DOI: https://doi.org/10.30525/2256-0742/2025-11-1-181-191

IMPACT OF WAR IN UKRAINE ON ECONOMIC GROWTH OF LITHUANIA

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Abstract. The issue of Russia's invasion of Ukraine and its impact on countries' economic growth is critical in today's global landscape. The conflict has caused severe economic disruption, including disruptions to trade routes, investment uncertainty, a decline in the country's GDP, a rise in inflation and a significant increase in unemployment rates, both in Ukraine and in neighbouring countries. The purpose of the article is to analyse the impact of the war in Ukraine on the economic growth of Lithuania, which plays an important role in the sovereignty and territorial integrity of Ukraine, the article covers the data for 2002-2023. In order to find a model of economic growth for Lithuania during the war in Ukraine, the following parameters were analysed: the number of immigrants from Ukraine in Lithuania, Lithuania's military spending, the long-term interest rate, the level of business confidence, Lithuania-Ukraine exports, Lithuania-Russia imports, Ukraine-Lithuania exports, Ukraine-Lithuania imports, foreign direct investment in Lithuania, financial help to Ukraine from Lithuania, renewable energy consumption, unemployment rate, and inflation. The subsequent factors have been selected on the basis of a review of the extant literature and an analysis of the research conducted by foreign and domestic scholars. The analysis of Lithuania's economic growth has been conducted using the Harrod-Domar model, which focuses on investments and savings as a means of increasing economic growth. The hypothesis concerning the factors has been tested using correlation analysis to ascertain the relationship between the dependent and independent variables, and to identify the parameters with the most significant impact on economic growth. A thorough regression analysis reveals a substantial non-linear association between Lithuania's economic growth, its military expenditure, the influx of immigrants from Ukraine, energy consumption and its provision of military assistance to Ukraine. To optimise the model's parameters, an assessment of expert opinions was conducted, utilising linear programming to maximise economic growth in Lithuania. As Lithuania is geographically proximate to both Ukraine and Russia, and has historically maintained robust trade relations with both nations, it is imperative to ascertain the potential ramifications of the war in Ukraine on Lithuania's economic growth. The research findings and the models developed can serve as a valuable analytical framework for the study of other post-Soviet economies, facilitating the evaluation of their economic development in the context of geopolitical conflicts.

Keywords: economic growth, geopolitical risk, war.

JEL Classification: O40, F50, H56

1. Introduction

In today's modern realities, the issue of the war in Ukraine is increasingly attracting the attention of researchers and politicians. The geopolitical conflict started in 2014, when Russia invaded Ukraine and annexed Crimea, but the global attention was brought by the full-scale Russian-Ukrainian war, which started in February 2022. The conflict between Russia and Ukraine has led to serious economic shocks around the world, as Ukraine has played a significant role in

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the global economy due to its favourable geopolitical location, Ukraine is a leader in the export of agricultural products and contributes to the global food supply (Oes et al., 2023). Moreover, it has functioned as a pivotal transit nation, providing Europe with natural gas from Russia.The ongoing war in Ukraine has underscored the significance of Ukraine in the global context and has exerted pressure on the global economy by disrupting supply chains and energy markets. In the case of Lithuania, which does not share a border with Ukraine, the economic growth model may have been subject to change due to fluctuations in trade, the arrival of immigrants, rising inflation and interest rates, and significant military spending, as well as substantial military aid to Ukraine (Ruta & Rastogi, 2022). It is for this reason that a full-scale war in Ukraine is considered to have the potential to impact Lithuania's economic growth. The aim of this study is to analyse the impact of the war in Ukraine on the economic development of Lithuania. The theoretical background of geopolitical conflicts and their impact on the economic growth of a country will be systematised, and a methodology for evaluating the impact of the war on Lithuania's economic growth will be created. The factors of economic growth model will be optimised with the help of an expert assessment in order to ascertain the maximal economic growth for Lithuania. By examining how geopolitical conflict affects neighbouring countries, with a particular focus on Lithuania, it will be possible to understand which factors have a greater impact on the economic growth of countries located close to a conflict zone (Revoltella, 2022). It is submitted that this will allow for more efficient resource allocation and help in fostering stable economic growth. Furthermore, it is argued that understanding the impact of the war will allow for the development of a policy to combat the crisis and adjust the economy to the new geopolitical realities.

2. Literature Review

The aim of this chapter is to provide evidence, based on scientific analysis of the literature, as to what factors affect a country's economic growth and how war affects the development of the neighbouring country. Based on the analysis of scientific literature, the following factors have been highlighted FDI, military expenditure, immigrants, exports and imports, inflation, business confidence, long-term interest rate, unemployment rate, consumption of renewable energy and military aid to neighbouring country, whose impact on the country's economic growth is explained by the researchers.

Based on the work of Ikechukwu (2021), FDI can boost the country's economic growth by providing capital, creating jobs and increasing productivity through increased technology transfer and innovation. FDI has been affected by the economic situation in the world, since the conflict in Ukraine, investments in Lithuania have decreased, which affects the country's capacity for economic growth (Teres, 2023). Investor confidence has fallen and investment flows have been reduced. High business confidence reflects optimism and leads to increased investment, whereas low confidence in the economy does not attract investment and does not encourage new companies to enter the market. In addition, the war in Ukraine has exacerbated political and economic unrest in the region, which may have a negative impact on Lithuania's economic growth.

Another factor that has been claimed to affect the country's economic development is military spending, while military spending can stimulate growth by creating demand and innovation, increased spending due to geopolitical tensions can divert resources from more productive investments and slow the country's economic growth (Chen & Kung, 2022). Due to the conflict, Lithuania may increase military spending and the number of military personnel, as Lithuania is close to the war zone. An increase in military spending can have both negative and positive effects on the country's GDP growth. It has a positive effect by creating jobs and demand, especially in manufacturing, technology and defence industries, which can affect the economic development of the country (Afonso et al., 2024). War is often linked to the flow of immigrants, the ultimate effect of immigration, and depends on how efficiently immigrants seek work. An increase in the number of immigrants fills labour shortages, increases the diversity of the workforce and boosts domestic consumption. Immigrants must become part of the economy, or they can contribute to reducing unemployment, social integration and the strain on public resources. The overall impact of immigration also depends on the skill composition of the newcomers and the state of the host economy (Al-Saidi, 2023). In contrast, the arrival of large numbers of Ukrainian migrants may shift the labour market in Lithuania for some time, making integration and employment somewhat more difficult. However, the refugee labour force could ultimately increase Lithuania's economic growth.

In their paper (Huang et al., 2024), they specify how disruptions to international trade, namely exports and imports, can severely affect the growth of a country. International trade is valuable for economic development as many nations rely on imports and exports to sustain their economies. Ukraine is a major producer and exporter of agricultural goods, and agricultural production has been disrupted by the conflict. This has affected neighbouring countries that rely on Ukrainian agricultural imports. The sanctions have had one of the biggest impacts on Lithuania's agriculture. After the conflict between Ukraine and

Russia, agricultural exports from Ukraine to Lithuania decreased (Martínez-García et al., 2023). Russia had also been an important market for Lithuanian energy imports, these disruptions make Lithuania to find alternative ways to supply the country with gas, one of the options was to increase the use of renewable energy (Chishti et al., 2023). Global price rises caused by wars involving major producers of commodities (such as food, energy and raw materials) are particularly painful for surrounding countries. Imported commodities become more expensive due to inflation, which increases domestic inflation in surrounding countries. Kimbrough et al. (2020) emphasise that war-induced inflation raises import costs, particularly for necessities such as food and energy. Inflation in Lithuania could be affected by the conflict in Ukraine in several ways. If Lithuania relies mainly on imports of goods and services from Ukraine and Russia, disruptions in trade could lead to a reduction in supply, which would push up prices due to shortages.

In addition, if the extra military spending that often follows a war is not supported by taxes or borrowing, inflationary pressures can arise. Higher long-term interest rates are linked to inflation and make borrowing more expensive for consumers and businesses alike, thus discouraging investment in productive capital and reducing consumer spending on high-priced items (Zykiene et al., 2023). This reduces the country's economic growth. As nations can provide military support to countries at war, this can put pressure on the economy of the supporting country. Military support can stabilise regional economies and promote trade, but it can put a strain on national budgets and divert resources from domestic growth (Chomać-Pierzecka et al., 2023).

3. Evaluation of the Impact of the War in Ukraine on Lithuania's Economic Growth

In order to examine the impact of the war in Ukraine on Lithuania's economic growth, a comprehensive approach to data collection was used. The data include indicators for the period 2002-2023. The Harrod-Domar model based on (Pistunov, 2019) was used to analyse the economic growth of Lithuania and to use it as the dependent variable Y. The formula employed was as follows:

$$E3 = \frac{\text{”}\, Y}{Y} = \frac{I : k}{I : s_{,}} = \frac{s_t}{k},$$

$$k = \frac{\Delta K}{\Delta Y}, \qquad (1)$$

where k is the share of capital growth (ΔK) in the growth of the total value of the social product (ΔY); I – investments; s_t – saving rate in period t.

This model of economic growth was chosen because it makes it possible to visualise the dependence of economic growth on investment and savings, which is extremely important in the case of the influence of external crisis factors such as the war in Ukraine. Actual GDP growth and economic growth according to the Harrod-Domar model are shown in Figure 1.

As can be seen from the graph, the economic growth of Harrod-Domar does not fluctuate as much as the real GDP growth. Moreover, in the period of war in Ukarine, from 2022, the following model shows the decline of economic growth for Lithuania, but the real GDP growth shows the increase of it. Such a downward trend of the Harrod-Domar model can be explained by focusing on investment and showing that the level of investment in the country decreased

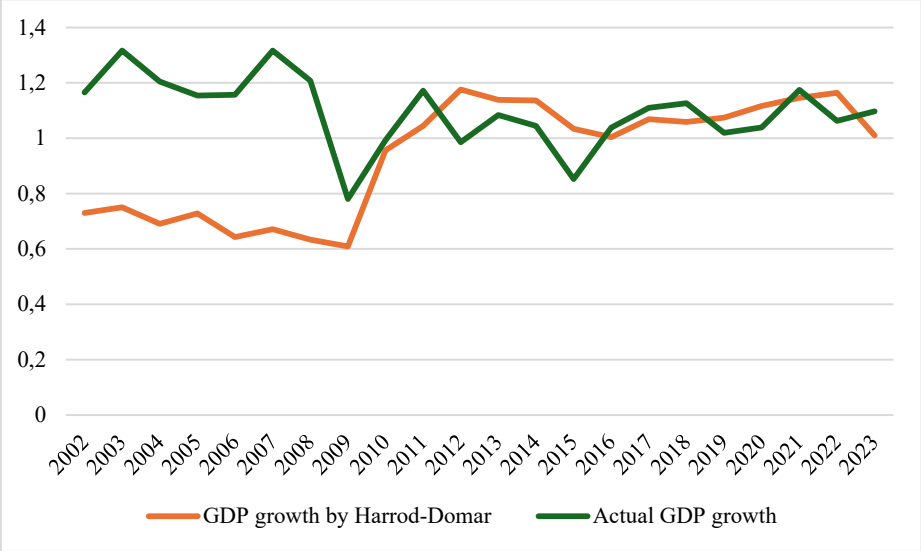

Figure 1. Actual GDP growth and GDP growth by Harrod-Domar 2002-2023, in%

Source: created by the authors

due to the geopolitical conflict in Ukraine. In contrast, it is difficult to study the real impact of the conflict on real GDP growth, which is why the Harrod-Domar model was used in the research. Correlation analysis was used to calculate the impact of the Ukrainian war on Lithuania's economic development. The statistical validity of the results, which shed light on the economic impact of geopolitical wars on surrounding nations, was assessed using Student's Significance Test. Before building the regression model, correlation analysis was conducted to understand which factors have the most significant impact on economic growth and can be added to the model. As data on Lithuanian assistance to Ukraine is only available for 2 years, the correlation coefficient was not calculated as it is not statistically reliable. Correlation coefficients and Student's t-test verification of the coefficients are presented in Table 1.

Variables such as military expenditure (0.31) and renewable energy consumption (0.74) have the most positive correlations with economic development. This means that an increase in defence spending and a rise in the use of renewable energy during the Ukraine crisis could have a significant impact on Lithuania's economic dynamics. The economic significance of commerce and migration in the context of geopolitical shifts is evidenced by the positive correlations observed between immigrants from Ukraine (0.30) and trade flows, including Lithuania-Ukraine exports (0.23), Ukraine-Lithuania imports (0.23), and Lithuania-Russia exports (0.25). Conversely, several factors have been identified as exerting a negative influence, most notably FDI to Lithuania (-0.16) and the long-term interest rate (-0.73). A decline in foreign direct investment signifies external constraints on Lithuania's economy, while elevated interest rates likely impede investment and growth. There is negligible correlation between the unemployment rate (0.01) and inflation (0.05), suggesting that both variables exert no direct influence on short-term growth during this period.

Correlation coefficients were tested for significance using Student's t-test. Correlation coefficients are significant if the calculated T-criterion > t-distribution. It is appropriate to use these indicators when building a regression model. If the calculated value of t exceeds the critical T, the null hypothesis is rejected and the correlation coefficient is considered significant. This means that the relationship between the variables is real and not random. Considering the results presented in Table 1, the relationship between military spending, immigrants from Ukraine and renewable energy consumption with economic growth in Lithuania is statistically significant, so these factors are included in the regression model.

After carrying out a correlation analysis of the data to determine the basic parameters and relationships between the variables, different types of models were tested, including both linear and non-linear regressions. Since data for the indicator of aid to Ukraine are only presented for 2022 and 2023, this indicator was not included in the model at the time of model selection. Therefore, a linear model was first used for the period 2002-2021, and then a forecast was made for 2022 and 2023 to see which model predicted more accurately. Firstly, linear model is presented:

$$Y = 0.70 - 0.47(X_1) + 132(X_2) + 0.02 * (X_3) \quad (2)$$

where Y is economic growth according to Harrod-Domar model; X_1 – military spending; X_2 – immigrants from Ukraine; X_3 – renewable energy consumption.

Next, the linear model was tested for statistical significance, the results are presented in Table 2.

As demonstrated in Table 2, the linear model was found to be reliable. Given that the P-value was found to be less than 0.05, it can be deduced that the F-significance tends to be 0, and the calculated t-statistic was found to be 1.7, which is less than the regression t-statistic. Utilising the model parameters, a prediction of economic growth for Lithuania in

Table 1
Correlation and Student's t-test coefficients

Variable	r	T criterion	t-distribution
FDI to Lithuania	-0,16	-0,72	1,71
Military spending	0,31	1,8	
Immigrants from Ukraine	0,30	1,9	
Lithuania-Ukraine export	0,23	1,05	
Lithuania- Russia import	0,26	1,20	
Ukraine-Lithuania import	0,23	1,05	
Lithuania-Russia export	0,25	1,15	
Inflation	0,05	0,22	
Business confidence index	0,11	0,49	
Long term interest rate	-0,73	-0,77	
Unemployment rate	0,01	0,04	
Consumption of renewable energy	0,74	4,9	

Source: calculated by the authors

Table 2
Coefficients of significance for regression model (2)

Indicator	Name of indicator	R-square	F-significance	P-value	t-statistical
Military spending	X_1	0,89	5,8E-08	8,05E-05	-5,24
Immigrants from Ukraine	X_2			0,00	2,98
Consumption of renewable energy	X_3			3,52E-06	6,9

Source: calculated by the authors

2022 was derived, yielding a predicted value of 2.6%. In comparison, the observed value for 2022 was 1.16%. At the next stage, a nonlinear model was created to compare and find the most accurate forecast:

$$Y = \exp(-1,06 - 0.16(X_1) + \\ + 37,7(X_2) + 0,87 * log(X_3), \quad (3)$$

where Y is economic growth according to Harrod-Domar model; X_1 – military spending; X_2 – immigrants from Ukraine; X_3 – renewable energy consumption. The results presented in Table 3 confirm the statistical validity of the model.

With regard to the non-linear model, the predicted value of economic growth for Lithuania in 2022 was calculated to be 1.08%, in comparison to the current value of 1.16%. A thorough examination of the outcomes from both the linear and nonlinear models reveals that both models demonstrated statistical reliability. However, the nonlinear model exhibited a superior capacity to predict the economic growth of Lithuania in 2022. Consequently, the indicator of aid to Ukraine was incorporated into the nonlinear model, and novel parameters were calculated for the model, which has the following form:

$$Y = exp(-0,97 - 0.20(X_1) + 55.4(X_2) + \\ + 0.8log(X_3) - 0,1X_4^2) \quad (4)$$

where Y – economic growth according to Harrod-omar model; X_1 – military spending; X_2 – Immigrants from Ukraine; X_3 – consumption of renewable energy; X_4 – military aid to Ukraine. The model was checked on significance and the results are presented in Table 4:

In fact, the model is statistically significant and can be used to predict the dependent variable, as indicated by the low F-significance value (less than 0.05). A significant relationship between the independent and dependent variables is indicated by a low P-value (less than 0.05), the t-statistic is higher than the calculated T-criteria.

As the data were not normalised and were collected in different units and scales, the elasticity coefficient, Beta coefficient and Delta coefficient were employed to interpret the model indicators. The calculation formulas were derived based on the work of Pistunov & Prihodchenko (2024). The elasticity coefficient, E, indicates the percentage change in the dependent variable, Y, when the factor variable, X, changes by 1%. The formula was used:

$$E = a_j * \frac{x_{ja}}{y_a} \quad (5)$$

where a_j – coefficient of regression x_j; x_{ja} – average of parameter x_j; y_a – avarage of depedent variable Y. Table 5 shows the elasticity coefficients for each regression factor:

Evidence suggests a negative correlation between military spending and military aid to Ukraine on the one hand, and economic growth in Lithuania on the other. Conversely, there is a positive correlation between renewable energy consumption and the number of emigrants from Ukraine. If each factor changes by

Table 3
Coefficients of significance for regression model (3)

Indicator	Name of indicator	R-square	F-significance	P-value	t-statistical
Military spending	X_1	0,87	1,8E-07	0,00	-4,01
Immigrants from Ukraine	X_2			0,03	2,33
Consumption of renewable energy	X_3			7,339-06	6,49

Source: calculated by the authors

Table 4
Coefficients of significance for regression model (4)

Indicator	Name of indicator	R-square	F-significance	P-value	t-statistical
Military spending	X_1	0,86	0,0001	4,9E-06	-6,54
Immigrants from Ukraine	X_2			0,00	-4,17
Consumption of renewable energy	X_3			0,04	2,14
Military support to Ukraine	X_4			9,9E-07	7,42

Source: calculated by the authors

Table 5
Elasticity coefficients

	Military spending (% of GDP)	Immigrants from Ukraine (% of population)	Renewable energy consumption (% of total consumption)	Military aid to Ukraine (% of GDP)
E	-0,301223397	0,16740247	1,4049429	-4,79228E-23

Source: calculated by the authors

1%, economic growth will change by the percentage presented in the table. The least influential factor is military aid to Ukraine, which may be due to a lack of statistical data over a sufficient period.

The beta coefficient (B) is a statistical term denoting the standardized effect of x_j on Y, with consideration given to the variances of the factors and the dependent variable. Beta coefficients standardize the effect of the factor variable on the dependent variable, thereby eliminating the influence of the units of measurement. They reflect the extent to which the dependent variable changes in response to a one-standard-deviation change in the factor variable. The following formulas is used for calculation:

$$B = a_j * \frac{S_{xj}}{S_y} \quad (6)$$

$$S_{xj} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(x_y - x_{ja}\right)^2} \quad (7)$$

$$S_y = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(y_i - y_{ja}\right)^2} \quad (8)$$

where S_{xj} is the standard deviation of the factor variable x_j; S_y is the standard deviation of the dependent variable y; a_j is regression coefficient; n is the sample size.

As is evident, the calculated beta coefficients demonstrate a comparable relationship to the y variable. The most significant positive impact is observed from renewable energy consumption and emigration from Ukraine, while the least significant positive impact is observed from military aid to Ukraine.

In the final stage of the analysis, the delta coefficients (Δ_j) were calculated. These coefficients indicate the contribution of each factor to the total impact of all variables on the dependent variable. The formula utilises both the strength of the relationship (beta coefficient) and the correlation of the variable with the dependent variable. The following formula was applied:

$$\Delta_j = r\left(x_{j,}y\right)\frac{B_j}{R^2}, \quad (9)$$

where $r\left(x_{j,}y\right)$ – correlation between the factor variable x_j, and dependent variable y; B_j – standardised (beta) coefficient; R^2 – coefficient of determination of the model.

The high value of the delta coefficients for the factors immigrants from Ukraine and renewable energy consumption indicate a potential criticality of the variables. They strongly dominate the model. On the other hand, military spending has a much smaller impact on economic growth, and military aid has no impact on Y, as the coefficient for this parameter is extremely low. The regression model was analysed in order to ascertain the impact of military spending on economic growth. It was found that military spending exerts a negative linear impact on economic growth. An increase in military spending of 1% results in a reduction of economic growth by approximately 0.30% (in the context of the logarithmic form of the model). This suggests that military spending may have negative

Table 6
Beta-coefficients

Beta-coefficients	Military spending (% of GDP)	Immigrants from Ukraine (% of population)	Renewable energy consumption (% of total consumption)	Military aid to Ukraine (% of GDP)
B	-8,115891186	25,17715	10,8911176	-5,26661E-20

Source: calculated by the authors

Table 7
Delta-coefficients

Delta-coefficients	Military spending (% of GDP)	Immigrants from Ukraine (% of population)	Renewable energy consumption (% of total consumption)	Military aid to Ukraine (% of GDP)
Δ_j	-2,985155379	83,432974	28,8269276	-1,21072E-21

Source: calculated by the authors

economic consequences for growth. The positive beta and delta coefficients indicate a significant impact of immigrants from Ukraine on Lithuania's economic growth. This means that a 1% increase in the number of immigrants contributes to economic growth by 0.16%, thus highlighting the importance of emigration as a factor of economic development, possibly through increased labor resources and productivity.

The coefficient for renewable energy consumption has been shown to reflect the positive yet gradual effect of such energy consumption on economic growth. The nonlinear logarithmic relationship indicates that a 1% increase in renewable energy use contributes to economic growth by 1.4%. This factor also has a high delta coefficient, indicating the strength of the relationship in the overall impact of the model. The final indicator of the model, amongst all the coefficients, demonstrated the least significant impact on Lithuania's economic growth. However, the non-linearity of this indicator indicates that, at initial levels, aid may exert a small or positive effect; nevertheless, with a substantial increase in aid, economic growth commences to decline. This may signify the effect of diminishing returns from a considerable aid contribution.

4. Expert Assessment of the Economic Growth Model

The methodology of expert assessments involves the processing of opinions from experienced specialists on the potential losses and their associated probabilities of occurrence (Lavoie & Daim, 2020). Following the identification of a significant regression model, which demonstrated the interdependence of the variables, expert assessments were conducted regarding the minimum and maximum value for each of the independent variables included in the regression model. These independent variables were military spending, military support to Ukraine, consumption of renewable energy and immigrants from Ukraine. A thorough and rigorous expert assessment was conducted with the objective of identifying the most suitable parameters for the model, with a view to promoting economic growth in Lithuania in the context of geopolitical risks posed by neighbouring countries.

The selection of experts was meticulous, with individuals chosen based on their credentials, background, and applicability to the study's primary themes. A total of fifteen individuals with a background in economics, energy policy, migration, and geopolitical events were prioritised during the selection process, ensuring a diverse range of viewpoints on the variables influencing Lithuania's economic expansion. The participants comprised academic researchers, government policymakers, representatives of international organisations, and experts from fields such as commerce, renewable energy, and the military. The opinions of the experts on the minimum value are presented in Table 8.

Opinions of experts regarding the maximum value for variables described in Table 9:

In order to ascertain the applicability of the expert assessment in a research context, it is imperative to verify the responses of the experts with the aid of the

Table 7
Expert assessment of parameters regarding MIN values

Minimal value		Military spending (% GDP)	Military support to Ukraine (% GDP)	Consumption of renewable energy (% total consumption)	Immigrants from Ukraine
Experts	1	2,5	0,4	46,00%	75000
	2	3	0,4	46,00%	73000
	3	3	0,4	46,50%	73000
	4	3	0,3	45,50%	74000
	5	3	0,4	46,50%	71000

Source: calculated by the authors

Table 8
Expert assessment of parameters regarding MAX values

Maximal values		Military spending (% GDP)	Military support to Ukraine (% GDP)	Consumption of renewable energy (% total consumption)	Immigrants from Ukraine
Experts	1	3,5	0,5	46,50%	75500
	2	3,5	0,5	47,50%	74000
	3	3,5	0,45	47,50%	74000
	4	7	0,4	46,50%	75500
	5	3,5	0,4	48%	72700

Source: calculated by the authors

coefficient of concordance of Kendall, utilising the following formula:

$$W = \frac{12\sum_{i=1}^{m}\sum_{j=1}^{d} p_{ij} - \frac{d(m+1)}{2})^2}{d^2\left(m^3 - m\right)}, \quad (10)$$

where: d – number of experts; m – number of criteria; p_{ij} – ranges.

The significance level of the Kendall coefficient was subjected to testing using the Pearson chi-square test. The tabulated value of the test is determined by the number of degrees of freedom and the confidence interval. Its designation is X_f^2.

$$X_f^2 = m(n-1)W, \quad (11)$$

where m – number of criteria; n – sample of size; W – coefficient of Kendall.

If the Kendall's W coefficient is zero, it means that the values do not agree (random rankings), and the closer it is to one, the more significant and sufficient the results are, which means that the values can be used in research. The Kendall's coefficient for the MIN and MAX values and the Pearson chi-square test are shown in Table 10:

Table 10
Kendall's coefficient concordance for MIN and MAX values and Pearson chi-square

	MIN values	MAX values
W	0,89	0,97
Significance level (X_f^2)	14,24	15,52
Tabular value (X_{cr}^2)	0,35	0,35

Source: calculated by the authors

As can be seen, the Kendall's coefficient is 0.89 and close to 1, indicating a high level of agreement among the experts. The actual significance level is higher than the tabular one, indicating t hat expert opinions for minimum values can be used in research. Furthermore, the high level of expert agreement is indicated by the Kendall's coefficient for maximum values, which is 0.97 and close to 1. The fact that the actual significance threshold is larger than the tabular one suggests that expert judgments for max values can be employed in research. For both MIN and MAX values by the test of Pearson the values are significant as $X_f^2 X_{cr}^2$

After analysing the parameters and checking them for consistency, the variables in the regression model were optimised to find the highest economic growth for Lithuania using a non-linear regression model (4). The following constraint was employed:

$$X_{(min)} \leq X_{(i)} \leq X_{(max)} \quad (12)$$

where $X_{(i)}$ – optimised values for each variable in regression model; $1 \leq i \leq N$; N – number of variables; $X_{(min)}$ – minimal value for each indicator, calculated with a help of finding the average value among questioned experts; $X_{(max)}$-maximal change each indicator, calculated with a help of finding the average value among questioned experts. Using the solver in Excel and following the constraints, optimised values were calculated to maximise the economic growth of Lithuania. The results are shown in Table 11:

In order to achieve maximum economic growth in Lithuania in 2024, it is recommended that the country allocate 2.9% of its GDP to military spending, 0.38% of its GDP to military aid to Ukraine, and 46.1% of its total consumption to renewable energy. Furthermore, it is estimated that the proportion of emigrants from Ukraine to the total population should be 2.6%. With such indicators, Lithuania's economic growth in 2024 is projected to be 1.17%. This figure represents a 0.16% increase on the GDP growth rate observed in 2023. It can thus be concluded that not all factors evaluated exert an effect on Lithuania's economic growth. Foreign direct investment, Lithuania's imports and exports with Ukraine and Russia, inflation, the business activity index, long-term interest rates and unemployment rates do not affect Lithuania's economic growth. Conversely, factors such as military expenditure, aid to Ukraine, the number of emigrants, and renewable energy consumption were found to be influential. These factors are closely related to the war in Ukraine, which confirms its impact on Lithuania's economic growth. The significant factors are presented in Figure 2:

The economic development of Lithuania in modern conditions corresponds to the specified model, since the country demonstrates a strong influence of the factors defined in the equation. The significant contribution of Ukrainian immigrants in Lithuania is

Table 11
Optimised parameters of the model

Year	Military spending (% GDP)	Military support to Ukraine (% GDP)	Consumption of renewable energy (% total consumption)	Immigrants from Ukraine
Optimised	2,9	0,38	46,1%	73200
2023	3	0,4	45,36%	74034

Source: calculated by the authors

Figure 2. Factors influencing Lithuania's economic growth

Source: calculated by the authors

reflected in the increase in employment, the creation of small businesses and the activation of consumer demand, which contributes to economic growth, similar to the high positive coefficient X_2. At the same time, the increase in military spending due to the geopolitical situation in the region leads to a partial limitation of economic opportunities, which correlates with the negative impact of X_1. By refusing to consume most of the gas purchased from Russia, Lithuania was forced to find other ways to supply the country with gas, so Lithuania began to invest even more actively in renewable energy, leading to increased consumption of renewable energy, which has a positive impact on the country's economy, as predicted by the model for X_3. Finally, Lithuania's substantial assistance to Ukraine shows that, while it stimulates economic growth in the early stages, excessive assistance can lead to economic constraints, which is consistent with the impact of X_4. However, the impact of this factor is not very significant because the data were only included for two years, which does not show the full picture of the impact due to the small statistical sample. Thus, the structure of Lithuania's economic development is consistent with the results of the model, reflecting the complex interaction of these factors.

The developed model has significant potential for application in future studies, especially in the analysis of the economic development of post-Soviet countries. Given the similarities in the structures of the economies of these countries, such as the impact of emigration, the role of state aid or the dependence on innovative industries, the model can be adapted to assess economic growth in countries with similar socio-economic conditions. It is imperative that other researchers planning to use this study focus on the correct choice of variables. It should be noted that key factors (emigration, defence spending, aid to other states) may have different weights depending on the specifics of the country. In addition, it is recommended that the data for each country is updated, as economic conditions change rapidly. The model has the potential to serve as a universal instrument for evaluating the impact of regional and global processes on the development of post-Soviet economies, thereby facilitating comparative analysis and the formulation of effective economic strategies.

5. Conclusions

1. Theoretical analyses demonstrate that a number of factors have a substantial impact on the economic development of a nation that borders a conflict-ridden area.Increased uncertainty and perceived risks have been shown to have a negative impact on foreign direct investment (FDI) and business confidence of the investors, which in turn lowers the inflow of funds that are essential for development. In order to ensure national security, an increase in military expenditure by a country can result in a decline in economic development, as funds are reallocated from other industries. The inflow of immigrants from other countries has been demonstrated to have a beneficial effect on labour market dynamics and to contribute to a reduction in unemployment rates. However, it should be noted that conflict can also result in trade disruption, with implications for both imports and exports. Furthermore, rising inflation, which can be attributed to such trade disruptions, as well as to energy prices, has the potential to jeopardise the stability of the economy. Such crises generally have a significant impact on long-term interest rates and unemployment rates, which in turn affect the country's economic growth. In order to promote resilience and reduce reliance on energy imports, it is recommended that the country invest in its own renewable energy sources. These factors have been analysed in the work

of researchers, and the impact of such actors has been found in the scientific literature.

2. A comprehensive methodology was developed, combining a literature review, correlation analysis using the Harrod-Domar model of economic growth, an assessment by experts and linear optimisation. The Harrod-Domar model of economic growth was selected for use in this research because it provides a straightforward framework for analysing the relationship between investment, savings and economic growth. This is particularly relevant in the context of Lithuania's economic performance during the Ukraine conflict. This model underscores the pivotal role of capital accumulation and the efficacy of capital utilisation (capital-output ratio) in determining economic growth. Consequently, it is particularly well-suited for the analysis of economies that have been impacted by exogenous shocks, such as geopolitical conflicts. This approach integrates statistical data, including trade flows, FDI, and renewable energy consumption, with expert-derived ranges for military expenditure and the impact of migration.

3. Following the conduction of correlation and regression analysis, it was determined that military expenditure, military support for Ukraine, consumption of renewable energy and immigrants from Ukraine increased following the war in Ukraine, thereby impacting economic growth in Lithuania. The Harrod-Domar economic growth model, when applied to Lithuania, yielded a pattern of predicted growth that closely followed the increase in the country's GDP over time, with some fluctuations during periods of external shocks. The model demonstrated the critical importance of investment and savings rates for economic growth, given their impact on capital accumulation. In Lithuania, the ratio functioned as a significant growth factor, as elevated investment levels resulted in augmented production volumes and productive capacity. Moreover, the capital-output ratio, a pivotal parameter within the Harrod-Domar model, exhibited the efficacy of investments in generating economic growth. In the event of a lower capital-output ratio, an economy would be considered relatively efficient with respect to the transformation of investments into output. Notwithstanding, the Harrod-Domar model provided a robust foundation for the analysis of the shaping of long-lasting economic growth trajectories by essential components, such as investment and resource utilisation efficiency. The correlation analysis revealed several key variables with the most significant effect on Lithuania's economic growth. These included military spending, which represents the allocation of resources required for national security but does so at the expense of opportunity; military assistance to Ukraine, which illustrates geopolitical alignment and its economic consequences; immigration from Ukraine, which has benefited the economy by boosting productivity and the labour market; and the use of renewable energy, which highlights the shift to sustainable energy sources and its impact on economic resilience. The present study demonstrates how military, immigration and energy policy are intertwined and have wider ramifications for economic development in a nation affected by regional instability. However, other factors, such as foreign direct investment, Lithuania's imports and exports with Ukraine and Russia, inflation, the business confidence index, long-term interest rates and unemployment rates, were found to be insignificant and were therefore not included in the model. The regression model was constructed with four factors, and the findings indicated that the consumption of renewable energy and immigrants from Ukraine exert a positive influence on Lithuania's economic growth. Conversely, military spending and military support for Ukraine were found to have a negative impact. Utilising the regression model, an expert assessment of the parameters was conducted, encompassing the potential alterations to each parameter of the model for the subsequent year. Their opinions were verified by consensus and included in the model for optimisation. The optimised parameters were found to maximise the economic growth of Lithuania for the next year. The found model can be used for analysing economic growth of other post-Soviet countries, for the reason that their economies can be similar, using the found model can help policy makers of their countries to find maximum economic growth of the counties.

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Received on: 14th of January, 2025
Accepted on: 25th of February, 2025
Published on: 13th of March, 2025