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The impact of sustainable finance on a country's economic performance

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Abstract

The increasing relevance of the concept of sustainable finance encourages research into the impact it can have on a country's economic performance. The concept of sustainable finance itself is defined in various ways, and different concepts lead to different approaches to the impact not only on the economy, but also on the environment and social areas. Sustainable finance may exert a positive impact on both climate change mitigation and energy efficiency. In order to analyze the impact of sustainable finance in Lithuania in the period 2009-2023, correlation and regression analyses were used. The results did not show a short-term relationship, but, in the long term, a statistically significant positive impact of sustainable finance on the country's economy was obtained.

Keywords: sustainable finance, green finance, energy efficiency, ESG, sustainable development

1. Introduction

Sustainability has become one of the most important principles in business, politics, economics and many other areas. Problems such as climate change, environmental degradation or social inequality encourage the search for financial solutions that can help solve such problems and ensure sustainable economic growth in countries. It is for these reasons that the concept that emerged – sustainable finance is described as investments or financing that promote sustainability and contribute to the implementation of sustainable development goals (Migliorelli, 2021). Countries that actively implement the principles of sustainable finance not only contribute to climate change mitigation, but also help create new jobs, increase competitiveness and ultimately – strengthen the resilience of financial systems and promote various innovations.

The business sector is responsible for taking sustainable decisions and implementing the good practice. However, adoption of sustainable practices may be encouraged or hurdled by institutional environment, social responsibility, consumer awareness and other factors. Therefore, the performance at the macro level is also dependent on the context. This implies that analysis of the sustainable behaviour needs to be conducted in different regions. Generally, sustainable finance can be related to investments that lead improved energy efficiency.

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However, the practical impact of sustainable finance on a country's economy may depend on a number of factors – legal regulation, decisions made by investors and the country's economic situation. For these reasons, it is important to analyze how sustainable finance can affect a country's economic indicators. The purpose of this study is to examine the impact of sustainable finance on a country's economy. The paper deals with the case of Lithuania. The present case is important as it represents a country that has integrated in the EU along with serious socioeconomic transformations afterwards.

2. Literature review

2.1. The concept of sustainable finance

Sustainable finance, green economy, responsible investment and many similar concepts are increasingly discussed in literature and their impact is increasingly being studied in the context of many different areas - environmental protection, economics and various social areas. The idea of sustainability began to be developed in the academic context at the end of the last century, and the concept of sustainable or sustainable development is described as economic development that aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs (Portney, 2015). Given the current focus on sustainability, sustainable development and its goals, traditional finance practices are criticized, for example, Alowais and Joseph (2024) argue that with the increasing importance of ESG principles in the context of decision-making, the strengthened approach to socially responsible investment, human rights and climate change has also strengthened the public's attitude towards sustainability, which encourages the study of the negative impact of finance and the activities of financial institutions in combining social goals with financial results. All this indicates the relevance and impact of the concept of sustainable finance in many areas. Traditional business models are oriented towards a linear system and are based on the availability of cheap and unlimited natural resources, which is particularly risky, since the amount of both non-renewable and renewable resources and the possibilities of renewal are constantly decreasing (Schoenmaker, D., 2017). The author argues that in order to reduce this risk, a transition to an economy based on sustainability in production and consumption is necessary. The functions of the financial system, particularly important in the context of sustainable finance, are (Schoenmaker, Schramade, 2019):

- Pre-prepared information about potential investments and appropriate capital allocation;
- Investment monitoring and ongoing company management;
- Facilitating trading, risk management and diversification.

According to the authors, the most important role of financing is to allocate it to the most productive use. For this reason, properly allocated finances can help make strategic decisions to achieve sustainable development goals.

Sustainable finance is defined as a financial activity or system that takes into account environmental, social and governance (ESG) principles. The goal of sustainable finance is to promote long-term economic growth while addressing climate change, social and other sustainability challenges (Faruq, Huq, 2024). According to Sari et al. (2025), sustainable finance is like an ecosystem supported by policies, regulations, norms and financial services focused on sustainable economic growth. Alowais and Joseph (2024) argue that the concept of sustainable finance combines business processes and environmental issues. According to the authors, sustainable finance can be considered one of the traditional finance models, the main goal of which, apart from the pursuit of conventional monetary profit, is sustainable impact. Sustainable finance can be divided into different types, each of which performs a separate function: environmental finance alleviates environmental degradation; green finance reduces emissions of various pollutants and environmental damage; microfinance can help reduce social exclusion; sustainable development and responsible investment can influence both environmental protection and social activities (Ziolo, M. et al, 2019). The concept of sustainable finance can be defined not only as a business model or certain obligations, but also as a separate financial model focused on and seeking to integrate sustainability aspects. Factors such as economic growth, sustainable long-term financing, investment decision-making or business ethics are also used to define the concept (Gutterman, 2024, Singhania et al., 2023).

The ambiguity of the concept of sustainable finance may arise from the different perspectives and engagement of stakeholders in the process. Stakeholders argue that politicians or financial institutions use the concept to demonstrate their preferences or beliefs (Malik et al., 2024). According to Alowais and Joseph (2024), the concept of sustainable finance can also be described as the behavior of all relevant parties, including financial institutions, consumers and producers, as well as supply chains of goods and services. Different groups of stakeholders may have different motives and pursue different goals in the context of sustainable finance. Kumar et al. (2022) present the uncertainty of the concept from a different perspective – the authors argue that after reviewing the existing literature in this area, such reviews have in most cases been limited to a certain factor of sustainable financing or individual concepts, such as the oldest used concept of socially responsible financing and the later concepts of green financing, ethical financing, ESG (environmental, social and governance) principles, climate financing or corporate social responsibility.

In summary, the concept of sustainable finance is understood as the interface between the business model and environmental protection, sustainability and social problem solving. A different concept of sustainable finance can manifest itself depending on the attitude, behavior and participation of stakeholders in the process. Concepts such as green finance, ESG, sustainable development goals, socially responsible investment, conscious capitalism, etc. are components that together summarize the concept of sustainable finance.

2.2. The impact of sustainable finance on the national economy

In order to determine the impact of sustainable finance on the economy of a country, it is first important to determine the definition of "impact" itself – the authors Bush et al. (2021) argue that this concept is not properly defined in the literature describing sustainable finance and its impact on the real economy. However, the impact of sustainable finance on the economy can be defined as the global social value created by the investor, but investors seeking this impact can often act inefficiently and focus only on their portfolio (Green and Roth, 2024). The authors argue that investors seeking sustainability should focus on less profitable projects, rather than valuable, profitable companies. Weber (2014), who examined the impact of the financial sector on sustainable development, argues that:

1. The financial sector must move to a proactive, inside-out business strategy;
2. In order to address sustainability issues, a systematic approach must be applied and intervention strategies must be developed;
3. Sustainability must be integrated into the core business strategy of banks.

The literature presents different opinions on the impact of sustainable finance on the national economy. The reasons for the positive impact on the economy may be the development of energy-saving and environmental protection industries and sustainable infrastructure (Nie et al., 2024, Liu et al., 2021, Seruca et al., 2023); financing of sustainable enterprises or the development of green industries (Chiu and Lee, 2020); new markets and technologies and economic transformation (Rodriguez et al., 2024); and finally, good ESG performance in companies or appropriate institutional actions (Heflich, and Saulnier, 2024). Sustainable capital plays a crucial role in directing capital to environmentally sustainable investments, promoting the transition to a lower carbon economy, and supporting the growth and development of environmental protection and energy-saving industries. The causes of negative impacts are economic challenges (Daly et al., 2022); the risk of "greenwashing", the risk of loss of value and different interpretations of financial instruments (Zielinska–Lont, 2020); investor distrust or regulatory problems can also have a negative impact on a country's economic indicators (Liu, 2023, Dholaka et al., 2019). Economic challenges can be caused by financing instruments such as official development assistance (ODA), which, although often strongly contributes to economic growth in developing countries, can also have the opposite effect; external debt, which can also reduce the human development index (HDI); personal remittances in developing countries can also have a negative impact on the economy (Daly et al., 2022). In summary, depending on certain regulatory factors or institutions, the economic situation of the country or the inappropriate application of financial instruments, sustainable finance can have different effects on the national economy. While factors such as increased energy efficiency or environmental protection and the proper application of ESG in companies have a negative impact, risks such as "greenwashing" or investor distrust can also have the opposite effect.

2.3. Overview of research on the impact of sustainable finance

Research on the impact of sustainable finance is diverse, analyzing the impact of different indicators on various sectors, such as energy efficiency, technology, environmental protection, and emissions. Table 1 shows examples of such research. Solangi et al. (2025) sought to assess how social investments and green financing promote sustainable development. They found 16 emerging market country indicators (social investment, green finance, sustainable development indicators, etc.); four regression methods were used (truncated regression, Price-Winsten regression, instrumental variables regression, and UKS panel lagged regression). The latter study implied that social investments and a green finance system have a statistically significant positive impact on sustainable development indicators; poverty and ecological footprint inhibit sustainable development. It is recommended to increase investments in green and social projects; limit the excess of natural resources. Liu et al. (2023) investigated whether and how sustainable financing influences the energy efficiency of companies. Various Chinese cities were analyzed; a Sustainable Finance Index (SFI) was created based on multi-dimensional data: green credit, investment, insurance, carbon emissions indicators, etc. Regression, moderation, and marginal effects models were performed. Liu et al. (2023) found that growth of sustainable finance significantly increases energy efficiency in enterprises; SFI encourages investments in technologies that increase efficiency. It is recommended to precisely formulate and develop SFI policies; encourage enterprises to invest in technologies and industrial sector transformation.

All the analyzed studies are similar in geographical terms – developing countries or certain areas of these countries were analyzed. The results obtained are also similar – in all cases, sustainable finance or certain parts of it (social investments, green finance) have a positive impact on the analyzed indicators. Liu et al. (2023) created the Sustainable Finance Index (SFI) for the study, and the results of the study show that this index and sustainable finance in general not only contribute to increasing energy efficiency, but also stimulate technological investments. However, although the studies obtained essentially similar results – the positive impact of sustainable finance on certain indicators or sectors, the research methods used differed substantially. This shows that there are many different ways to determine the relationship and mutual influence of indicators. In summary, the studies obtained have a common conclusion – properly applied sustainable finance has a positive impact on the economic and other indicators of countries.

2.4. Overview of the sustainable finance situation in Lithuania

In order to assess the impact of sustainable finance on economic indicators in Lithuania, it is important to also review the country's situation in the context of environmental protection. Figure 1 shows corporate investments in environmental protection in the period 2014-2023.

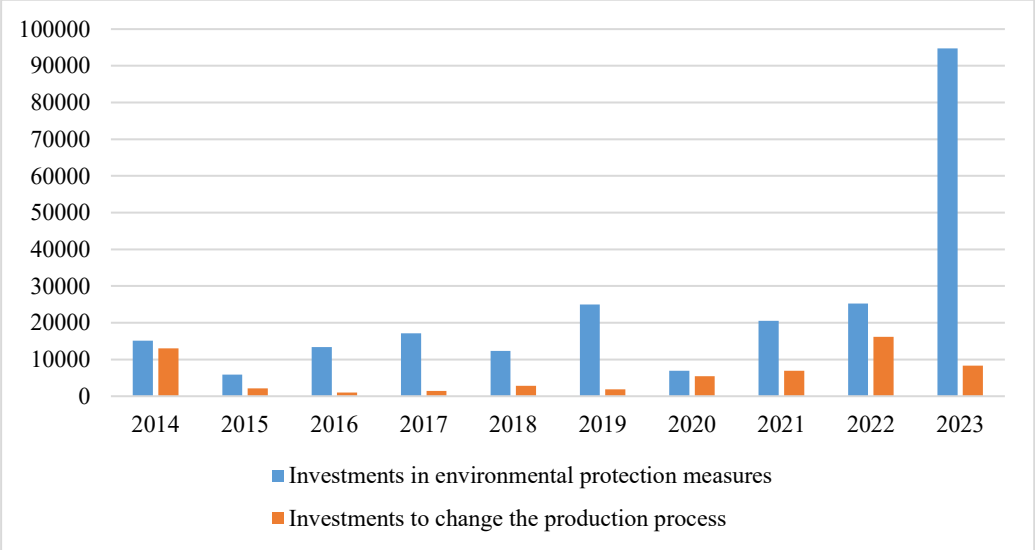

Figure 1. Corporate investments in environmental protection, thousand EUR, 2014-2023

Source: designed by the author, based on data from Statistics Lithuania

Based on the data presented in Figure 1, it can be stated that investments in environmental protection in Lithuania during the analyzed period (2014-2023) were unstable - although there is a noticeable growth in investments, a decrease in this indicator is observed in certain years. The largest investments in environmental protection measures were in the most recent analyzed period - 2023 (94,747.4 thousand EUR), the smallest - in 2015 (5,888.7 thousand EUR). Investments in changing the production process were significantly lower than those allocated to environmental protection measures - this shows that most companies would rather try to eliminate the pollution caused during production than fundamentally change the processes that will reduce the pollution they cause in the long term. In contrast to the case of investments in environmental protection measures, the largest investments in changing the production process are observed in 2022 (16,206.4 thousand EUR), the smallest - in 2016 (1,027.6 thousand EUR). Summarizing the analyzed data, it can be stated that in Lithuania, companies are making visible efforts to invest in environmental protection – both in conservation measures and in changing production processes. However, in all cases, companies choose to invest more in conservation measures than in changing production processes.

3. Methods

In order to assess the impact of sustainable finance on the country's economic growth and taking into account the results of the studies already conducted, in this case it was decided to conduct correlation and regression analysis in order to determine whether there is a statistically significant relationship between the indicators. The geographical scope of the study is the Lithuanian economy. For the analysis, energy

efficiency was chosen as the independent variable, calculated according to the formula below:

$$Energy\ efficiency = \frac{Gross\ domestic\ product}{Final\ energy\ consumption}$$

In Lithuania, as in most smaller economies, accurate data on sustainable financial products is not available. Network for Greening the Financial system (2022) states that as the sustainable finance market is emerging, the lack of historical data and benchmarks makes it particularly difficult to assess the ambition of performance targets. Most authors also point out the short time series of data as a problem – in order to perform regression analysis and obtain accurate results, it is necessary to evaluate as much historical data as possible (Daumas, 2023, Li, 2024). The study covers 2009–2023.

Gross domestic product was chosen as the independent variable – this indicator most accurately describes the macroeconomic situation of the country. Data for both indicators were collected from the publicly available database Eurostat. The study comprises four stages, which are depicted in Figure 2.

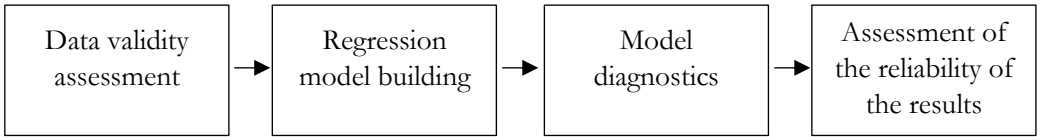

Fig. 2. Stages of regression analysis.
Source: designed by the author

The first stage includes statistical analysis of the data (mean, median, standard deviation, etc.) and the assumption of normal distribution, assessed using the Jarque-Bera criterion. This stage also includes a preliminary assessment of the relationship between indicators by performing correlation analysis.
In the second stage, a regression model is built with the appropriate data and its parameters are estimated. In the third stage, the model residuals are evaluated - the normal distribution of the residuals, the assumptions of heteroscedasticity and autocorrelation are evaluated. Ideally, the residuals, like the original data, should meet all the criteria.

Finally, in order to assess the reliability of the obtained results, a sensitivity analysis is performed - new regression models are created after removing outliers, for example, years of crisis or pandemic periods. In this case, if the parameters of the obtained models do not change, or change slightly, the reliability of the obtained results and their resistance to sensitivity tests are confirmed.

4. Results

To assess the relevance of the data, a statistical analysis of the data was performed. The results are presented in Table 1.

Table 1
Statistical data analysis

Variable	Gross domestic product	Energy efficiency
Average	35720.73	6.934
Median	34999.4	6.864
Minimum value	27545.8	5.756
Maximum value	44180.5	8.305
Standard deviation	5714.66	0.745
Number of observations	15	15

Source: designed by the author

On average, in 2009-2023, the level of gross domestic product in Lithuania reached 35720,73 million. EUR, the highest value is observed in 2009 (27545,8 million EUR), the highest – in the most recent period – in 2023 (44180,5 million EUR). The lowest energy efficiency in Lithuania is observed in the period of 2010, and the highest – also in the most recent period. The distribution of both indicators according to the normal distribution is assessed below.

The normal distribution of data is tested according to the Jarque-Bera test. The null hypothesis of normal distribution is rejected if p-value is less than 0.05. When assessing the distribution of the dependent variable, it can be stated that the data are normally distributed, since the p-value reaches 0.598. The assumption of normal distribution of data can also be confirmed in the case of the dependent variable - energy efficiency, since the p-value is equal to 0.809. Since the data are distributed according to the normal distribution, a correlation analysis is further performed in order to preliminarily assess the relationship between the indicators. The correlation analysis revealed a very strong correlation between the analyzed indicators – 0.96. This Pearson correlation coefficient indicates a very strong relationship between the indicators and allows to create a regression model in order to assess the exact impact of sustainable finance in Lithuania.

Before developing a regression model to assess the impact of sustainable finance on the Lithuanian macroeconomics, it is important to assess the type of data selected for the study and, in order to obtain accurate data, select the correct regression model. In this case, since the analyzed indicators are of the data series type, when assessing stationarity, it was observed that the data has an increasing trend. For this reason, the regression will be constructed by differentiating the data, since otherwise the results obtained, although statistically significant, would not be economically justified. Differentiating the data will provide an opportunity to assess the short-term relationship between the dependent and independent variables, avoiding the influence of the long-term trend. However, in order to assess the impact of sustainable finance on the Lithuanian economy in the most accurate way, it is useful to also assess the long-term impact of energy efficiency on the gross domestic product. For the long-term relationship, the data were logged. The results of both logarithmic and differential regressions are illustrated in Table 2.

Table 2
Parameters of regression models

Indicator	Difference model (short-term relationship)	Logarithmic model (long-term relationship)
Adjusted R^2	-0.08	0.92
P – value (β_1 coefficient)	0.99	0.00
F – statistic	0.00	153.85
P value (F – statistic)	0.99	0.00
β_1 coefficient	14.45	1.45

Source: designed by the author

The obtained parameters of both models show very different results in the short and long term. First of all, the significance of the models is assessed - the differentiated model, created to assess the short-term relationship between the indicators, is statistically insignificant - the model p-values are equal to 0,99. Moreover, the model's adjusted R^2 is less than 0 – the model has no significant explanatory power. On the other hand, when the data is logged and the long-term impact of energy efficiency on gross domestic product is examined, a strong statistically significant relationship between the indicators is observed. Both the F-statistics and p-values satisfy the model's significance assumptions, and the result allows to interpret that a 1% increase in energy efficiency increases gross domestic product by 1,45%. The obtained regression results show the absence of a short-term (annual) impact of sustainable finance on the Lithuanian economy and a strong relationship in the long run. In this case, since a significant relationship was observed only in the long term, i.e. when developing a logarithmic model, model diagnostics and assessment of the reliability of the results will be performed only for this model. The diagnostic results are presented in Table 3.

Table 3
Model diagnostic results

Test	Coefficient	Value
Normal distribution	P (Jarque – Bera)	0.56
Heteroscedasticity	P (F statistic)	0.43
	P (X^2 statistic)	0.39
	P (Dispersion statistics)	0.59
Autocorrelation	P (F statistic)	0.1
	P (X^2 statistic)	0.08

Source: designed by the author

When performing model diagnostics, the distribution of model residuals is evaluated and the assumptions of heteroscedasticity and autocorrelation are checked. In order to evaluate these assumptions, p-values are evaluated, the result of which must be greater than 0,05 in order to confirm the hypothesis. The results in

the table confirm that the model is significant and reliable, as the residuals are normally distributed and the assumptions of heteroscedasticity and autocorrelation are rejected.

Finally, it is important to assess the reliability of the results by performing sensitivity analysis. Sensitivity analysis in this case is performed by removing outlier years and checking the model parameters, compared to the original model. The selected outlier years are: 2009 – due to the economic crisis in Lithuania and 2020 – due to the global pandemic that caused economic shocks. The results of this analysis are shown in Table 4.

Table 4
Sensitivity analysis results

Indicator	Model without 2009	Model without 2020
Adjusted R^2	0.9	0.91
P – value (β_1 coefficient)	0.000	0.000
F – statistic	119.45	134.47
P value (F – statistic)	0.000	0.000
β_1 coefficient	1.42	1.45

Source: designed by the author.

Sensitivity analysis suggests that removing outliers does not change the significance of the model – both p-values remain equal to 0 and the F-statistic result remains high. The adjusted R^2, which describes the explanatory power of the model, also remains almost identical. Finally, the β_1 coefficient, which indicates the impact of energy efficiency on gross domestic product, although slightly reduced after excluding 2009 (1,42 < 1,45), shows almost the same influence of the independent indicator. In summary, it can be stated that the obtained model results are resistant to sensitivity checks and can be used to formulate the conclusions of the study.

To summarize, the results of the study show that there is a long-term impact of sustainable finance on Lithuania's gross domestic product - a statistically significant positive impact on energy efficiency is visible in the period 2009-2023. The results of the study also showed that there is no short-term (annual) impact of sustainable finance on the country's economy in Lithuania during the analyzed period. In this case, since the results were obtained using an indicator describing energy efficiency in the country, it is recommended to expand this sector and strive for the greatest possible use of renewable energy resources for energy production in Lithuania. However, since energy efficiency is not a direct instrument of sustainable finance, it is appropriate to repeat this type of study using sustainable finance products (green shares, bonds, etc.) as independent variables in order to obtain more accurate results of the impact of sustainable finance.

5. Conclusions

In summary, sustainable finance can be described both as a business practice, when ESG criteria are applied in the company's activities, and as a separate financial system that integrates sustainability principles. However, this concept, which is not properly defined and interpreted differently, gives rise to various opinions, especially when analyzing the impact of sustainable finance. The literature shows different opinions on the impact of sustainable finance on the economy - although increasing environmental protection or energy efficiency has a positive impact and brings us closer to sustainable development, sustainable finance instruments or products can be interpreted differently and cause distrust - inappropriate decisions made by investors cause various risks and have a negative impact.

The obtained results of the study showed a statistically significant positive impact of sustainable finance on the Lithuanian economy in the long term. On the other hand, there is no short-term relationship between energy efficiency and gross domestic product in the analyzed period. Future studies could attempt using more diverse measures of sustainable finance development.

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