 2008 to 2020 in Poland". Additionally, we asked the following research questions:

- How did the level of financial security develop between the financial crisis and the Covid-19 pandemic?
- Which environmental taxes burden the logistics sector the most?
- Which type of environmental tax has the highest statistically significant impact on the financial security of the logistics sector?

The research includes the following stages:

1. Synthetic indicators for assessing the financial security of enterprises were created based on:
 - stimulants: current ratio, quick ratio, ROS, ROA, ROE, total assets turnover/productivity of assets, assets structure ratio,
 - destimulants: inventories cycle, receivables cycle, operating cycle, debt ratio, debt-to-equity ratio;
2. The indicators were normalized based on the method:
 - for the stimulants:

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

- for the destimulants:

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

where:

BFS_{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 the financial security of the logistics sector (FS) we use the formula:

$$FS = \frac{\sum_{j=1}^n (SFS_{ij} + DFS_{ij})}{n}, FS_{ij} \in [0; 1] \quad (3)$$

3. We created a two different linear equation, which we estimated using the classic least squares method, based on formula:

$$FS_{ij} = \alpha_0 + \alpha_1 \text{Envtax} + \varepsilon_i \quad (4)$$

$$FS_{ij} = \alpha_0 + \alpha_1 \text{Entax} + \alpha_2 \text{Entax}(t-1) + \alpha_3 \text{Polltax} + \alpha_4 \text{Polltax}(t-1) + \alpha_5 \text{Restax} + \alpha_6 \text{Restax}(t-1) + \alpha_7 \text{Trtax} + \alpha_8 \text{Trtax}(t-1) + \varepsilon_i; \quad (5)$$

$$s(\hat{\alpha}_0, \dots, \hat{\alpha}_5) = \sum_{i=1}^n e_i^2 = \sum_{i=1}^n (FS_i - \widehat{FS}_i)^2 \rightarrow \min \quad (6)$$

where:

t – time;

Entax – energy taxes;

Polltax – pollution taxes;

Restax – resource taxes;

Trtax – transport taxes.

5. Research results

Table 1 presents selected indicators for assessing the financial security of the logistics sector in 2008-2020. In the analyzed period, this sector is characterized by an increase in financial liquidity and relatively low levels of profitability of sales, assets and equity. The level of debt increases from 55% to 68%, which indicates a relatively high level of debt financing of operations.

Table 1.
Indicators for assessing the financial security of logistics sector

	Current ratio	Quick ratio	ROS	ROA	ROE	Inventories cycle	Receivables cycle	Operating cycle	Total assets turnover/ Productivity of assets	Debt ratio	Debt-to-equity ratio	Assets structure ratio
2008	1.31	1.17	0.01	0.01	0.01	8.31	56.65	64.96	0.90	0.55	1.24	2.56
2009	1.24	1.11	0.02	0.01	0.03	8.41	59.32	67.73	0.85	0.55	1.20	2.65
2010	1.30	1.17	0.03	0.02	0.05	7.20	56.63	63.83	0.87	0.55	1.21	2.65
2011	1.33	1.21	0.03	0.02	0.06	6.60	57.91	64.51	0.87	0.57	1.34	2.58
2012	1.31	1.20	0.03	0.02	0.05	6.11	56.72	62.84	0.85	0.59	1.46	2.67
2013	1.39	1.29	0.03	0.02	0.06	6.02	59.23	65.25	0.81	0.60	1.49	2.64
2014	1.42	1.31	0.03	0.02	0.06	6.36	60.02	66.38	0.76	0.63	1.69	2.77
2015	1.52	1.41	0.04	0.03	0.07	6.06	63.33	69.39	0.73	0.64	1.78	2.89
2016	1.62	1.49	0.04	0.03	0.09	8.23	63.31	71.55	0.70	0.66	1.92	2.67
2017	1.52	1.39	0.04	0.03	0.08	7.94	63.97	71.91	0.72	0.66	1.93	2.69
2018	1.51	1.38	0.04	0.03	0.08	7.64	65.61	73.25	0.75	0.66	1.90	2.63
2019	1.48	1.35	0.04	0.03	0.09	7.55	63.52	71.07	0.75	0.67	2.05	2.72
2020	1.58	1.45	0.02	0.01	0.04	7.71	64.87	72.58	0.66	0.68	2.08	2.79

Source: wskaznikibranzowe.pl, 27.12.2023.

Figure 1 shows the integrated financial security indicator of the logistics sector. Its trend is positive, which means that the situation in the sector is improving, but there is a visible decrease in its level in 2020, which is the result of the outbreak of the COVID-19 pandemic and the closure of the economy.

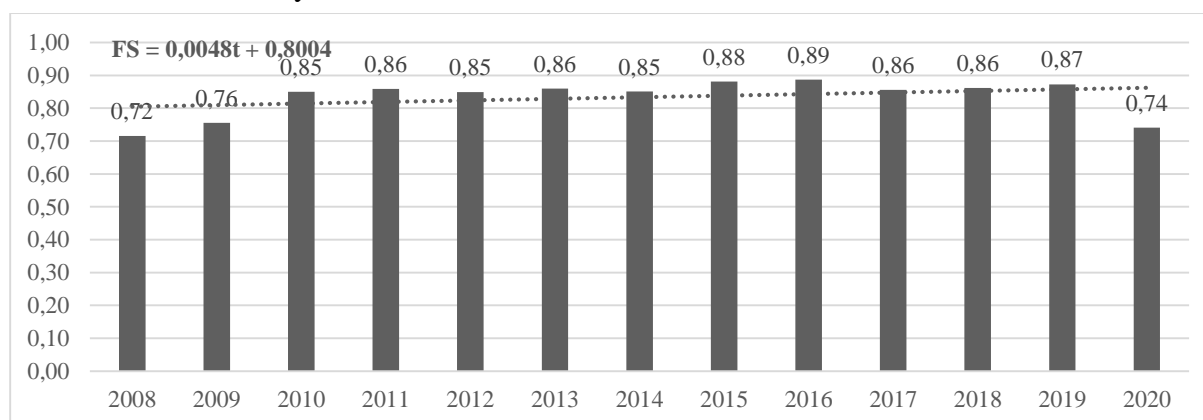


Figure 1. The indicator of financial security of the logistics sector.

Source: <https://wskaznikibranzowe.pl>, 27.12.2023.

Table 2 shows environmental taxes and their types in the logistics sector. The amount of environmental taxes in the analyzed period varies, with the largest tax share being taxes on energy and the smallest being taxes on natural resources.

Table 2.*Environmental taxes in the logistics sector in Poland from 2008 to 2020*

Year	Total environmental Taxes	Energy taxes	Pollution taxes	Resource taxes	Transport taxes
2008	2 403.14	2 192.59	94.61	7.74	108.21
2009	2 004.39	1 833.47	81.88	7.44	81.59
2010	2 248.91	2 073.44	85.92	8.37	81.19
2011	2 259.58	2 055.36	89.87	8.47	105.88
2012	2 256.22	2 071.54	70.72	7.72	106.23
2013	2 305.57	2 149.86	36.06	5.79	113.85
2014	2 503.42	2 324.65	67.96	6.35	104.46
2015	2 673.73	2 471.16	80.61	5.06	116.9
2016	2 715.23	2 561.5	61.73	4.27	87.73
2017	2 969.04	2 815.05	63.32	2.03	88.63
2018	3 210.22	3 061.57	64.66	2.95	81.04
2019	3 245.27	3 082.89	69.1	2.39	90.88
2020	2 541.36	2 415.9	72.63	5.53	47.31

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Environmental_tax_statistics.

The Ordinary Least Square estimation results indicate a statistically significant positive impact of environmental taxes from the current period and a negative, although insignificant, impact of environmental taxes from two years ago on the financial security of the logistics sector (Table 3).

Table 3.*The OLS estimation (dependent variable: BF)*

	Coefficient	Std.dev.	t-Student	p-value	R ²
const	0.907456	0.0485941	18.67	<0.0001	0.8
Envtax	9.31574e-05	2.10758e-05	4.420	0.0022	
Envtax (t-2)	-0.000120027	2.20210e-05	-5.451	0.0006	
The White test: LM = 0.639016; p = P(Chi-square(5) > 0.639016) = 0.986147					
Chi-square(2) = 2.23441; p = 0.327193					
LMF = 2.14747; p = P(F(1.7) > 2.14747) = 0.186227					

Source: own calculations.

Table 4 presents the results of estimating the impact of individual types of environmental taxes on the financial security of the logistics sector in Poland. The results indicate that taxes on energy and natural resources from the previous period positively impact financial security.

Table 4.*The OLS estimation (dependent variable: BF; explanatory variables: Entax, Polltax, ResTax, Trtax)*

	Coefficient	Std.dev.	t-Student	p-value	R ²
const	0.184876	0.105938	1.745	0.1149	0.81
EnTax	0.000199363	3.20448e-05	6.221	0.0002	
ResTax (t-1)	0.0312406	0.00555157	5.627	0.0003	
LM = 8.42295; p = P(Chi-square(5) > 8.42295) = 0.134415					
Chi-kwadrat(2) = 0.299018; p = 0.861131					
LMF = 0.876466; p = P(F(1.8) > 0.876466) = 0.376568					

Source: own calculations.

The research results show that environmental taxes affect financial security, but it should be emphasized that they do not play a key role in maintaining its appropriate level. However, they should be taken into account in business activities because, apart from financial security, they affect the environmental development of enterprises and the costs of running a business.

6. Discussion and conclusions

Financial security is an essential factor influencing enterprises' functioning and development. It means a state where it is possible to perform economic functions related to raising capital, dividing it and using it appropriately in operational, investment and financial activities. Financial security is assessed using various financial indicators, both accrual and cash. Liquidity, solvency and profitability are assessed.

An appropriate level of financial security enables the implementation of new investments and is, therefore, one of the basic elements influencing enterprises' sustainable and stable development. Financial security depends on some factors, external and internal. In our analyses, we decided to check whether environmental taxes, whose role is to reduce the negative impact of business activities on the natural environment, affect the level of financial security.

The results of our research indicate that environmental taxes have a statistically significant impact on the financial security of the logistics sector. Therefore, the main hypothesis of the study is true. Moreover, it should be noted that this impact, although statistically significant, is relatively small, and therefore, an increase in environmental taxes, which is good for the protection of the natural environment, should not have a very negative impact on the liquidity, profitability, operational efficiency and debt of the logistics sector in Poland.

The level of financial security is increasing (the first research question), although the dynamics are not high, and what is more, in the analyzed period, there were years in which its level decreased. A particularly large decline in its level was visible in 2020, the year of the outbreak of the COVID-19 pandemic, which was the result of restrictions on business activity and temporary lockdowns.

In answer to the second research question, the largest share in environmental taxes in the logistics sector are energy taxes, followed by transport taxes.

It should also be emphasized that the results of the OLS estimation indicate that the greatest statistically significant impact on the logistics sector comes from taxes on energy and taxes on natural resources from two years ago.

The study results indicate that company managers should consider fiscal aspects in their analyses, including those related to environmental taxes. The amount of these taxes is relatively low and, therefore, does not significantly impact the analysis of costs incurred by enterprises.

The research limitation is assessing the level of financial security only to the level of accrual indicators, which results from the need for more availability of cash data at the level of business sectors.

We will devote further research to assessing the impact of environmental taxes on the logistics sector in other European Union countries, allowing us to conduct a comparative analysis of the logistics sectors and the determinants of their development.

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