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Defense Spending, Conflict and Economic Growth in Europe

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Abstract: This study seeks to answer the following research question: *How do defense spending and conflict impact economic growth in Europe, and what role does NATO membership play in shaping these dynamics?* Using a panel dataset of 40 European countries from 1999 to 2023, the analysis investigates a change in security dynamics in Europe post-2014, determinants of military expenditure, whether NATO's influence is more pronounced for countries closer to Russia, and how military expenditure and conflict impact economic performance. Employing panel econometric techniques, the analysis reveals that while military expenditure is not directly correlated with GDP per capita growth, conflict exerts a profoundly negative effect, with battle-related deaths significantly reducing economic performance. NATO membership is associated with increased defense spending, where geographical distance to Russia implies weakening of NATO countries' military budgets. For NATO members, higher US military expenditure correlates with reduced European spending, highlighting reliance on American security provisions. The findings underscore the complex dynamics between defense allocations, alliance structures, and economic conditions, emphasizing the need for balanced policy approaches that address security imperatives without compromising long-term economic growth.

Keywords: defense spending; economic growth; military expenditure; NATO; panel data

JEL Classification: H56; N44; O11; C33

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1 Introduction

The end of the Cold War seemingly ended the period of use of coercive means in international affairs, particularly for the transatlantic community, representing a role model for a functional cooperative security system. The use of military hardware in the international arena was regarded as obsolete, while processes of alignment and integration dominated the agenda. That period marked an unprecedented enlargement of the EU (European Union) and NATO (North Atlantic Treaty Organization) to former socialist states to unify Europe and ensure its security and sustainable development in the coming period.

Consequently, the European countries started gradually downscaling the level of investment in the defense sector, which was regarded as an unnecessary burden for state budgets in the era of peaceful coexistence and globalization. There was an overarching impression that the system of liberal-democratic values outperformed other societal concepts, which cleansed the international arena of threats of armed conflict. Some authors even debated the ‘end of history’ (Fukuyama 1989).

In parallel with that, broader globalization trends opened various possibilities for the transfer of advanced technologies and production capacities to different corners of the globe, predominantly to remote sizeable markets with cheap labor, regardless of the character of their political system. The continuous growth of Western economies was frequently based on the affordable import of natural materials from resource-rich countries that received significant amounts of Western financial resources. It resulted in significant growth of (global share of) the GDP of recipient states that was expected to be utilized to bridge the development gap with the West and gradually introduce liberal-democratic values.

In contrast to the expectations, receiving countries characterized with significant resentment for the enlargement of the transatlantic community used the continuous rise of their GDP to foster capacities that strengthen their strategic posture, both political/economic leverage and military power. This resulted in strategic competition in different regions and parallel with the broader process of deregulation of international affairs. It deteriorated the overall security at the global level, creating significant challenges for Europe. While the Russian annexation of Crimea in 2014 indicated the end of the post-Cold War honeymoon period, its full-scale invasion of Ukraine in 2022 brought back warfare as a policy tool to the European arena.

That kind of development greatly impacted the security and stability of the entire European continent and beyond. It dramatically changed the narrative of European affairs, bringing ahead defense-related topics, including the necessity for increased investment in defense. Namely, in the current global security

environment, marked by rising geopolitical tensions, particularly with Russia's invasion of Ukraine, as well as the growing influence of China, European countries face an increasingly complex and volatile security landscape. The EU's collective defense capabilities are crucial not only for regional stability but also for the credibility of NATO, which the EU heavily relies on for its security. With defense budgets historically being underfunded or spread thin, European nations need to significantly increase their defense spending to modernize military infrastructure, enhance deterrence capabilities, and ensure readiness for emerging threats such as cyber warfare, hybrid tactics, and irregular military strategies.

Strengthening defense spending will also allow for greater strategic autonomy, reducing reliance on external actors and better positioning the EU to respond to crises, whether in the immediate neighborhood or beyond. Enhanced military capabilities are essential for protecting European borders and contributing to global security, making defense investment a crucial priority for European countries in this new era of uncertainty. However, not all European countries reacted similarly regarding threat perception, public support for defense reform, and international solidarity.

From an economic perspective, military expenditure and its relationship with economic growth have been subjects of considerable debate. The share of military expenditure in GDP serves not only as a measure of a country's defense commitment but also as a potential driver of economic outcomes. This study focuses on the economic dimensions of defense spending, particularly its impact on GDP per capita growth. By examining the lagged effects of military expenditure alongside other key economic factors – such as investment share of GDP, trade openness, government spending, and GDP per capita – this paper aims to uncover the nuanced interplay between defense allocations and broader economic performance. Furthermore, including variables for NATO and EU membership provides additional context for understanding how institutional alignments influence economic growth dynamics in the contemporary security and economic landscape.

Despite extensive literature on the relationship between military spending, conflict, and economic performance, existing studies often present mixed conclusions, with results varying by regional context, methodology, and geopolitical factors. Some studies suggest that military spending boosts economic growth by driving technological advancements and infrastructure investments (Alpetkin and Levine 2012), while others argue that excessive defense expenditure crowds out productive investments, hindering long-term growth (Desley and Gkoulgkoutsika 2021; Dunne and Tian 2013). Similarly, while conflict is generally associated with economic downturns, certain conflicts have also been linked to increased military-driven economic activity (Harrison 2000), complicating conventional wisdom. However, these debates have largely overlooked the European context, particularly

in light of recent geopolitical shifts, including NATO expansion and the ongoing Russian-Ukrainian conflict. Additionally, most studies treat military spending as a homogeneous factor rather than considering how its effects might vary across different economic contexts and institutional frameworks. In response to these gaps, this paper investigates how defense spending and conflict shape economic growth in Europe, with a particular focus on NATO membership's role in these dynamics. Specifically, we test whether casualties from conflict increase military spending, whether NATO membership influences military expenditure differently in countries closer to Russia, how post-2014 security concerns may lead NATO members to increase their defense spending, and the effects of military spending and conflict on GDP growth. Using a dataset of 40 European countries from 1999 to 2023, we examine these hypotheses to provide new insights into the relationship between military spending, conflict, and economic performance.

The paper focuses on all European countries, unlike previous studies that dealt only with more developed economies. Also, our sample includes the years of the Russian invasion of Ukraine and the most recent data on military spending. Our main results present strong persistence in defense budgets; military spending is strongly determined by past spending, implying path dependence. NATO members tend to spend more on defense, but this effect weakens with distance to Russia. Countries engaged in conflicts and experiencing casualties substantially increase their military spending. There is also a negative relationship between US military spending and NATO countries' defense spending, hinting that NATO members may reduce their budgets when the US increases its military expenditures. From 2014, the impact of NATO membership on military spending became significantly stronger, reflecting heightened security concerns, while the effect of geographical distance from Russia became more pronounced. The interaction with US military expenditure seems not to be relevant post-2014. Incorporating military spending into GDP growth models shows it is not directly correlated with growth. Still, conflict has a significant negative impact, with conflict-related deaths leading to a substantial decrease in GDP growth. These findings underscore the interplay between security, alliance structures, economic conditions, and geopolitical events in shaping military expenditure and economic outcomes.

The Introduction is followed by a section summarizing key studies on military expenditure and economic growth. The third section describes the dataset, variables, and econometric models employed, followed by a section that presents findings on the drivers of military expenditure, their variation across contexts, and the relationship between military spending and GDP growth, with a focus on the impact of conflict. Finally, the last section synthesizes the insights, emphasizing the policy implications of the study's findings.

2 Literature Review

To explain GDP growth, we initially rely on mainstream economic literature and common drivers of growth. Economists typically identify four key factors that drive economic growth. First, human capital plays a crucial role; a highly skilled, educated, and well-trained workforce enhances economic performance through efficient work and quality output, while an unskilled workforce can lead to negative consequences such as increased unemployment. Second, physical capital, which includes infrastructure like factories, transport links, and machinery, reduces costs, facilitates international trade, and boosts labor productivity and overall economic output. Third, natural resources, such as oil, can significantly enhance production capacity and economic growth, but their effective utilization depends on factors such as skills, knowledge, labor availability, and technology. Finally, technological advancements are vital, as they can dramatically increase productivity and drive economic progress at lower costs.

While existing research provides valuable insights into the fundamental drivers of economic growth, it is relatively limited in directly addressing the specific factors most relevant to our study. It suggests that the lagged GDP per capita typically negatively affects GDP per capita growth (Barro and Sala-i-Martin 1992). Licchetta and Mattozzi (2023) ran an empirical analysis of EU countries and found a statistically negative effect of lagged GDP per capita on per capita GDP growth. The empirical results on the role of investment in economic growth are somewhat ambiguous. Barro (1991), for example, claims that investment, especially public, is not correlated with growth, while Zou (2006) finds a stronger effect only for private investment. Another critical factor in explaining economic growth is trade openness, where research has shown there is strong evidence of a positive relationship between trade openness and economic growth (Alcala and Ciccone 2004; Borensztein, De Gregorio, and Lee 1998; Coe and Helpman 1995). Openness to trade promotes the spread of technology and knowledge, which is essential for driving economic development. In their seminal work on the causal relationship between trade and economic growth, Frankel and Romer (1999) found that a one percentage point increase in the trade-to-GDP ratio leads to at least a 0.5 percent rise in income per capita. It has also been shown that government expenditure has a positive but often minimal effect on economic growth, which largely depends on the composition of government expenditure (Arawatari, Hori, and Mino 2023; Devarajan, Swaroop, and Heng-fu 1996).

Moving onto more defense-oriented growth drivers, research has often looked at the experiences of NATO members who coordinate their defense spending on a supranational level. The 2014 Wales NATO Summit defined that required defense

spending for NATO members at the two percent GDP threshold should be met by 2024. The threshold sparked the debate about burden sharing within the Alliance and different interpretations of the matter. Alozius (2022) assesses how NATO's two percent guideline can be viewed from a demand for military expenditure perspective and to what extent the EU regulations on public debt hindered development in military expenditure. It also proposes and estimates a dynamic panel model for this purpose. The estimations from the models show that the development of military expenditure between 2014 and 2019 for the NATO allies in the EU has been positively and significantly influenced by the previous level of military expenditure. The results suggest that the states' military expenditure has not been significantly impacted by the US and Russia's military expenditures, nor has real GDP change or real economic growth affected developments in the military expenditure of the states. On the other hand, other research also suggests that US defense spending exerts a notable influence on both the military budgets (Caruso and Di Domizio 2015) and debt levels (Caruso and Di Domizio 2016) of European countries, indicating transatlantic interdependence in defense-economic dynamics.

Using the example of the Visegrád Group (V4) Central European countries – Poland, Czech Republic, Slovakia, and Hungary – Waskiewicz (2020) considers the impact of military expenditure on the economic stance of these states. He attempted to search the long- and short-range causality between defense spending and economic growth in the V4 countries by analyzing general values (total spending approach) and outlay distribution in the defense sector (spending division approach). Two fundamental theoretical approaches have been accounted for – the Keynesian school of thought, which is associated with the demand channel, and a neoliberal one, associated with the supply channel. The first one supports proactive state using military spending (as a short-term stimulant) to increase output in times of low aggregate demand and unemployment (Dunne and Uye 2009). It is believed that greater government expenditure leads to better capital allocation, which causes additional profits, lower interest rates, and stimulated production and economic growth. The classical school maintains that defense expenses are likely to weaken economic growth. Additionally, military outlay causes low private investment and domestic savings, finally hampering consumption because of reduced aggregate demand. The supply channel is related to the neoliberal school of thought, by which national defense is treated as a public good that generates opportunity costs. Examining defense expenditures' impact on GDP based on VAR models, Waskiewicz (2020) rejected the possibility of any long-range causality within the Visegrád countries. This aligns with international empirical findings from recent years (Daněk 2015; Topcu and Aras 2015, 2017). Considering the short-term perspective, he proved strong causality in the Czech economy, which is the most developed and stable in the V4 group of countries. The rest of the examined economies did not experience

causality between defense outlay and economic growth. This suggests causality is contingent on national well-being and defense spending's stability, not the total volume of defense expenditures.

Alptekin and Levine (2012) also analyze the relationship between military expenditure and economic growth. They address two main issues: whether a 'genuine' relationship exists between military expenditure and economic growth and the sources of variation in the literature on military expenditure growth. The paper provides a substantial quantitative survey of military expenditure and economic growth literature by conducting a meta-regression analysis. In total, it considers 32 empirical studies and 169 estimates. The authors reject the hypotheses that military expenditure reduces economic growth and is detrimental to economic growth in least-developed countries (LDCs). They also confirm that the effect of military expenditure on economic growth is positive for developed economies and non-linear. Potential explanations for the positive effects observed in developed countries include their relatively lower military expenditure levels than LDCs and their greater focus on military research and development (R&D). Military R&D is often regarded as having beneficial spillover effects on the civilian sector, contributing to technological advancements and economic growth. The finding related to a nonlinear relationship suggests that the net impact of military expenditure on growth may vary in direction or magnitude. The meta-analysis shows that the studies that conducted a non-linear military expenditure-growth relationship found a strong positive effect.

Desli and Gkoulgkoutsika (2021) offer a somewhat different approach. Their study examines the worldwide effect of military spending on economic growth for the period 1960–2017 utilizing the dynamic common correlated effects estimator that accounts for country heterogeneity and cross-sectional dependence, while it provides not only sample-average coefficients but country-specific coefficients as well. They estimate a basic model in which military expenditure is a variable that can potentially impact economic growth without the potential influence of another factor. The model estimation uses the common correlated effects estimator of Chudik and Pesaran (2015). Another component implemented is the Pesaran (2004) cross-sectional dependence test implemented using Ditzgen's (2018) Stata module. Analyzing 99 countries from 1996 to 2017, the authors estimate a two-step procedure. First, they obtain the perceived impact of military spending on economic growth. And then they add control variables to identify the true impact. Different forms of groups were used for the second step of the analysis. One includes 15 countries that were NATO members in 1982. Another formation includes arms-exporting countries, classified by the Stockholm International Peace Research Institute (SIPRI). Developed countries, as defined through their OECD membership, form another selection element. Lastly, a category based on income level is formed, following the World

Bank classification, consisting of high-income, upper-middle-income, and lower-middle-income plus low-income countries. From the first step of the analysis, it becomes evident that the effect tends to be negative and statistically significant in most cases. It becomes stronger following the end of the Cold War era and is affected in the aftermath of the 2001 terrorist attacks, but not by the financial crisis. When the control variables are applied in step two, it provides more accurate information about the true impact of military spending while other influences are being accounted for. In general, in all cases where military spending showed a significant effect overall, that effect was negative. Considering individual countries, the results are lacking stability. For this reason, it can be said that the impact of military spending differs across economies or time frames.

Additionally, Dunne and Tian (2013) analyze nearly 170 studies to find strong evidence that military expenditure negatively affects economic growth, particularly in the post-Cold War era. Cheung (2021) discusses how global technological advancements and geopolitical rivalries reshape defense innovation, proposing a framework for examining its state across various countries in the twenty-first century. Barnum et al. (2024) introduce the Global Military Spending Dataset to improve the measurement of military spending and its correlation with economic factors, uncovering that democratic allies have a substantially dampening effect on military expenditures, while the influence of GDP growth is significantly stronger than previously estimated.

The literature on the relationship between military spending and GDP growth highlights both general economic growth drivers and defense-specific considerations. Key economic factors such as human and physical capital, natural resources, trade openness, and technological advancements are foundational to growth. However, their role in the context of military spending is nuanced. Empirical studies demonstrate mixed outcomes: while trade openness and selective investments promote growth, public debt often hinders it. Research focused on defense spending, particularly in NATO and Visegrád Group countries, illustrates both demand and supply-side considerations, with findings pointing to short-term stimulative effects but limited or no long-term causality. Meta-analyses and advanced econometric studies reveal that the effects of military spending on growth are often nonlinear, varying by country and economic context, with developed nations benefiting more due to lower expenditure levels and a focus on military R&D. Contrarily, many studies, especially in the post-Cold War period, find military spending to be negatively correlated with growth, underscoring the complexities of this relationship across different economies and time frames.

3 Data and Estimation Methodology

Our analysis employs annual data due to its widespread availability across most variables, covering a panel dataset of 40 European countries¹ from 1999 to 2023, resulting in 1,000 observations. However, the panel is unbalanced, as some variables are missing for specific years and countries, leading to varying observation counts depending on the variables included in the model. The primary dependent variable is the share of military expenditure in GDP, which is then used as an explanatory variable for the percentage change in GDP per capita growth from the previous year. Additional drivers of GDP per capita growth are its lagged value and four additional lagged control variables: GDP per capita, investment share of GDP, trade openness, and government expenditure as a percentage of GDP. We also include a dummy variable for EU membership. All data were sourced from publicly available databases, with detailed descriptions, sources, and variable definitions provided in Appendix A1.

Appendix A2 presents key insights into the distribution and variability of these indicators across the observations, illustrating the dataset's diverse economic activities and policy contexts. The descriptive statistics show that the average GDP per capita growth rate is 2.48 percent, with notable variability. The GDP per capita levels exhibit considerable variation, reflected in a standard deviation of 23,852. Investment share and government expenditure remain relatively consistent across observations, whereas trade openness shows a broader range.

Our sample's mean value of military expenditure amounts to 1.6 percent of GDP, with moderate variability. Figure 1 shows the military expenditure for the European countries in the last year of our sample, 2023. Ukraine stands out with 36.65 percent, followed by the Russian Federation at 5.86 percent, with Ireland at 0.22 percent at the bottom. The value for the US is 3.65 percent, with a maximum value of 4.9 percent, as depicted in 2010. There is a total of 13 country-year observations for which a conflict occurred. Serbia in 1999, North Macedonia in 2001, the Russian Federation in 2023, and Ukraine in the 2014–2023 period. The mean value for casualties is 171.33, with a maximum of 91,752 battle-related deaths in Ukraine in 2022. 56 percent of our observations are years when a country was a NATO member and 62 percent for EU membership. As expected, variability in distance observations is quite large, with a maximum value of 3,907 km.

¹ The countries included are: Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Malta, Moldova, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and United Kingdom.

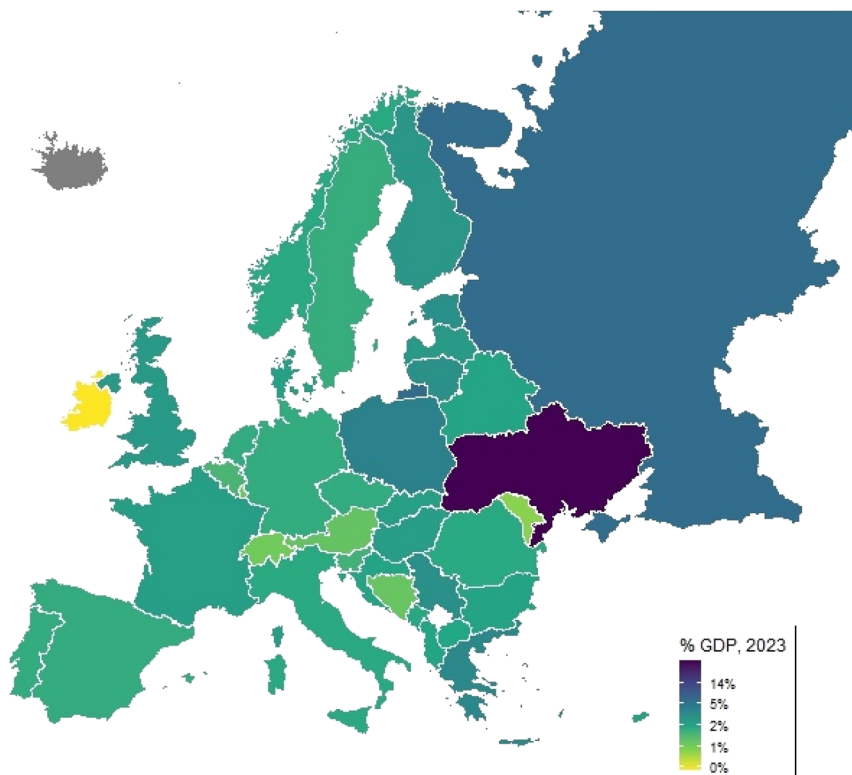


Figure 1: Military expenditure by country in 2023. Note: The variable is scaled as military expenditure per GDP in 2023. Source: SIPRI military database; author's presentation.

The modeling framework we present is grounded in well-established theoretical and empirical literature. Specifically, our approach to military expenditure draws on path dependency and strategic behavior in defense economics (Dunne and Perlo-Freeman 2003; Smith 1980), while our economic growth specification follows the Barro-type regression tradition (Barro 1991), enriched by elements of endogenous growth theory (Aghion and Howitt 1992; Romer 1990). These foundations, discussed in more detail below, provide the conceptual basis for the structure of the model.

We employ fixed effects to control for unobserved country-specific factors that do not vary over time and temporal shocks that affect all countries in the sample. This approach allows us to isolate the within-country variation, helping to address potential omitted variable bias and improving the internal validity of our findings. Since including a lagged dependent variable can introduce additional concerns, such as potential dynamic endogeneity, in addition to fixed effects, we utilize the

generalized method of moments (GMM) with robust standard errors to estimate dynamic panel data models.² The estimated equations are as follows:

$$\begin{aligned} \text{Military expenditure}_{it} = & \beta_1 \text{military expenditure}_{i,t-1} + \beta_2 X_i + \beta_3 C_i \\ & + \beta_4 D_i + \beta_5 I_i + \mu_i + \lambda_t + \varepsilon_i \end{aligned} \quad (1)$$

$$\begin{aligned} \text{gdp per capita growth}_{it} = & \beta_1 \text{gdp per capita growth}_{i,t-1} + \beta_2 X_{i,t-1} + \beta_3 C_{i,t-1} + \beta_4 D_i \\ & + \mu_i + \lambda_t + \varepsilon_i \end{aligned} \quad (2)$$

Equation (1) reveals that in this model, the dependent variable is military expenditure, with its lagged value serving as the first explanatory variable. X represents additional regressors, such as the level of GDP per capita. Vector C captures defense or conflict-related variables such as military expenditure, dummy for conflict, or battle-related number of deaths. D comprises dummy variables in both equations, such as NATO for equation (1) or EU membership for equation (2). Vector I includes interaction terms that capture how the effect of NATO membership on military expenditure varies depending on a country's geographical distance from Russia and the level of US military spending. We construct a variable defined as the aerial distance between Moscow and the European capital to capture the strategic considerations and threat perceptions that may influence a nation's defense spending (building on Boulding 1962, and more recently on Hulme and Gartzke 2021). The underlying hypothesis is that proximity to Moscow, as a geopolitical center, may be a significant determinant of a country's military expenditure decisions. In equation (2), vector X consists of the lagged values of GDP per capita, investment share in GDP, trade openness and the share of government expenditure or government spending net of military expenditure when military expenditure is incorporated as a regressor. μ_i and λ_t represent the country and year fixed effects and ε_{it} is the error term. The estimation begins with a parsimonious model that includes only the lagged value of the dependent variable and some of the regressors. The model is then gradually expanded to incorporate other proposed variables.

Equation (1), modeling military expenditure, is grounded in established defense economics literature. It reflects path dependency in spending behavior (Dunne and Perlo-Freeman 2003; Smith 1980), economic capacity measured through GDP per capita (Deger and Sen 1995), alliance dynamics such as NATO membership (Sandler and Hartley 1995), and threat perceptions shaped by conflict involvement and geographic proximity to adversaries (Collier and Hoeffler 2002). Equation (2), modeling GDP per capita growth, is built upon empirical growth frameworks, particularly Barro-type growth regressions (Barro 1991), incorporating standard

² We employ the 'xtabond2' command in Stata.

determinants like investment, trade openness, and government expenditure. By including military expenditure, conflict, and casualties, this model also reflects insights from the literature on the complex interplay between defense spending and growth (Aizenman and Glick 2006; Benoit 1978), capturing both crowding-out effects and the potential stabilizing role of security. The inclusion of lagged GDP and other dynamic terms aligns with endogenous growth models (Aghion and Howitt 1992; Romer 1990).

Building on the existing literature and the identified research gaps, this paper tests the following hypotheses:

H1: Casualties from conflicts lead to an increase in military expenditure, with the effect being more pronounced in recent years due to heightened security concerns and geopolitical instability.

H2: NATO's influence on military spending is particularly stronger for countries closer to Russia, likely due to heightened security concerns in the post-2014 geopolitical context.

H3: Possibly due to tensions involving Russia post-2014, the security dynamics in Europe are changing, and NATO members might feel the need to increase their own military spending instead of relying on the US military spending.

H4: Military expenditure does not have a significant effect on GDP growth, while armed conflict and casualties have a consistently negative impact on economic performance, confirming that war-related instability undermines growth in the short run.

These hypotheses guide our empirical analysis, helping to clarify how military expenditure and conflict shape economic performance in the European context.

4 Empirical Findings and Discussion

Our estimation strategy examines the main drivers of military expenditure in European countries. After that, we delve into the drivers of economic growth, to which we add defense-related variables as potential driving factors.

Table 1 presents the results of a broader model where we incorporate independent variables and controls from previous literature depicted as important predictors of military expenditure, and we enrich these with additional regressors. Since one of the main predictors of military expenditures is past military

Table 1: Determinants of military expenditure, fixed effects, full sample.

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
<i>Military expenditure_{t-1}</i>	1.264*** (40.186)	1.268*** (39.453)	1.191*** (37.360)	0.673*** (59.206)	0.670*** (58.693)	0.670*** (58.820)	0.670*** (58.775)
<i>Nato</i>	0.139 (1.199)	-0.064 (-0.505)	-0.031 (-0.255)	-0.002 (-0.047)	0.311** (2.532)	0.511*** (3.234)	0.518*** (3.181)
<i>Conflict</i>			2.492*** (9.265)	0.867*** (10.156)	0.867*** (10.195)	0.888*** (10.378)	0.887*** (10.336)
<i>Casualties</i>				0.0002*** (92.455)	0.0002*** (92.762)	0.0002*** (92.919)	0.0002*** (92.732)
<i>Nato*distance</i>					-0.0002*** (-2.676)	-0.0002** (-2.571)	-0.0002** (-2.568)
<i>Nato × US military expenditure</i>						-0.057** (-2.013)	-0.058** (-2.013)
<i>gdp per capita</i>						-0.007 (-2.007)	-0.012 (-0.167)
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES	YES
Adjusted R2	0.738	0.743	0.765	0.977	0.978	0.978	0.978
F-statistic	68.12***	44.57***	49.28***	631.1***	626.1***	619.1***	609.6***
Observations	979	979	979	979	979	979	979

Notes: The dependent variable is military expenditure. t-statistics are provided in parentheses. ***, ** and * indicate statistical significance at the 1, and 5 percent levels.

expenditures, the lagged value of the dependent variable is our crucial regressor. As discussed in the previous chapter, fixed effects are commonly used to estimate panel data, and the results of these estimations are presented in Table 1. We present seven models, from the most parsimonious one incorporating only two regressors and country fixed effects to the most elaborate one in the last column. Model (1) suggests that the lagged value of the dependent variable is statistically significant, positive, and large. The coefficient of 1.264 implies that a 1-percentage-point increase in military expenditure in the previous year, on average, leads to a 1.264 percentage-point increase in military expenditure in the current year. This result aligns with existing research and is consistent throughout different model specifications presented in Table 1. We have also added a dummy NATO-member variable in Model (1) to control for the fact that not all European countries are NATO members. 28 European countries were NATO members up to 2023 (the most recent member, Sweden, joined in 2024) out of 40 countries we explore in this paper. The coefficient is positive but not statistically significant, implying that NATO membership alone does not have a discernible effect on a country's military spending. This indicates that any influence of NATO on defense budgets becomes more evident only when factors like threat perception or geopolitical proximity are included, as seen in later models. We enhance this model by year fixed effects and a dummy variable for country being in conflict in a given year in Model (3). Conflict appears to be statistically significant, large, and positive. The coefficient of 2.492 indicates that active conflict is a major driver of defense expenditures. To test the first part of our H1 hypothesis, we add casualties in Model (4). Including casualties decreases lagged military expenditure and conflict coefficients, but they remain positive and statistically significant. Although low, the coefficient next to casualties accumulates for large-scale conflicts since each additional casualty is associated with a 0.02 percent increase in military spending. This confirms the first part of the H1 hypothesis.

Models 5 and 6 incorporate interaction terms: NATO membership with distance to Moscow and NATO membership with US military spending. The interaction term with distance confirms the first part of our H2 hypothesis, and the negative and statistically significant coefficient suggests that for NATO members, each additional unit of distance from Moscow is associated with a 0.02 percent reduction in military spending. NATO members tend to spend more on defense, but this effect weakens with distance. For NATO members, each additional unit increase in US military spending is associated with a 5.9 percent decrease in national military spending. This suggests possible burden-sharing – NATO countries may rely on US defense spending rather than increasing their own budgets. The military expenditure of the US can be seen as a precursor to lower military expenditure in European countries for several reasons. First, the US has historically provided a security umbrella for Europe, particularly through NATO. This means that European countries have been able to

rely on the US for significant military support, reducing the need for high defense spending. This phenomenon is often called “burden-sharing,” where the US takes on a substantial portion of the defense burden, allowing European allies to spend less (Kivimäki 2019). Second, high US military expenditure can lead to stability in global security, which might reduce the perceived threat levels in Europe. As a result, European countries may prioritize economic development, welfare, or other domestic expenditures over military investments, trusting in US military power to deter major threats. Third, while NATO sets defense spending targets (such as 2 percent of GDP), the strong US military presence and investment have historically allowed many European NATO members to fall short of these targets without significantly compromising collective security. This reliance on US military strength indirectly encourages lower military spending among European allies (as explained in Kivimäki 2019).

Results from Model (7) imply that the level of economic development (represented by *gdp per capita*) does not significantly impact military expenditure. In other words, wealthier countries in this sample do not necessarily spend more or less on defense once other factors – such as conflict, NATO membership, casualties, and strategic positioning – are accounted for. This result aligns with the idea that military spending decisions are often driven more by security concerns, geopolitical context, and alliance dynamics than by purely economic capacity.

We proceed by splitting our benchmark Model (7) into varying subsamples. The first subsample focuses on the years before the Russian aggression on Ukraine, i.e. the period from 1999 to 2021, and the second subsample on the post-2014 period (Table 2).

Table 2: Determinants of military expenditure, fixed effects, different time periods.

Variables	Benchmark model (1999–2023)	1999–2021	2014–2023
<i>Military expenditure</i> _{<i>t</i>–1}	0.670*** (58.775)	0.562*** (26.863)	0.696*** (57.178)
<i>Nato</i>	0.518*** (3.181)	0.522*** (3.194)	1.720** (2.280)
<i>Conflict</i>	0.887*** (10.336)	1.242*** (12.120)	1.008*** (4.301)
<i>Casualties</i>	0.0002*** (92.732)	–0.0001** (–2.233)	0.0002*** (93.433)
<i>Nato</i> × <i>distance</i>	–0.0002** (–2.568)	–0.0002*** (–2.748)	–0.0006** (–2.473)
<i>Nato</i> × <i>US military expenditure</i>	–0.058** (–2.013)	–0.052* (–1.864)	–0.014 (–0.798)
<i>gdp per capita</i>	–0.012 (–0.167)	–0.059 (–0.782)	–0.011 (–0.468)
Country FE	YES	YES	YES

Table 2: (continued)

Variables	Benchmark model (1999–2023)	1999–2021	2014–2023
Year FE	YES	YES	YES
Adjusted R ²	0.978	0.917	0.991
F-statistic	609.6***	147.3***	789.4***
Observations	979	899	400

Notes: The dependent variable is military expenditure. t-statistics are provided in parentheses. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels.

Compared to the benchmark, we can tell that the effect of lagged military expenditure increases with the conflict in Ukraine. Also, the difference for NATO members becomes more apparent, especially in the post-2014 period (third column), implying that member states spent more on defense than before 2014. This result aligns with a recent finding by Dimitriou et al. (2024), who emphasize that alliance participation incentives or facilitates increased defense commitments. The variable that measures conflict in the 2014–2023 period – characterized by heightened geopolitical tensions – shows a slightly higher coefficient than the benchmark but lower than 1999–2021, possibly indicating that military spending has become more systematic or embedded in budgets post-2014, not just conflict-reactive. The benchmark and 2014–2023 estimates for casualties are positive, highly significant, and identical, reinforcing the idea that rising battle-related deaths increase military spending. Interestingly, from 1999 to 2021, the coefficient became negative and significant, implying that higher casualties may have led to military restraint or shifts toward conflict de-escalation in earlier years. This could reflect changing political dynamics or international norms pre-2014. This confirms the second part of our H1 hypothesis.

This $NATO \times distance$ interaction term is consistently negative and significant across all periods, indicating that distance from Russia continues to dampen the effect of NATO membership on military spending. However, the effect was strongest during 2014–2023, suggesting that proximity to Russia became a more powerful driver of military buildup after 2014, likely due to growing concerns over regional security following Crimea's annexation and the Ukraine conflict. This confirms the second part of our H2 hypothesis.

In the benchmark and 1999–2021, the $NATO \times US\ military\ spending$ interaction term is negative and significant, consistent with the idea that increases in US military spending reduce the pressure on NATO allies to spend more (burden-sharing). But during 2014–2023, the coefficient becomes smaller and statistically insignificant, indicating that in recent years, European NATO countries no longer reduce their

spending in response to US defense increases. This could reflect shifting alliance dynamics, greater emphasis on autonomy, or pressure to meet NATO’s 2 percent GDP target, consistent with our H3 hypothesis. Recent research highlights a post-2014 shift in EU defense dynamics, with rising national military spending coinciding with a decline in joint cooperation initiatives (Mombelli 2024). These results are also consistent with the literature on spillover effects (George and Sandler 2022, 2024). Several spillover effects within NATO are explored, including free riding among allies, responses to Russian military spending, and the strategic implications of NATO enlargement, all of which influence defense spending behaviors and regional security dynamics.

The GMM results (Table 3) largely confirm the fixed effects findings, particularly the positive and significant effect of NATO membership and lagged military expenditure on current military spending. However, some variables – like conflict – lose

Table 3: Determinants of military expenditure, GMM estimations.

Variables	Benchmark model (1999–2023)	1999–2021	2014–2023
<i>Military expenditure_{t-1}</i>	0.898*** (0.111)	0.879*** (0.042)	0.908*** (0.227)
<i>Nato</i>	0.363*** (0.079)	0.234*** (0.067)	0.331 (0.459)
<i>Conflict</i>	1.046 (1.111)	1.888 (1.563)	−0.110 (0.518)
<i>Casualties</i>	0.0002*** (0.000)	−0.000 (0.000)	0.0002*** (0.000)
<i>Nato*distance</i>	−0.00003* (0.000)	−0.000 (0.000)	−0.00007*** (0.000)
<i>Nato × US military expenditure</i>	−0.068*** (0.017)	−0.045*** (0.016)	−0.037 (0.115)
<i>gdp per capita</i>	0.005 (0.005)	0.002 (0.025)	−0.016 (0.038)
AR(1)	−2.14**	−1.86*	−2.34**
AR(2)	1.26	0.30	1.27
Sargan test	26.51	38.77***	4.91*
Hansen test	27.04	22.49	2.62
Observations	942	862	400

Notes: The dependent variable is military expenditure. Robust standard errors are provided in parentheses. AR(1) and AR(2) are the serial correlation tests, with AR(2) being the Arellano-Bond test for second-order serial correlation in the first-differenced errors for which the null hypothesis is the absence of serial correlation. The Sargan is a test of overidentifying restrictions for which the null hypothesis is that the instruments are valid, assuming homoskedastic errors. The Hansen test is a robust version of the Sargan test that allows for heteroskedasticity, though its power may be weakened with many instruments. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels.

statistical significance under GMM, suggesting potential endogeneity concerns or reduced short-term responsiveness when accounting for dynamic relationships. The interaction terms remain negative and significant, reinforcing the burden-sharing hypothesis, while distance continues to have a dampening effect. Overall, the GMM estimations provide robustness to the core results while highlighting the importance of accounting for dynamics and endogeneity in the military expenditure-growth nexus.

We now turn to incorporating military expenditure into the GDP growth equation. Table 4 presents building a GDP growth model that incorporates the standard growth drivers, the lagged dependent variable, the lagged level of GDP per capita, investment, trade openness, and government expenditure (Models 1 and 2). We then add a dummy variable for EU membership (column 3), which has a negative effect since most EU members are high-income countries with naturally lower GDP growth rates, as consistent with the convergence hypothesis. Model (3) presents expected results, such as that previous GDP per capita growth positively affects growth in the current period, that the level of GDP per capita has a small negative effect and that trade openness and government expenditure are strongly positively associated with GDP growth (as found in Frankel and Romer 1999). Since we are interested in how expenses on defense affect growth, to Model (3), we add our military expenditure variable. Still, since this expense is incorporated into government expenditure, we need a new variable to represent government expenditure. This variable is government spending net of military spending. Results in column 4 show that our coefficients are not affected by the inclusion of military expenditure but also that this variable does not seem to be correlated with GDP per capita growth. We then (column 5) use another, more sensitive measure of conflict, a dummy variable that detects a country in conflict. As expected, conflict, not military spending alone, strongly predicts GDP growth. A country in conflict decreases its GDP per capita growth on average by as much as -3.477 percentage points. Taking the mean GDP per capita growth in our sample as 2.484 leads to a -0.993 GDP per capita growth rate or deteriorating economic standard. In model (6), we incorporate a varying measure of conflict: the number of battle-related casualties. The results are consistent, with a thousand deaths correlated with a 2-percentage point drop in GDP growth. These results confirm our H4 hypothesis.

The GMM results in Table 5 serve as a robustness check for the fixed effects models in Table 4 and confirm several key findings, particularly the negative and significant effect of lagged GDP per capita on GDP per capita growth, consistent across both approaches. However, military expenditure, which appeared positive but insignificant under fixed effects, now shows a negative but still insignificant

Table 4: Determinants of GDP per capita growth, fixed effects estimations.

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
gdp per capita growth $_{t-1}$	0.336*** (8.704)	0.332*** (8.870)	0.326*** (8.736)	0.328*** (8.749)	0.309*** (8.184)	0.300*** (7.992)
gdp per capita $_{t-1}$	-0.0004*** (-6.782)	-0.0002*** (-3.707)	-0.0003*** (-4.025)	-0.0003*** (-4.022)	-0.0002*** (-4.206)	-0.0003*** (-4.214)
$Investment_{t-1}$	0.028 (0.293)	0.006 (0.079)	-0.004 (-0.054)	-0.007 (-0.092)	0.003 (0.041)	0.003 (0.040)
$Trade\ openness_{t-1}$	0.020* (1.932)	0.045*** (5.325)	0.051*** (5.774)	0.051*** (5.771)	0.051*** (5.828)	0.051*** (5.869)
$Government\ expenditure_{t-1}$	0.228** (2.233)	0.262** (3.289)	0.210** (2.539)			
eu			-1.137** (-2.290)	-1.120** (-2.255)	-1.219** (-2.472)	-1.229** (-2.511)
$Government\ spending$ $net\ of\ military$ $expenditure_{t-1}$				0.213** (2.537)	0.200** (2.381)	0.198** (2.377)
$Military\ expenditure_{t-1}$				0.311 (0.797)		
$Conflict_{t-1}$					-3.477** (-2.179)	
$Casualties_{t-1}$						-0.002*** (-3.518)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	YES	YES
Adjusted R2	0.289	0.602	0.605	0.604	0.607	0.612
F-statistic	7.246***	17.57***	17.49***	17.21***	17.39***	17.74***
Observations	648	648	648	648	648	648

Notes: The dependent variable is GDP per capita growth. t-statistics are provided in parentheses. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels.

Table 5: Determinants of GDP per capita growth, GMM estimations.

Variables	Model (1)	Model (2)	Model (3)
<i>gdp per capita growth</i> _{<i>t</i>−1}	−0.757 (0.503)	−0.677 (0.552)	−0.736 (0.548)
<i>gdp per capita</i> _{<i>t</i>−1}	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)
<i>Investment</i> _{<i>t</i>−1}	0.031 (0.205)	0.015 (0.203)	0.024 (0.204)
<i>Trade openness</i> _{<i>t</i>−1}	0.053 (0.056)	0.047 (0.066)	0.054 (0.065)
<i>Government spending net of military expenditure</i> _{<i>t</i>−1}	−0.687 (0.778)	−0.575 (0.905)	−0.655 (0.876)
<i>eu</i>	1.389* (0.785)	1.383 (0.900)	1.460 (0.911)
<i>Military expenditure</i> _{<i>t</i>−1}	−0.248 (1.778)		
<i>Conflict</i> _{<i>t</i>−1}		−9.561** (4.556)	
<i>Casualties</i> _{<i>t</i>−1}			−0.003*** (0.001)
AR(1)	0.19	0.22	0.18
AR(2)	−1.49	−1.32	−1.39
Sargan test	2.48	2.48	2.93*
Hansen test	0.88	0.49	0.72
Observations	614	614	614

Notes: The dependent variable is military expenditure. Robust standard errors are provided in parentheses. AR(1) and AR(2) are the serial correlation tests, with AR(2) being the Arellano-Bond test for second-order serial correlation in the first-differenced errors for which the null hypothesis is the absence of serial correlation. The Sargan is a test of overidentifying restrictions for which the null hypothesis is that the instruments are valid, assuming homoskedastic errors. The Hansen test is a robust version of the Sargan test that allows for heteroskedasticity, though its power may be weakened with many instruments. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels.

coefficient, suggesting no robust link with growth. Importantly, conflict and casualties remain negatively associated with growth and retain statistical significance under GMM, reinforcing the adverse economic effects of violence and instability. While dynamic estimations reveal some shifts in magnitude and sign, the core message on conflict-related variables holds firm.

5 Concluding Remarks

The strategic landscape of Europe and the entire world has changed immensely over the last decade, bringing significant uncertainty. The multilateral forums of

governance have gradually lost their legitimacy. At the same time, unilateral and assertive activities of increasing subjects had driven the world back to the environment in which geostrategic competition and military leverage prevail over cooperative frameworks of security. Consequentially, this affects the economic performance of European countries and creates increased pressure on defense spending as a functional precondition of a sustainable security system.

This study delves into the complex relationship between military expenditure and economic growth in European countries, shedding light on the broader implications of defense spending for regional stability and development. Through a detailed analysis of military expenditure and its interplay with economic variables such as GDP growth, trade openness, government expenditure, and investment, several key insights emerge that can inform policy decisions in a rapidly changing geopolitical environment.

First and foremost, our findings emphasize the nuanced effects of military spending on economic growth. While military expenditure does not appear to be directly correlated with GDP per capita growth, the influence of conflict is significantly detrimental. Countries experiencing conflict see substantial declines in their GDP growth, as reflected in our model, which suggests that battle-related deaths can lead to a reduction in growth by two percentage points. This highlights the catastrophic economic consequences of war and underscores the importance of conflict prevention in promoting sustained economic development.

Our results also reinforce the importance of strategic defense spending in maintaining stability. European nations, particularly those in NATO, have historically benefited from the alliance's collective security arrangements. NATO membership is associated with higher defense spending, especially post-2014, where member states catch up with the 2 percent defense budget obligation reflecting the impact of growing geopolitical tensions, such as the Russian invasion of Ukraine. This effect is further nuanced by the interaction with distance to Moscow, where NATO member states farther from Russia tend to allocate less to defense. This shift suggests that recent security challenges are prompting even NATO countries to reassess and strengthen their defense budgets.

On a broader scale, the study also reinforces the positive relationship between trade openness and government expenditure with economic growth. Our analysis reveals that countries with higher levels of trade openness experience stronger economic growth, aligning with existing literature that links international trade to economic prosperity. Similarly, government expenditure, excluding military spending, is positively associated with GDP growth, suggesting that well-targeted public investments can foster economic development. This insight has important implications for policymakers who must balance defense needs with economic

growth objectives, ensuring that defense investments do not crowd out vital public sector investments in education, infrastructure, and health necessary for long-term prosperity.

One of the most critical takeaways from this research is the economic burden that conflict places on affected nations. The findings show that countries in conflict suffer significant economic setbacks, with GDP growth rates falling dramatically due to battle-related deaths and the broader consequences of warfare. This finding is a stark reminder of the importance of diplomacy, conflict prevention, and international cooperation in maintaining peace and security. For European policymakers, particularly in light of recent tensions with Russia and the ongoing war in Ukraine, the study emphasizes the need to invest not only in military capabilities but also in robust diplomatic and economic strategies that can prevent the escalation of conflicts into full-scale wars.

In conclusion, the study highlights the multifaceted nature of defense spending, underscoring its dual role in safeguarding security and influencing economic outcomes. While military expenditure alone does not guarantee economic growth, the broader security environment, trade openness, and government investment are all integral to fostering prosperity. Policymakers must carefully navigate the complex dynamics between defense, economic growth, and security, ensuring that defense spending is aligned with broader economic goals and that the specter of conflict is mitigated through international cooperation and strategic planning. Future research could build on the work of Becker and Dunne (2023) and Becker et al. (2024) by exploring the impact of disaggregated military expenditure data, examining how different components of defense spending – such as personnel, equipment, infrastructure, and operations and maintenance – affect economic outcomes, providing a more nuanced understanding of defense budgets' economic impacts. The recent shifts in the global security landscape make these insights particularly timely, as European countries face increasingly complex and volatile challenges that require both military readiness and economic resilience.

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Appendices

Appendix A1: Variables and Data Sources

Variable	Definition	Source	Period
Military expenditure	All current and capital expenditures on the armed forces (% of GDP)	Stockholm International Peace Research Institute (SIPRI), Yearbook: Armaments, Disarmament and International Security	1999–2023
US military expenditure	All current and capital expenditures on the armed forces in the US (% of GDP)	Stockholm International Peace Research Institute (SIPRI), Yearbook: Armaments, Disarmament and International Security	1999–2023
Conflict	Dummy variable for the country in armed conflict where at least one party is the government of a state	UCDP/PRIO Armed Conflict Dataset version 24.1	1999–2023
Casualties	The UCDP best estimate for battle-related deaths in the dyad in the given year	UCDP Battle-related Deaths Dataset Codebook Version 24.1	1999–2023
nato	Dummy variable indicating NATO membership in the given year	NATO	1999–2023
GDP per capita growth	GDP per capita growth (annual %)	World Bank national accounts data, and OECD National Accounts data files	1999–2023
GDP per capita	Logarithm of the GDP per capita (constant 2015 US\$)	World Bank national accounts data, and OECD National Accounts data files	1999–2023
Investment	Net investment in nonfinancial assets (% of GDP)	International Monetary Fund, Government Finance Statistics Yearbook and data files	1999–2023
Trade openness	Sum of exports and imports of goods and services (% of GDP)	World Bank national accounts data, and OECD National Accounts data files	1999–2023
Government expenditure	General government final consumption expenditure (% of GDP)	World Bank national accounts data, and OECD National Accounts data files	1999–2023
Government spending net of military expenditure	Government spending net of military expenditure (% of GDP)	Stockholm International Peace Research Institute (SIPRI), Yearbook: Armaments, Disarmament and International Security	1999–2023
eu	Dummy variable indicating EU membership in the given year	EU	1999–2023
Distance	The aerial distance between capital cities and Moscow (in kilometers)	Google maps	2024

Appendix A2: Descriptive Statistics

Variable	Number of observations	Mean	Standard deviation	Min	Max
Military expenditure	982	1.613	1.577	0.016	36.653
US military expenditure	1,000	3.787	0.554	3.086	4.904
Conflict	1,000	0.013	0.113	0	1
Casualties	1,000	171.33	3,663.52	0	91,752
Nato	1,000	0.557	0.497	0	1
gdp per capita growth	987	2.484	4.099	−17.127	23.305
gdp per capita ^a	991	26,260	23,852	1,316	112,418
Investment	648	2.455	2.498	−1.812	25.655
Trade openness	990	111.583	57.473	22.492	394.221
Government expenditure	989	19.166	3.61	9.692	41.684
Government spending net of military expenditure	942	17.542	3.416	6.290	27.246
eu	1,000	0.616	0.487	0	1
Distance	1,000	1,800	750.89	0	3,906.86

^aFor the estimation, the GDP per capita variable is used in the logarithm, but it is in its original form for descriptive statistics.

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