

MILITARY SPENDING AND ECONOMIC GROWTH: IS THERE AN INTERDEPENDENCE? CASE OF DEVELOPED COUNTRIES

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Abstract. This study investigates the impact of military spending and arms exports on economic growth. Using data from developed countries spanning the period 1973–2022, we employ a regression model to analyse the relationship between gross domestic investment, military expenditure, arms exports, and GDP per capita growth. Our findings indicate that domestic investment has a significant positive influence on economic growth, while military spending and arms exports show negligible effects. The results emphasize the critical importance of domestic investment in fostering economic development, highlighting its superiority over military-related expenditures and exports in shaping economic outcomes.

Keywords: military spending, GDP per capita, economic growth, war, arms exports.

JEL Classification: H56, O40.

1. Introduction

The impact of military spending and arms exports on economic growth is a subject of interest and scholarly debate in both academic and political circles. Under the conditions of the war in Ukraine 2022–2024 and other military conflicts around the world, the relevance of this problem only increases. With the help of theoretical concepts, putting forward scientific hypotheses, and empirically testing them, we will try to investigate the factors influencing the militarization of the economy and indicators of economic growth.

Moreover, this study is timely and critical, as it unfolds against a backdrop of escalating global military engagements, which underscores the exigency of understanding the economic repercussions of heightened defence allocations. By examining the interplay between military spending and economic growth within the specific context of developed nations, this article endeavours to provide a comprehensive understanding of the strategic considerations that underpin fiscal policy decisions in an era of complex security challenges.

2. Literature review

Numerous scholarly publications have addressed the correlation between military expenditure and the economic progress of nations globally (Churchill & Yew, 2018; Harris, 2004; Hartley, 2017; Hou & Chen, 2014; Nikolaidou, 2016; Buchholz, 2022; Shahbaz et al., 2013; Saeed, 2023).

For example, the paper (Lee et al., 2016) examines the impact of military spending on economic growth within a small open stochastic endogenous growth model, highlighting four channels through which military spending influences growth: crowding-out, spin-off, resource mobilization, and portfolio effects. The overall effect on growth is shown to be uncertain due to the interplay of these channels, suggesting the presence of an optimal defence burden that maximizes economic growth.

The research (Pieroni et al., 2008) empirically investigates the Keynesian hypothesis regarding the positive impact of government defence spending on aggregate output in the U.S. and the UK. It contributes to existing literature by adjusting inferences for structural breaks in

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fiscal and monetary variables and considering different dynamics between defence spending and aggregate output. The findings suggest that while estimated elasticities lack significance in more recent years, defence spending priorities aimed at international security may revitalize pro-cyclical effects in the UK, particularly through an industrial policy of defence shared with EU members. The paper discusses conceptual issues, econometric specifications, data, model identification tests, estimation results, and concludes with policy implications.

The paper (Yang et al., 2015) investigates the economic implications of increasing military expenditure in the Republic of Korea, aiming to strike a balance between national security and economic growth. Utilizing a dynamic Computational General Equilibrium (CGE) model, various scenarios are examined to gauge the aggregate effects of changes in military spending. Results suggest that raising the indirect tax rate yields the greatest impact on GDP, while increasing the corporate income tax rate is optimal for gross output. The study underscores the importance of effective budget planning for military expenditure, especially in countries facing security challenges like South Korea. The analysis highlights the dynamic changes in key economic indicators, emphasizing the need for careful consideration of the short-term and long-term effects of military budget allocations.

The book (Hartley, 2017) provides a comprehensive exploration of the global arms industry, delving into its intricate business operations and economic significance. By dissecting key metrics such as GDP allocation to military spending and the financial performance of major defence contractors like Lockheed Martin, the author offers valuable insights into the financial landscape of the arms sector.

The study (Heo, 2010) evaluates the relationship between defence spending and economic growth in the U.S. from 1954 to 2005, utilizing both the Feder-Ram and augmented Solow models. While the Feder-Ram model has been traditionally employed for this analysis, its limitations prompted the authors to also consider the augmented Solow model. Despite the strengths of the augmented Solow model in addressing certain weaknesses of the Feder-Ram model, the results suggest that defence spending does not have a significant impact on the U.S. economy during the period studied.

The article (Herrera & Gentilucci, 2013) provides a critical analysis of the economic implications of military spending, focusing on the challenges faced by economists in understanding its impact. Despite extensive research within the neoclassical mainstream, consensus remains elusive due to methodological and theoretical complexities. The text explores demand-side and supply-side models, highlighting the difficulties in distinguishing the effects of military expenditures and integrating economic and strategic considerations. Empirical studies on the relationship between military spending and economic growth yield contradictory results, with some suggesting positive impacts through demand stimulation and

technological spin-offs, while others emphasize negative effects such as crowding out of investment. The article concludes by advocating for more nuanced analyses that consider the multifaceted nature of military spending and its implications for economic security and growth.

The study (Rahman & Siddiqui, 2019) examines the relationship between military spending and economic growth across 85 countries over the past two decades. While military spending is typically seen as non-productive, it indirectly contributes to GDP by reducing risk and providing stability. Findings suggest that higher defence expenditure negatively affects economic growth as it leaves less funds for investment in infrastructure, health, education, and routine goods production. Therefore, for developed countries, military spending alongside arms exports serves as an effective foreign policy tool for fostering economic growth, political stability, and the rule of law.

This study (Olofin, 2012) investigates the relationship between defence spending components and poverty reduction in Nigeria from 1990 to 2010, employing a novel poverty index constructed from human development indicators. These findings highlight a trade-off between military capital intensity and the welfare of the poor in Nigeria, challenging the Keynesian hypothesis that defence spending positively impacts well-being. The study underscores the importance of considering multiple indicators and urges policymakers to carefully assess the implications of defence spending on poverty levels, emphasizing the need for a balanced approach in resource allocation.

The study (Polat, 2020) employs panel data analysis methods to investigate the relationship between defence expenditure and economic growth across 15 countries with the highest defence spending from 1992 to 2017. The study identifies a causal relationship from national income to defence expenditure only in the long term, while causality exists bidirectionally between defence expenditure and national income in both the short and long terms. The findings underscore the importance of defence expenditures for national security but also raise questions about resource allocation and their impact on economic growth, particularly in the context of developing countries like Turkey.

Employing an Augmented Solow Growth Model augmented with a military burden variable, the study (Hou & Chen, 2014) scrutinizes the impact of military expenditure on the economic growth trajectories of 21 OECD countries spanning the years 1960 to 2009. Diverse panel estimation techniques are deployed to meticulously assess the economic ramifications of military outlays. The empirical findings proffer compelling evidence indicating that military expenditure tends to exert a deleterious influence on economic growth.

The article (Sokhatskyi et al., 2020) investigates the impact of military expenditures, public debt, arms exports, and other factors on economic growth in six countries facing "hybrid" military conflicts. Using panel data

analysis, the study explores the hypothesis of sustaining positive macroeconomic effects amidst persistent conflict phases. Findings suggest that while increased military spending may address security threats, it should be balanced with economic considerations to foster sustainable development. The research highlights the complex interplay between military expenditure, economic growth, and geopolitical dynamics, providing insights for policymakers navigating security challenges without compromising economic stability.

The paper (Callado-Muñoz et al., 2023) investigates the impact of multilateral defence alliances and arms trade on economic growth among allies, focusing on NATO member countries from 1990 to 2019. The theoretical analysis suggests that importing advanced weapons from allies can lead to technology diffusion and positive economic effects. Empirical evidence confirms that arms imports from NATO allies have a positive impact on output and productivity, indicating military technology spillovers. The findings highlight the importance of international military collaborations for economic growth and suggest that policymakers should consider the interaction between foreign policy and economic goals.

The study (Yolcu Karadam et al., 2023) challenges the conventional assumption of linear relationships between military expenditure and economic growth by employing Panel Smooth Transition Regression models on a dataset spanning 103 countries from 1988 to 2019. The findings suggest distinct asymmetric relationships based on income levels, with both low and high levels of military expenditure exhibiting rising negative effects on economic growth. Additionally, the study highlights the role of net arms exports in governing regime change for high-income countries, deepening the negative impacts of military expenditure on economic growth as net arms exports increase.

The study (Njamen Kengdo, 2023) aims to contribute by examining the joint effects of military expenditure and public debt on growth in Cameroon, offering insights for policymakers to manage defence spending and debt sustainability. While military spending has intensified, economic growth has faced challenges, including negative growth rates in certain periods, exacerbated by external crises like the COVID-19 pandemic and the war against Ukraine.

The article (Koshulko & Dluhopolskyi, 2022) presents a comprehensive examination of women's resistance against occupation and war in Ukraine, spanning from 2013–2014 to the present. Drawing on both theoretical frameworks and practical insights, the study aims to elucidate the various forms and manifestations of women's resistance in Ukraine and abroad. One of the primary objectives of the research is to analyse the impact of women's resistance to shifting gender stereotypes, models, and gender inequality within the Ukrainian Army and society at large.

The article (Cucino & Scarazzato, 2023) discusses the surge in demand for military equipment and ammunition

in Europe due to Russia's war against Ukraine, highlighting Poland's role as a top supplier to Ukraine and the increase in military spending by European states in response to perceived threats from Russia. Poland's long-standing ambition to modernize its armed forces and grow its arms industry is examined, with a focus on recent developments and procurement deals since the start of the war. The government's efforts to bolster the domestic arms industry through Polonization requirements and partnerships with foreign companies are discussed, along with the potential opportunities and risks associated with this strategy. Overall, while Poland sees an opportunity to enhance its arms industry and capabilities, the reliance on external events and long-term investment plans poses potential challenges to sustaining growth and ambition in the sector.

3. Methodology

The primary aim of this study is to investigate the correlation between gross domestic investment, military expenditure, arms exports, and the level of economic growth, with a focus on developed countries (Israel, Germany, Italy, Spain, Turkey, U.S., and South Korea). Three indicators were taken as independent (predictor) variables: gross domestic investment (% of GDP), military expenditure (% of GDP), arms exports (SIPRI values). The response (dependent) variable is GDP per capita growth (annual %). Research period is 1973–2022. Also, we will use the Granger causality test to check two hypotheses: 1) GDP per capita growth causes military expenditure: 2) Military expenditure causes GDP per capita growth.

Data were collected from World Bank Development Indicators, IMF, and Stockholm International Peace Research Institute (World Development Indicators, 2023; Statista, 2022; SIPRI, 2023).

4. Results

We posited a theoretical framework wherein the variables of gross domestic investment, military expenditure, and arms exports exert substantial influence on a nation's gross domestic product (GDP). Consequently, an analysis was conducted utilizing data from multiple developed nations worldwide (Israel, Germany, Italy, Spain, Turkey, U.S., South Korea), facilitating the construction of a comprehensive three-factor model.

The Equation (1) representing the model with intercept and three predictor variables (x_1 , x_2 , x_3) can be written as:

$$y = -5.4247 + 0.3091x_1 - 0.0794x_2 + 7.51224 \times 10^{-11}x_3, \quad (1)$$

where y – GDP per capita growth (annual %), x_1 – gross capital formation (% of GDP), x_2 – military expenditure (% of GDP), x_3 – arms exports (SIPRI trend indicator values).

The regression statistics from Table 1 provide information about the relationship between the variables in the regression model:

1. Multiple R 0.410609 represents the correlation coefficient between the dependent variable and the independent variables in the model. The correlation coefficient is positive, suggesting a positive relationship between the variables.

2. R Square (coefficient of determination) measures the proportion of the variance in the dependent variable that is explained by the independent variables in the model. In our case, approximately 16.86% of the variance in the dependent variable is accounted for by the independent variables.

3. Adjusted R Square 0.159258 indicates the proportion of variance in the dependent variable that is explained by the independent variables, adjusted for the number of predictors.

4. The Standard Error of the regression 2.536866 represents the average deviation of the observed values from the regression line.

5. In our case there are 271 observations included in the analysis.

Table 1. Regression statistics (source: own research)

Regression Statistics	
Multiple R	0.410609
R Square	0.1686
Adjusted R Square	0.159258
Standard Error	2.536866
Observations	271

The regression coefficients and analysis of variance from Tables 2–3 provide information about the relationship between the independent variables (x_1, x_2, x_3) and the dependent variable (y) in the regression model:

1. The intercept term represents the value of the dependent variable when all independent variables are zero. In this case, the intercept is approximately -5.42 .

2. The coefficient for x_1 is 0.309. This indicates that for every one-unit increase in x_1 , the dependent variable (y) is expected to increase by approximately 0.309 units, all else being equal. The t-statistic is 7.337, and the p-value is very small, indicating that the coefficient is statistically significant.

3. The coefficient for x_2 is -0.079 . This suggests that for every one-unit increase in x_2 , the dependent variable (y) is expected to decrease by approximately 0.079 units, holding other variables constant. However, the coefficient is not statistically significant, as indicated by the high p-value (0.471552466).

4. The coefficient for x_3 is very small and suggests that the variable x_3 has a very minor impact on the dependent variable. The t-statistic is 1.663, and the p-value is 0.097475679, indicating that the coefficient is not statistically significant at conventional levels.

Table 2. Regression coefficients and statistical significance (source: own research)

	Coefficients	Standard Error	t Stat	P-value
Intercept	-5.4247	1.034394	-5.24433	3.19E-07
x_1	0.309145	0.042134	7.337122	2.63E-12
x_2	-0.07942	0.110162	-0.72098	0.471552
x_3	7.51E-11	4.52E-11	1.66305	0.097476

Table 3. Analysis of variance (source: own research)

	df	SS	MS	F
Regression	3	348.4603	116.153428	18.04833
Residual	267	1718.329	6.435689686	
Total	270	2066.789		

Overall, x_1 appears to be the most influential variable in the model, as it has a significant and positive effect on the dependent variable. x_2 does not seem to have a statistically significant impact, while x_3 has a negligible effect on the dependent variable.

The residual plots that show the difference between the observed values of the dependent variable and the values predicted by the regression model plotted against the independent variable or the predicted values, are shown in Figures 1–3.

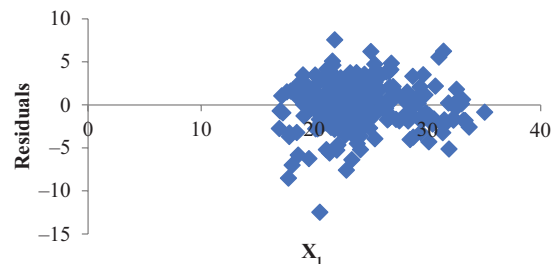


Figure 1. X_1 residual plot (source: own research)

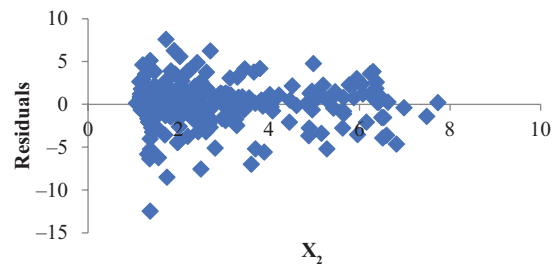


Figure 2. X_2 residual plot (source: own research)

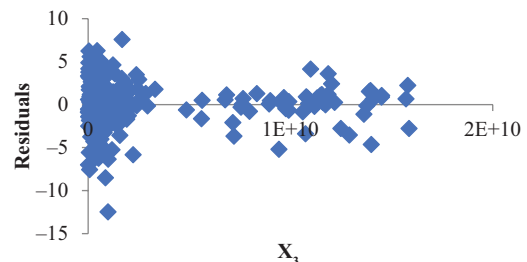


Figure 3. X_3 residual plot

The regression line plots (Line Fit plots), which display the observed data points along with a line that represents the best-fitting linear regression model, are shown in Figures 4–6.

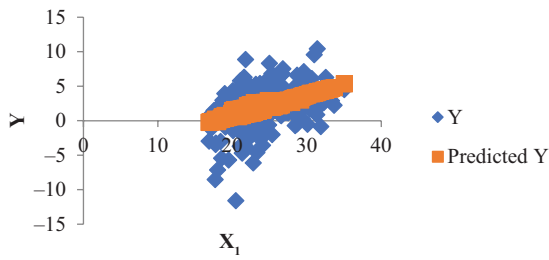


Figure 4. X_1 Line Fit plot (source: own research)

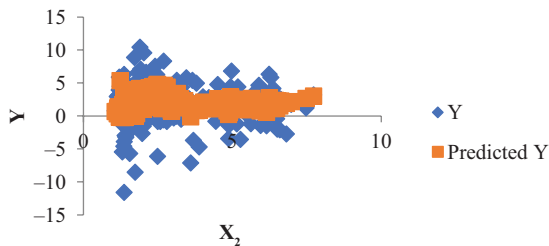


Figure 5. X_2 Line Fit plot (source: own research)

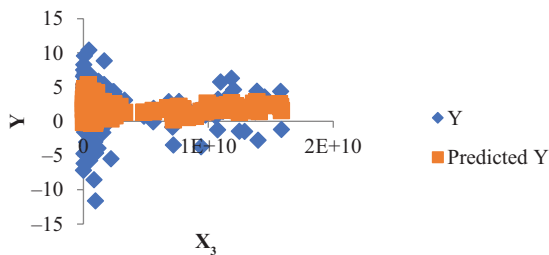


Figure 6. X_3 Line Fit plot (source: own research)

Normal Probability Plot (Q-Q plot) is a graphical tool used to assess whether a dataset follows a normal distribution. The results in Figure 7 indicate a positive correlation between the percentile values and the corresponding y values.

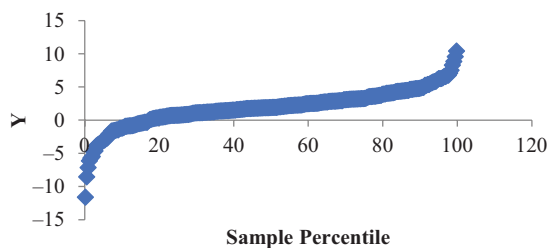


Figure 7. Normal Probability Plot (source: own research)

Overall, the results show that neither military spending nor arms exports have a significant impact on economic growth. More important in terms of economic growth is gross domestic investment.

In the endeavour to elucidate the dynamic interplay between military expenditures and economic growth, we will undertake further analysis based on data from the same countries, utilizing the Granger causality test.

The outcomes of this investigation are presented in Tables 4–5.

Table 4. The results of Granger causality test – GDP per Capita Growth causes Military Expenditure (source: own research)

Country	Observations/lags	F-Statistic	P-Value	Result
USA	Obs: 50 Lags: 4	5.2072	0.2667	No causality
Germany	Obs: 50 Lags: 4	2.91	0.034	Causality
Turkey	Obs: 50 Lags: 1	4.0617	0.0439	Causality
Italy	Obs: 50 Lags: 3	0.4297	0.7329	No causality
Spain	Obs: 50 Lags: 4	1.7681	0.1561	No causality
Israel	Obs: 26 Lags: 3	0.5404	0.6614	No causality
South Korea	Obs: 50 Lags: 4	1.3863	0.2582	No causality

Table 5. The results of Granger causality test – Military Expenditure causes GDP per capita growth (source: own research)

Country	Observations/lags	F-Statistic	P-Value	Result
USA	Obs: 50 Lags: 4	9.4353	0.0511	Marginal causality
Germany	Obs: 50 Lags: 4	0.61	0.659	No causality
Turkey	Obs: 50 Lags: 1	0.8516	0.3561	No causality
Italy	Obs: 50 Lags: 3	3.0909	0.0380	Causality
Spain	Obs: 50 Lags: 4	0.2720	0.8941	No causality
Israel	Obs: 26 Lags: 3	0.5739	0.6404	No causality
South Korea	Obs: 50 Lags: 4	0.4633	0.7622	No causality

It is obvious that the nature of causality varies across the different countries. The findings indicate that GDP per capita growth leads to an increase in military expenditure in Germany and Turkey. This causality suggests that economic prosperity provides the fiscal space for increased defence spending, possibly reflecting a policy preference for bolstering national security in times of economic buoyancy.

Unidirectional effects running from military expenditure to GDP per capita growth have been detected in Italy and in USA. The USA’s marginal causality result further complicates the narrative, suggesting a nuanced effect where defence spending may contribute to economic growth under specific conditions, albeit with a limited impact.

The absence of causality in both directions for countries like Spain, Israel, and South Korea underscores the presence of other dominant factors influencing economic growth, beyond military expenditure. This observation highlights the importance of considering a broader array of economic and non-economic variables when analysing the growth-defence spending relationship.

5. Discussion

The results obtained from the analysis have enabled us to draw the following discussion moments regarding implementing the hypotheses proposed in the study. Our findings indicate that both military expenditure and arms exports do not exert a considerable influence on economic growth. Rather, gross domestic investment emerges as a more critical determinant in the context of economic growth.

These conclusions contradict the earlier research by Churchill and Yew (2018), who highlights that the positive effects of military expenditure on growth tend to be more prominent in developed countries compared to their less developed counterparts.

Additionally, the research (Chary, 2024) investigates the relationship between arms imports, military expenditure, and per capita GDP for twenty-five of the top arms importers from 2000 to 2021. The findings suggest that arms imports and military spending have a negative short-term impact on GDP per capita but are beneficial in the long run. Also, causality tests reveal a unidirectional relationship between per capita GDP to military expenditure and from military spending to arms imports.

However, under the conditions of wars that are being waged all over the world today, sanctions pressure on aggressor countries, and rapid changes in the defence budgets of countries due to external threats, the results of the analysis may change in the future based on new data.

Currently, there are many studies on the impact of sanctions on defence budgets and the level of economic growth of the aggressor countries on the world stage. For example, the article (Cheratian et al., 2023) focus is particularly timely given the enduring economic sanctions imposed on Iran, which have precipitated significant challenges for the country's economy and business environment. The findings underscore the imperative for firms to adopt resilient strategies to navigate through sanctions-induced adversities effectively. The research (Farzanegan, 2023) argued that history of economic sanctions imposed on Iran reflects a complex interplay between geopolitical tensions and diplomatic manoeuvres. Initiated in response to various perceived threats, these sanctions evolved over time, targeting Iran's nuclear program, military capabilities, and economic infrastructure. While intended to induce behavioural changes and political reforms, their prolonged imposition underscores their limited effectiveness and unintended consequences, including adverse impacts on Iran's economy and welfare. Furthermore, the intricate linkages between Iran's

military industry and its broader economy highlight the nuanced effects of sanctions, suggesting potential trade-offs between military spending reduction and economic growth. The study (Dizaji & Farzanegan, 2019) examines the impact of sanctions on military spending in Iran utilizing data spanning from 1960 to 2017 and employing the autoregressive distributed lag model. The findings reveal that heightened sanctions intensity correlates with a significant reduction in military expenditure, both in the short and long term. Specifically, each level increase in sanctions intensity leads to approximately a 33% decrease in military spending over the long run. Notably, multilateral sanctions, particularly those involving the U.S. and other nations, exhibit a notably stronger and statistically significant negative influence on Iran's military spending, reducing it by approximately 77% in the long run.

The study (Kim et al., 2022) sheds light on the economic repercussions of recent United Nations sanctions imposed on North Korea. By analysing data on North Korean firms, the research demonstrates substantial declines in local nighttime luminosity, indicative of economic downturns resulting from export and intermediate input sanctions. Moreover, the examination of product-level price data highlights significant market price increases due to import sanctions. The study estimates a notable 20% reduction in the country's manufacturing output attributable to the sanctions. The analysis (Jo, 2020) explores the evolving defence policy priorities and expenditure of North Korea, particularly regarding the balance between economic development and strategic weapons programs. Despite initial indications of a shift away from prioritizing nuclear weapons development, recent data suggest a resurgence in focus on strategic weapons. North Korea has revealed plans to allocate approximately 16% of its state expenditure for defence in a long run (Grevatt & MacDonald, 2023).

The analysis in the article (Rácz et al., 2023) demonstrates, that sanctions have significantly weakened Russia's military capacity in its war against Ukraine, signalling Western resolve. However, Russia has adapted its economy into a war economy, increasing military spending while cutting other expenditures despite widening deficits. Sanctions have hindered Russia's access to necessary technology, impacting its defence industry and military production. Maintaining and tightening sanctions, alongside enforcing export controls, are crucial to further weaken Russia's military and economic power. Sanctions are complementary to continued weapons deliveries to Ukraine and are supportive of its defence. While Russia has adjusted its economy to withstand sanctions, efforts to close loopholes and strengthen enforcement are essential. Moreover, constraining Russia's procurement of weapons from other countries, such as Iran and North Korea, through existing sanctions could further limit its military capabilities. The Russian economy has faced significant challenges due to a sharp decline in foreign trade and the devaluation of the Russian rouble. Global oil price decreases and the EU import embargo on Russian

oil have exacerbated the situation, leading to a 32% decline in goods exports while imports surged by 17%. To address inflationary pressures, the central bank raised its key rate, stabilizing the exchange rate but maintaining high inflation expectations. Despite these challenges, domestic demand has driven economic recovery, supported by fiscal stimulus related to the war effort (Astrov et al., 2024). Russia's invasion of Ukraine in February 2022 has inflicted significant costs on both its federal budget and economy. Direct military expenses reached \$40 billion by September 2022. GDP losses April-June 2022 amounted to \$30 billion, with annual losses projected between \$103 billion and \$160 billion for 2022 (Shatz & Reach, 2023). Despite sustaining these costs in the short term, Russia's economy and standard of living are likely to decline over the long term. However, the economy's reliance on export revenue from oil and gas sales may sustain these costs for several years.

However, in our research, we did not aim to analyse military expenditures and arms exports in sanctioned countries, especially in view of their military aggression against the civilized world. Therefore, our research may have certain limitations, since if we conduct a similar scientific investigation of Russia, Iran, and North Korea, the results may be different.

6. Conclusions

The study examines the relationship between military spending, arms exports, and economic growth, focusing on developed countries during the period 1973–2022. Utilizing a regression model, the analysis reveals that gross domestic investment exerts the most significant positive influence on economic growth, while military expenditure and arms exports demonstrate negligible impacts. Statistical tests confirm the significant effect of domestic investment on GDP per capita growth, while military spending and arms exports do not attain statistical significance. These findings underscore the importance of gross domestic investment as a driver of economic growth, highlighting its superior role compared to military-related expenditures and exports in shaping economic outcomes.

The expansion of the military industry can have both positive and negative effects on economic growth. Among the positive effects we can mention increased GDP, job creation, technological innovation, and infrastructure development. Among the negative effects we can mention resource allocation, budget deficits, environmental impact, and social impacts. Balancing the benefits and drawbacks requires careful consideration of both economic and societal priorities.

This study contributes to the ongoing discourse on the economics of defence spending by providing empirical evidence of the complex and varied relationship between military expenditure and economic growth across developed nations. For policymakers, the nuanced insights from this analysis underscore the importance of

tailoring defence spending decisions to the specific economic and strategic contexts of their countries, with an eye towards optimizing the broader economic impact of such expenditures.

Author contributions

L. Kolinets – conception and design of the work, acquisition of data, methodology, drafting the article; O. Dluhopolskyi – analysis and interpretation of data, literature review, drafting the article, revising critically for important intellectual content.

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