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# MODEL OF SECURITY-ECONOMIC TRANSFORMATIONS: THE CONTEXT OF CONTEMPORARY INTERNATIONAL CONFLICTS. PRELIMINARY EVALUATIONS

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## Abstract

**Research background:** The 21st century has seen major shifts, particularly international conflicts impacting national economies. Russia's aggression against Ukraine, from Crimea's annexation in 2014 to a full-scale war in 2022, has reshaped security-economic dynamics. Hybrid wars require rethinking classical models of military spending and growth. Building on prior research (Berezka, Kovalchuk, 2023; Kovalchuk et al., 2023, 2024a, 2024b, 2024c), this paper stresses the need for dynamic analytical tools to guide post-war recovery strategies.
**Purpose:** This study aims to identify the causal impact of military expenditure on GDP, general government spending, and civilian expenditures in Israel, Ukraine, and Russia during 2014–2024 under conflict, sanctions, and instability.

**Research methodology:** A two-stage econometric approach was applied using time series data. ADF tests assessed variable integration; Johansen cointegration tested long-run relationships among military, civilian, and total government expenditures and GDP.
**Results:** We analyzed the links between military, civilian, and total government spending and economic growth in Israel, Ukraine, and Russia (2014–2024), revealing patterns that can guide postwar recovery and resource allocation in conflict-affected countries.
**Novelty:** The study shows that defensive operations, active defense, and military aggression generate distinct fiscal multipliers and spending-growth patterns, providing new insights for postwar policy planning.

**Keywords**: international security, military conflicts, general government final consumption expenditure, mobilization economy, postwar recovery.

**JEL classification:** C32, E69, H56

## Introduction

The modern world is marked by rising geopolitical tensions and the intensification of military conflicts of varying scales, which exert a significant impact on the economic systems of the countries involved. Among the most consequential conflicts of the past decade are the war in Syria (2011–2020) (Blanchard, 2023), the conflict in Yemen (2014–2024) (Marlowe, 2024), heightened tensions between the United States and Iran (Confrontation with Iran, 2025), the escalation of hostilities between Israel and Palestine (Mbandlwa, 2024), and a full-scale war initiated by Russia against Ukraine in 2022, following the annexation of Crimea in 2014 (Götz, Ekman, 2024).

Economic theory reveals the complex and multifaceted relationship between military expenditure and economic growth (Elshafei et al., 2025). On the one hand, armed conflicts necessitate a substantial reallocation of budgetary resources in favor of defense needs, which may adversely affect civilian sectors of the economy and social programs. On the other hand, the military-industrial complex can stimulate technological advancement, generate employment, and contribute to arms exports. Given the multidimensional and often ambiguous nature of this relationship, there is an objective need to apply econometric and statistical methods for in-depth analysis and pattern identification. Such tools enable the assessment of both direct and indirect effects of defense spending on economic and social indicators of sustainable development.

This study aims to address these research gaps by developing a comprehensive structural model of security-economic transformations and empirically testing it using data from Ukraine, Russia, and Israel over the period 2014–2025. This approach not only allows for the verification of previous findings in a new geopolitical context but also facilitates the identification of specific mechanisms through which contemporary conflicts affect national economies.

The aim of our study is to analyze the interdependence between gross domestic product (GDP), general government expenditure, military expenditure, and civilian government spending. This issue has become particularly relevant in the context of current geopolitical challenges. The diversity of forms and intensities of modern conflicts requires a differentiated approach to analyzing their economic impact. Some countries operate under conditions of prolonged confrontation with consistently high levels of military spending; others serve as global providers of security and arms; and still others are forced to adapt to sudden military threats and full-scale conflicts on their own territory. Each of these models generates specific interactions between defense needs and economic development, which require separate investigation. To conduct a comprehensive analysis of the economic impact of military conflicts, three countries were selected – Israel, Ukraine, and Russia – representing different models of defense-economy interaction over the period 2014–2024. The choice of these countries for a comparative analysis is based on their unique roles in the current international security system.

First of all, Israel represents a compelling example of a small economy operating under constant security threats, while simultaneously demonstrating effective mechanisms for transforming military innovations into civilian technologies (Freilich, 2023). It stands as a unique case of a state that has existed in a state of near-perpetual military confrontation since its founding in 1948 (Tariq, 2024). The country has engaged in prolonged conflicts with Arab states, including the wars of 1948–1949, 1967, and 1973 (Encyclopædia Britannica, 2025), as well as numerous localized hostilities with Palestine, Lebanon, and other neighboring countries (Bukhari et al., 2024). In 2023–2024, a renewed escalation of the conflict with Hamas in the Gaza Strip and with Hezbollah in Lebanon led to a substantial increase in military expenditures (AFP & ToI Staff, 2025). The Israel Defense Forces (IDF) comprise approximately 170,000 active-duty personnel and more than 460,000 reservists, making Israel one of the most militarized societies in the world in terms of military personnel relative to population size (Abushamala, 2025).

Secondly, Ukraine represents a model of a country that has faced direct military aggression on its own territory. Following the annexation of Crimea by the Russian Federation

in 2014 and the onset of armed conflict in eastern Ukraine, the country was forced to drastically reorient its economic priorities toward defense needs. The full-scale invasion launched by Russia on February 24, 2022, led to the mobilization of all available economic resources to repel the aggression. The Armed Forces of Ukraine expanded from approximately 250,000 to over 700,000 personnel, while military expenditure rose from 3–4% of GDP in 2013 to over 30% in 2022–2024, totaling $64.7 billion (34% of GDP – the highest in the world) (Stockholm International Peace Research Institute [SIPRI], 2025). Russia's war against Ukraine has become the largest military conflict in Europe since World War II, making the Ukrainian case critically important for understanding the impact of modern warfare on national economies.

Thirdly, Russia, in turn, exemplifies a state model that combines characteristics of a militarized economy with an authoritarian political regime, in which military spending functions not only as a means of national security but also as a tool of geopolitical influence. Since 2014, following the annexation of Crimea and involvement in the Donbas conflict, Russian military expenditure has steadily increased, accompanied by a decline in the share of social and infrastructure spending within the state budget. After launching the full-scale invasion of Ukraine in 2022, Russia's defense spending exceeded 6% of GDP and, according to publicly available sources, surpassed USD 149 billion in 2024 – equivalent to 7.1% of GDP and 19% of total government expenditure (SIPRI, 2025).

Such a high level of militarization has a profound impact on the structure of the economy: sectors linked to the defense-industrial complex become prioritized, while other industries suffer from the effects of sanctions, declining investment, and labor force outflows. The increase in military expenditure is accompanied by the growing isolation of the Russian economy from global markets, ultimately undermining its long-term competitiveness. Thus, the Russian case illustrates a paradox: short-term GDP growth driven by wartime public spending is coupled with structural economic degradation and a decline in population welfare.

The analysis of economic indicators across these three countries enables the identification of diverse models through which national economies adapt to military challenges. It also facilitates the evaluation of the effectiveness of different strategies for allocating resources between defense and civilian needs under conditions of prolonged conflict. The war in Ukraine provides a unique context for studying security–economic transformations for several reasons. First, it represents the largest military conflict in Europe since World War II, taking place in the era of deep economic globalization. Second, the conflict involves countries with distinct levels of economic development, institutional structures, and geostrategic positions, allowing for the analysis of differentiated effects of security shocks across contrasting national settings.

This study focuses on the dynamic context of an ongoing high-intensity conflict, which presents fundamentally new conditions for analyzing security-economic interactions. Specifically, this study seeks to examine:

1. How the integration properties of key economic indicators (GDP, military expenditure, and civilian government spending) differ across countries with distinct models of involvement in military conflicts.
2. What long-term cointegration relationships exist between military expenditure, civilian government spending, and economic growth in each of the countries under investigation.
3. Whether different types of military conflicts (defensive operations vs. active defense vs. military aggression) generate distinct fiscal multipliers.
4. Which adaptation mechanisms within national economies are most effective in maintaining economic stability during prolonged military conflicts.
5. How the geopolitical context and nature of the conflict influence the variability in the effectiveness of public spending in stimulating economic growth.

In response to these research questions, the following hypotheses are formulated:

H1: The impact of military expenditure on economic growth differs significantly depending on the nature of the military conflict – defensive operations, active defense, and military aggression each shape fundamentally distinct relationships between defense spending and GDP.

H2: Countries with long-standing experience operating under continuous security threats (e.g., Israel) demonstrate greater structural stability and economic adaptability compared to countries that have faced sudden military challenges (e.g., Ukraine) or conduct aggressive warfare (e.g., Russia).

H3: In situations of active defense, there exists a positive synergistic effect between military expenditure and civilian government spending, which supports economic growth even during wartime.

H4: Long-term cointegration relationships between the components of government expenditure and GDP reflect the degree of a mobilized economy and the efficiency of resource allocation.

The structure of the paper is as follows: the literature review and theoretical background (Section 1), research methodology (Section 2), data description and variable definitions, along with the presentation and analysis of results (Section 3), discussion and limitations (Section 4), and conclusions with recommendations for further research (Section 5).

Thus, the present investigation tests these hypotheses, and its results may provide valuable insights into the adaptive mechanisms of national economies in response to contemporary military challenges, as well as identify optimal strategies for allocating resources between defense and socio-economic needs under conditions of prolonged confrontation.

## 1. Literature review

Numerous researchers have examined the impact of military expenditure on economic growth; however, the vast majority of studies have focused on analyzing the relationship between sustainable development indicators and defense spending in individual regions or countries during peacetime or based on historical conflicts of the 20th century. For instance, Lorusso and Pieroni (2019) proposed a dynamic stochastic general equilibrium (DSGE) model that incorporates both civilian and military spending for the periods 1954–1979 and 1983–2008. The model was estimated using Bayesian methods. Their findings indicate that civilian expenditure has a more positive impact on output than military expenditure (Lorusso, Pieroni, 2019). Researchers from the General Jonas Žemaitis Military Academy of Lithuania employed a Spearman correlation analysis and automated linear modeling to identify a set of key sustainable development factors that influence changes in defense spending levels. Based on empirical data for the Baltic States from 2000 to 2018, the authors concluded that ensuring the security and defense capabilities of small states requires a comprehensive approach that accounts for economic, social, and environmental dimensions (Dudzevičiūtė et al., 2021). A group of Romanian and Chinese scholars applied a bootstrap-based rolling window Granger causality test to analyze dynamic changes in the causal relationship between military expenditure and sustainable economic development in Romania. The study revealed that, unlike in previous periods, after Romania's accession to NATO, economic growth no longer exerted a significant influence on the level of military expenditure (Tao et al., 2021). Researchers from the University of Defence in the Czech Republic developed an autoregressive distributed lag (ARDL) model to analyze the relationship between military spending among NATO member states and selected socio-economic variables. Their results indicated that the effects varied significantly across different NATO countries (Odehnal et al., 2021). Arezki and Brueckner (2021) developed a panel data model to evaluate the impact of military expenditure on the onset of civil conflict in relation to the level of investment security, and established a direct causal relationship between these variables. Das and Hussain (2023) employed a comprehensive set of econometric techniques to explore the long-term relationship and

causality between military spending and green capital in 20 countries with the most powerful armed forces over the period 1991–2020. Their findings indicate that in most countries, military expenditure has a long-term effect on green capital. Specifically, they identified a crowding-out effect in eight countries and a crowding-in effect in twelve (Das, Hussain, 2023). Gül and Torusdağ (2019) applied various statistical tests to examine the relationship between defense spending, economic development, and income distribution in BRICS countries and Turkey for the period 1995–2015. The results varied across sub-periods and countries, highlighting the heterogeneity of effects (Gül, Torusdağ, 2019). Saba and Ngepah (2019) investigated the causal relationship between military expenditure and economic growth using bivariate heterogeneous panel causality tests along with GMM and system-GMM estimations. Based on a balanced panel of 35 African countries for the period 1990–2015, their analysis revealed no causal link in seven countries, a unidirectional relationship from military expenditure to growth in two countries, from growth to military expenditure in fourteen countries, and bidirectional causality in twelve countries (Saba, Ngepah, 2019).

The divergent results observed across individual countries indicate the absence of a universal relationship between military expenditure and economic growth. In some cases, military spending exerts a positive impact; in others, the effect is negative or entirely insignificant. These variations are shaped by a range of factors, including the structure of the economy, political stability, the level of institutional development, the nature of security threats, and the broader geopolitical context. Consequently, there is a clear need for in-depth, country- or region-specific empirical studies that take into account the unique socio-economic, political, and security characteristics of each setting. Such a targeted approach enables more accurate conclusions regarding the efficiency of defense spending and its implications for economic dynamics in diverse contexts. Moreover, the current geopolitical landscape – marked by new forms of hybrid warfare, cyberattacks, and full-scale conflicts involving advanced technologies – necessitates an updated analytical framework for assessing the economic consequences of military actions.

## 2. Research methodology

To examine the direction and nature of causality among economic time series, we employ the Granger causality approach (Granger, 1969), which assesses whether the lagged values of one variable improve the prediction of another beyond its own lagged history. Specifically,

variable $x$ is said to Granger-cause $y$ if the past values of $x$ contain statistically significant information that enhances the forecast of $y$.

This is tested by estimating a vector autoregressive (VAR) model of the form:

$$y_t = \mu + \sum_{j=1}^{p} \gamma_{11_j} y_{t-j} + \sum_{j=1}^{p} \gamma_{12_j} x_{t-j} + u_t \tag{1}$$

The null hypothesis of non-causality is expressed as:

$$\begin{gathered} H_0\text{: for } j = 1, ..., p \\ H_1\text{: for at least one } j \end{gathered} \tag{2}$$

Rejection of this hypothesis via the Wald test suggests the existence of Granger causality from $x$ to $y$. A symmetric test may be applied to examine whether $y$ causes $x$.

However, when time series are non-stationary, a conventional regression analysis may produce spurious results (Granger, Newbold, 1974). Therefore, all series are first tested for stationarity using the Augmented Dickey-Fuller (ADF) test:

$$\Delta x_t = \alpha_0 + \alpha_1 t + \beta x_{t-1} + \sum_{j=1}^{p} \delta_j \Delta x_{t-j} + \varepsilon_t \tag{3}$$

The null hypothesis $H_0$: $\beta = 0$ implies the presence of a unit root. Rejection indicates stationarity. The optimal lag order is chosen using Akaike's Information Criterion (AIC).

If the series are non-stationary but integrated of the same order, the next step is to test for cointegration by estimating:

$$y_t = \beta x_t + \varepsilon_t \tag{4}$$

If the residuals $\varepsilon_t$ are stationary (I(0)), the variables are cointegrated, suggesting a long-run equilibrium relationship. In such cases, Granger causality should be assessed within the Vector Error Correction Model (VECM) framework.

The VECM incorporates both the short-term dynamics and long-term equilibrium through the error correction term $ECT_{t-1}$. For a system of three endogenous variables $x_t$, $y_t$, and $z_t$, the model can be represented as:

$$\Delta y_t = \mu_y + \alpha_y \mathrm{ECT}_{t-1} + \sum_{k=1}^{p} \beta_{yx,k} \Delta x_{t-k} + \sum_{k=1}^{p} \beta_{yy,k} \Delta y_{t-k} + \sum_{k=1}^{p} \beta_{yz,k} \Delta z_{t-k} + \varepsilon_{yt} \tag{5}$$

$$\Delta x_t = \mu_x + \alpha_x \mathrm{ECT}_{t-1} + \sum_{k=1}^{p} \beta_{xx,k} \Delta x_{t-k} + \sum_{k=1}^{p} \beta_{xy,k} \Delta y_{t-k} + \sum_{k=1}^{p} \beta_{xz,k} \Delta z_{t-k} + \varepsilon_{xt} \tag{6}$$

$$\Delta z_t = \mu_z + \alpha_z \mathrm{ECT}_{t-1} + \sum_{k=1}^{p} \beta_{zx,k} \Delta x_{t-k} + \sum_{k=1}^{p} \beta_{zy,k} \Delta y_{t-k} + \sum_{k=1}^{p} \beta_{zz,k} \Delta z_{t-k} + \varepsilon_{zt} \tag{7}$$

Here, $\mu_i$ denotes constant terms, $\alpha_i$ are the adjustment coefficients measuring the speed at which variables revert to long-run equilibrium, and $\beta_{ij,k}$ quantify the impact of lagged differences of variable *j* on variable *i*. The residuals $\varepsilon_{it}$ are assumed to be white noise and mutually uncorrelated.

Granger causality in this framework is evaluated by jointly testing whether the coefficients on the lagged differenced variables and the error correction term are significantly different from zero. A significant $\alpha_i$ implies that variable *i* adjusts to restore equilibrium after deviations, indicating long-run causality, while significant $\beta_{ij,k}$ terms reveal short-run causal dynamics.

## 3. Results

To measure the size of government, we use the ratio of general government final consumption expenditure to nominal GDP, expressed in natural logarithms. The variables LGY and LMY represent the natural logarithms of the military burden, defined as the ratio of military expenditure to GDP. LGGY denotes the natural logarithm of the ratio of general government final consumption expenditure to GDP. LGDP refers to the natural logarithm of real GDP per capita. Data on real GDP, general government final consumption expenditure, and military expenditure were obtained from the World Bank Open Data platform (World Bank, 2025). Since international databases do not report government civilian expenditures directly, these were calculated as the difference between general government final consumption expenditure and military expenditure for each of the analyzed countries. Our sample includes the following countries: Israel, Ukraine, and Russia for the period 2014–2024.

The first stage of our empirical analysis involved determining the order of integration for each variable using Augmented Dickey-Fuller (ADF) tests. The ADF test results, summarized in Table 1, reveal substantial variation in the stationarity properties of the variables across countries, which has important implications for the subsequent analysis of interrelationships. For Israel, the variables LGDP and LGGFC are stationary at levels (I(0)), whereas LME and LCGE are non-stationary at levels (I(1)) but become stationary after first differencing (I(0)). For Ukraine, the variables LGDP and LCGE are stationary at levels (I(0)); LME and LGGFC are non-stationary at levels (I(1)), with LME becoming stationary at first difference (I(0)), while LGGFC remains non-stationary even after first differencing (I(1)). For Russia, the variable LGDP is stationary at levels (I(0)); LGGFC and LME are non-stationary at levels (I(1)) but become stationary after first differencing (I(0)), whereas LCGE remains non-stationary even at first difference (I(1)). These findings indicate a mixed order of integration across variables

and countries, necessitating the use of techniques that can accommodate such heterogeneity, including cointegration analysis and error correction modeling in the subsequent stages of the study.

Table 1. Results of the ADF unit root test

| Country | Variable | ADF with trend and intercept | | | | | |
|---|---|---|---|---|---|---|---|
| | | Levels | | | First differences | | |
| | | ADF | *p* | LM(4) | ADF | *p* | LM(4) |
| Israel | LGDP | –3.617*** | 1 | 0.072 | –3.72** | 1 | 1.397 |
| | LGGFC | –3.474* | 2 | 0.289 | –4.294*** | 0 | 0.276 |
| | LME | –4.272** | 1 | 5.279 | –5.257*** | 0 | 6.730 |
| | LCGE | –0.584 | 3 | 2.829 | –2.703* | 2 | 0.131 |
| Ukraine | LGDP | –5.108*** | 0 | 5.885 | –7.203*** | 0 | 7.490 |
| | LGGFC | –1.125 | 3 | 7.688 | –2.115 | 3 | 5.841 |
| | LME | –1.817 | 3 | 6.962 | –4.268** | 0 | 7.733 |
| | LCGE | –4.811*** | 0 | 7.723 | –4.746*** | 0 | 7.391 |
| Russia | LGDP | 4.924*** | 0 | 6.879 | –3.894*** | 0 | 7.854 |
| | LGGFC | –2.685 | 3 | 6.927 | –3.639** | 1 | 7.366 |
| | LME | –2.056 | 3 | 5.308 | –2.678* | 2 | 3.289 |
| | LCGE | –0.777 | 3 | 8.360 | –2.613 | 3 | 8.348 |

Note: LGDP, LGGFC, LME, and LCGE represent the natural logarithms of real GDP, the natural logarithm of the ratio of general government final consumption expenditure to nominal GDP, the natural logarithm of military expenditure, and the natural logarithm of the ratio of government civilian expenditures to GDP, respectively.

The symbols (*, **, ***) indicate significance at the 10, 5, and 1% levels, respectively. LM(1) is the Lagrange Multiplier test for first-order serial correlation in residuals, which is asymptotically distributed as $\chi^2_{(4)}$.

The test is based on A/C residuals with a maximum lag length of six; *p* is the optimal lag length, chosen based on the Akaike criterion.

The LM(4) test – a fourth-order Lagrange Multiplier test – was employed to detect the presence of autocorrelation in the residuals.

Source: own elaboration using R.

The test results for Israel indicate a predominance of first-order stationary processes. The natural logarithm of real GDP was found to be stationary at the 1% significance level, suggesting the absence of a stochastic trend in economic growth. Government sector consumption and military expenditure also exhibit stationarity, albeit at different levels of statistical significance. Only government civilian expenditure showed signs of being integrated of order one; however, even this result was statistically weak. Ukraine presented a mixed picture in terms of integration properties, possibly reflecting structural economic instability during the analyzed period. Real GDP and government civilian expenditure were

found to be stationary processes, whereas military expenditure was clearly, with strong statistical significance. General government consumption was problematic to classify, as it failed to meet critical values for either stationarity at levels or integration at first difference. Russia demonstrated the most consistent pattern in support of a potential cointegration analysis. Real GDP remains stationary, while both general government consumption and military expenditure are integrated of order one. As in the case of Ukraine, government civilian expenditure was difficult to classify definitively in terms of its order of integration.

The analysis of integration properties reveals differing possibilities for investigating long-term relationships among the variables. In the case of Israel, the predominance of stationary processes limits the applicability of a classical cointegration analysis, as most variables do not exhibit stochastic trends. This suggests a structurally stable economy in which fluctuations around long-term trends do not accumulate over time.

Ukraine presents a more complex case due to the mixed orders of integration. The stationarity of real GDP and government civilian expenditure allows for the analysis of their relationships within a stable framework; however, the first-order integration of military expenditure enables only limited causal inference or analysis within a restricted error correction model (VECM) structure.

Russia demonstrates the greatest potential for a full-scale cointegration analysis, owing to the presence of two variables – general government consumption and military expenditure – that are both integrated of order one. This provides a theoretical basis for examining long-term equilibrium between the civilian and military components of public spending, potentially reflecting the state's strategic allocation priorities.

The identified integration properties carry significant economic implications for understanding the interaction between military expenditure, government consumption, and economic growth. The stationarity of GDP across all three countries contrasts with typical empirical findings, where GDP is usually found to be integrated of order one. This divergence may reflect the unique characteristics of the study period – marked by war and instability – or the structural specificities of the analyzed economies. In Israel, the stationarity of military expenditure may indicate a stable level of security needs and the effective integration of the defense-industrial complex into the broader economic structure. The absence of long-term cumulative imbalances among various components of government policy suggests a balanced approach to resource allocation. In Ukraine, the first-order integration of military expenditure clearly reflects the effects of the armed conflict that began in 2014. The persistent upward trend in defense spending, which does not revert to a long-run equilibrium, signals

a structural shift in national policy priorities. At the same time, the stationarity of GDP may indicate a degree of resilience to external shocks or the effectiveness of adaptive economic mechanisms. Russia represents the most analytically intriguing case in terms of potential long-run interrelationships. The first-order integration of both general government consumption and military expenditure allows for the existence of cointegrating relationships, which may reflect a strategic trade-off between civilian and military priorities. This configuration opens up the possibility of investigating whether a long-run equilibrium exists between the expansion of the state apparatus and continued military buildup.

The identified integration properties determine the appropriate empirical strategy for each country. For Russia, it is appropriate to apply the Johansen cointegration test to a system comprising general government consumption and military expenditure. This approach enables the identification of potential long-run equilibrium relationships and the estimation of adjustment speeds in response to short-run deviations. For Ukraine, a combined approach is recommended, incorporating the analysis of stationary relationships between GDP and government civilian expenditure. Given the mixed integration orders, this allows for the assessment of stable interactions without violating statistical assumptions. For Israel, the optimal strategy is to employ a vector autoregressive (VAR) model in levels for stationary variables. This allows for the examination of short-term dynamics and impulse response functions without the need to model long-run cointegrating relationships. Such an approach aligns with the structural stability of the Israeli economy and the absence of cumulative imbalances among the analyzed variables.

The second step involves performing a cointegration test between the relevant variables. The Johansen cointegration test was applied to examine long-run relationships between government expenditure variables and GDP for Israel, Ukraine, and Russia. The test uses the maximum eigenvalue ($\lambda_{max}$) statistic to determine the number of cointegrating vectors.

The results of the Johansen cointegration test reveal fundamentally different models of economic functioning among the three countries under conditions of military conflict.

The Israeli economy demonstrates no evidence of a long-term relationship between gross domestic product and government civilian expenditure. This suggests a high degree of adaptability within the economic system, which is capable of rapidly reconfiguring in response to security challenges. Over the decades, Israel has developed a flexible model in which the economy is not rigidly dependent on specific categories of government spending, thus enabling the effective reallocation of resources between civilian and military needs.

Table 2. Johansen Cointegration Analysis Results

| Variables | $\lambda_{max}$ | | $p$ | $r$ | Cointegration equation |
|---|---|---|---|---|---|
| | $r = 0$ | $r = 1$ | | | |
| Israel | | | | | |
| LGDP, LCGE | 10.01 | 2.96 | 1 | 0 | Not found |
| Ukraine | | | | | |
| LGDP, LGGFC, LME | 41.07*** | 24.60*** | 2 | 1 | LGDP = 24.40 + 1.11·LGGFC+ 1.13·LME |
| Russia | | | | | |
| LGDP, LGGC | 24.60*** | 12.97*** | 3 | 1 | LGDP = 25.73 –1.4205·LGGFC |
| LGDP, LGC, LME | 5.90** | NA | 3 | 1 | LGDP = 24.52403 – 0.51092 ·LME –1.02167·LCGE |

Note: LGDP, LGGFC, LME, and LCGE represent the natural logarithms of real GDP, the natural logarithm of the ratio of general government final consumption expenditure to nominal GDP, the natural logarithm of military expenditure, and the natural logarithm of the ratio of government civilian expenditures to GDP, respectively.

The symbols (*, **, ***) indicate significance at the 10, 5, and 1% levels, respectively.

$\lambda_{max}$ is the maximum lag length based on AIC from the unrestricted VAR model.

The number of cointegration vectors based on Johansen's method.

Source: own elaboration using R.

The Ukrainian economy, under the conditions of full-scale war, presents an opposite picture – exhibiting a stable cointegrating relationship among all examined variables. The positive impact of both military expenditure and public investment on GDP reflects the mobilization-driven nature of the economy. Defense spending stimulates the development of the military-industrial complex, creates employment opportunities, and activates related sectors. At the same time, public investment supports critical infrastructure and ensures the functioning of the economy under extreme conditions.

The Russian economy displays the most contradictory trends. A negative relationship between government spending and GDP may indicate inefficient resource allocation and the growing cost of military aggression. The complex structure of dependencies suggests that the Russian economy is undergoing structural distortions due to wartime conditions, where increased military expenditure not only fails to stimulate, but may even hinder economic growth.

These differences reflect the distinct stages and nature of military conflicts faced by each country. Israel, with its long-standing experience of operating under continuous threat, has developed a resilient economic model. Ukraine is in a state of active defense, with the entire economy mobilized to repel aggression. Russia, as the aggressor, is experiencing the adverse consequences of its military adventurism for the national economy. The results also highlight

the importance of institutional capacity and governance effectiveness during wartime. The positive economic impact of government spending in Ukraine indicates a relatively efficient use of resources – even under extreme conditions – whereas Russia's indicators point to mounting challenges in public sector performance under the dual pressure of international sanctions and escalating military costs.

## 4. Discussion and limitations

It should be noted that this analysis covers a relatively short time span (2014–2024) and includes a limited number of countries. The results may be specific to the examined geopolitical context and should be interpreted with caution. Further validation using a broader set of countries and longer time series is necessary to generalize the findings. Moreover, the study does not fully account for the influence of international financial assistance and sanction regimes, both of which may significantly alter the observed relationships among domestic economic variables.

## Conclusions

The conducted analysis of the interrelationships between military expenditure, government civilian spending, and economic growth in Israel, Ukraine, and Russia over the period 2014–2024 reveals fundamentally different models of national economic functioning under varying types of military conflict.

The analysis of the integration properties of the time series highlights structural differences across the three economies. The Israeli economy exhibits predominant stationarity across all analyzed variables, indicating structural stability and an absence of cumulative imbalances. The Ukrainian economy displays a mixed integration profile, with stationary GDP combined with first-order integration of military expenditure. The Russian economy demonstrates the greatest potential for a cointegration analysis, owing to the integration of both government consumption and military expenditure variables.

The Johansen cointegration test results further underscore fundamental distinctions in the economic mechanisms of wartime adaptation. The absence of long-term cointegration in Israel reflects a highly adaptive system capable of reallocating resources flexibly without generating structural distortions. In contrast, the presence of stable cointegrating relationships in Ukraine reveals a mobilization-based economic structure, in which all components of public spending

function synergistically to support growth. The contradictory patterns observed in Russia point to inefficiencies in resource allocation and the escalating economic costs of military aggression.

This study provides the first comparative empirical evidence of varying fiscal multipliers depending on the nature of military conflict. It was found that defensive operations (Israel) foster the most resilient economic structures with minimal long-term imbalances. Active defense (Ukraine) generates positive synergistic effects between different categories of public expenditure. In contrast, military aggression (Russia) leads to structural distortions and negative economic consequences.

These findings expand the theoretical understanding of the interaction between public finance and economic growth under extreme conditions, contributing new empirical insights to the literature on the variability of fiscal multipliers based on a geopolitical context. For countries engaged in active defense, the results confirm the effectiveness of coordinated increases in both military expenditure and public investment in critical infrastructure. The synergistic effect of these expenditure categories can support economic growth even under wartime conditions.

For economies operating under continuous security threats, the Israeli case demonstrates the effectiveness of building flexible and adaptive mechanisms that allow for rapid resource reallocation without generating long-term structural imbalances. The findings also underscore the critical importance of institutional capacity and governance efficiency in maximizing the positive effects of public spending during times of war.

The observed patterns lay the groundwork for developing theoretical models of optimal public resource allocation under different types of military conflict. Future research should explore the mechanisms of transition from wartime to peacetime economies and formulate postwar recovery strategies that account for the identified structural features. Additional attention should be given to the long-term consequences of different wartime financing models on economic development and social stability in the post-conflict period.

## References

Abushamala, R.R.A. (2025). *Israel set to increase reserve force by 50,000 to expand Gaza genocide: Israeli media*. Middle East. Retrieved from https://www.aa.com.tr/en/middle-east/israel-set-to-increase-reserve-force-by-50-000-to-expand-gaza-genocide-israeli-media/3579913.

AFP & ToI Staff (2025, April 28). *Israel leads global surge in military spending, with steepest increase since 1967*. The Times of Israel. Retrieved from https://www.timesofisrael.com/israel-leads-global-surge-in-military-spending-with-steepest-increase-since-1967.

Arezki, R., Brueckner, M. (2021). Natural resources and civil conflict: The role of military expenditures. *Journal of Risk and Financial Management*, *14*(12), 575. DOI: 10.3390/jrfm14120575.

Berezka, K.M., Kovalchuk, O. Ya. (2023). Associative rules for modeling international security decisions in the context of the Ukrainian-Russian war: Preliminary evaluations. *Folia Oeconomica*, *23*(2), 67–85. DOI: 10.2478/foli-2023-0019.

Blanchard, C.M. (2023). *Syria conflict overview: 2011–2021*. Congress.gov. Retrieved from https://www.congress.gov/crs-product/IF11080#citation.

Bukhari, S.R.H., Iqbal, N., Khan, A.U. (2024). Israel's military actions in Palestine and Lebanon: A critical analysis of humanitarian, political, and strategic implications. *Journal of Development and Social Sciences*, *5*(3), 577–586. DOI: 10.47205/jdss.2024(5-III)51.

*Confrontation with Iran*. (2025). Global Conflict Tracker. https://www.cfr.org/global-conflict-tracker/conflict/confrontation-between-united-states-and-iran.

Das, R.C., Hussain, I. (2023). Relationships between military spending and green capital formation: Complementary or substitutes? *Social Sciences*, *12*(10), 571. DOI: 10.3390/socsci12100571.

Dudzevičiūtė, G., Bekesienė, S., Meidutė-Kavaliauskienė, I., Ševčenko-Kozlovska, G. (2021). An assessment of the relationship between defence expenditure and sustainable development in the Baltic countries. *Sustainability*, *13*(12), 6916. DOI: 10.3390/su13126916.

Elshafei, A.S.M.A., Shrahili, M., Kayid, M., Mohammad, S. (2025). Military expenditure and economic growth in the largest military spending country: Using machine learning analysis. *Journal of Radiation Research and Applied Sciences*, *18*(2). DOI: 10.1016/j.jrras.2025.101429.

Encyclopædia Britannica (2025). *Arab-Israeli wars*. Retrieved from https://www.britannica.com/event/Arab-Israeli-wars.

Freilich, C. (2023). Israel's national security strategy. In: *The Palgrave International Handbook of Israel* (pp. 1–19). DOI: 10.1007/978-981-16-2717-0_87-1.

Götz, E., Ekman, P. (2024). Russia's war against Ukraine: Context, causes, and consequences. *Problems of Post-Communism*, *71*(3), 193–205. DOI: 10.1080/10758216.2024.234364.

Granger, C.W.J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, *37*(3), 424–438. Retrieved from https://www.scirp.org/reference/ReferencesPapers?ReferenceID=1202880.

Granger, C.W.J., Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics*, *2*(2), 111–120. DOI: 10.1016/0304-4076(74)90034-7.

Gül, E., Torusdağ, M. (2019). Analysis of the effects of defense expenditures on income distribution and economic development with panel asymmetric causality test: BRICS countries and Turkey case. *International Journal of Contemporary Economics and Administrative Sciences*, *9*(1), 1–23. DOI: 10.5281/zenodo.3262188.

Kovalchuk, O., Berezka, K., Tulai, O., Ferens, B., Babala, L., Zapolskyi, O. (2024a). Modeling the determinants of global economic uncertainty. *Proceedings of International Conference on Applied Innovation in IT*, *12*(2), 191–197. DOI: 10.25673/118133.

Kovalchuk, O., Berezka, K., Babala, L., Ivanytskyy, R., Karpyshyn, N., Zhuk, N. (2024b). Modeling country economic security: A machine learning approach. In: *2024 14th International Conference on Advanced Computer Information Technologies (ACIT)* (pp. 370–375). DOI: 10.1109/ACIT62333.2024.10712462.

Kovalchuk, O., Berezka, K., Masonkova, M., Chudyk, N., Ukhach, V., Pilyukov, Yu. (2024c). Statistical modeling of determinants influencing economic security in the context of sustainable development and national security. *Proceedings of International Conference on Applied Innovation in IT*, *12*(1), 197–203. DOI: 10.25673/115700.

Kovalchuk, O., Berezka, K., Danylyuk, I., Babala, L., Chopyk, P., Basistyi, P. (2023). Modeling Russian-Ukrainian war impact on global food safety: Preliminary evaluations. In: *2023 13th International Conference on Advanced Computer Information Technologies (ACIT)* (pp. 382–387). DOI: 10.1109/ACIT58437.2023.10275672.

Lorusso, M., Pieroni, L. (2019). Disentangling civilian and military spending shocks: A Bayesian DSGE approach for the US economy. *Journal of Risk and Financial Management*, *12*(3), 141. DOI: 10.3390/jrfm12030141.

Marlowe, O. (2024). *The crisis in Yemen*, *explained: 5 things to know in 2024*. Concern. Retrieved from https://www.concern.net/news/yemen-crisis-explained.

Mbandlwa, Z. (2024). Comprehensive analysis of the Israel-Palestine conflict: A path towards sustainable peace. *Journal of Research Administration*, *6*(1), 4705–4717.

Odehnal, J., Neubauer, J., Olejníček, A., Boulaouad, J., Brizgalová, L. (2021). Empirical analysis of military expenditures in NATO nations. *Economies*, *9*(3), 107. DOI: 10.3390/economies9030107.

Saba, C.S., Ngepah, N. (2019). Military expenditure and economic growth: Evidence from a heterogeneous panel of African countries. *Economic Research-Ekonomska Istraživanja*, *32*(1), 3586–3606. DOI: 10.1080/1331677X.2019.1674179.

Stockholm International Peace Research Institute (SIPRI) (2025). *Unprecedented rise in global military expenditure as European and Middle East spending surges*. Retrieved from https://www.sipri.org/media/press-release/2025/unprecedented-rise-global-military-expenditure-european-and-middle-east-spending-surges.

Tao, R., Glonț, O.R., Li, Z.-Z., Lobonț, O.R., Guzun, A.A. (2020). New evidence for Romania regarding dynamic causality between military expenditure and sustainable economic growth. *Sustainability*, *12*(12), 5053. DOI: 10.3390/su12125053.

Tariq, D. (2024). *Merchants of death: Israel's permanent war economy*. Security Context. Retrieved from https://www.securityincontext.org/posts/merchants-of-death-israels-permanent-war-economy.

World Bank (2025). *World Bank Open Data*. Retrieved from https://data.worldbank.org.

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