

The Central Northern European Military Mobility Area: Economic Determinants of Defence Modernisation and Strategic Mobility

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Abstract

The paper examines the economic determinants of military modernisation within the Central Northern European Military Mobility Area (CNE MMA) from 2010 to 2024. Using correlation analysis and linear models for panel data, the paper investigates the relationship between Gross Domestic Product (GDP) growth and expenditures on military equipment and infrastructure across eight member states. Furthermore, the article defines the roles of individual states within the military mobility capability across European territory. A significant contribution of this work, which distinguishes it from existing literature in the field, is the assessment of the specific relationship between economic growth and defence infrastructure investments. While most research focuses on aggregate military spending, this study isolates infrastructure investment as a critical enabler of strategic mobility. The findings reveal a significant infrastructure decoupling in major powers like Germany and Poland, where equipment procurement crowds out infrastructure investment despite rising budgets. Conversely, frontline state like Lithuania demonstrates synchronized spending. The study concludes that current prioritisation of equipment over infrastructure creates strategic risks for rapid force deployment. The primary contribution lies in the disaggregated analysis of dual-use infrastructure within the CNE MMA framework, providing actionable insights for balancing fiscal allocation to ensure logistical resilience in contemporary geopolitical conditions.

KEY WORDS: *military mobility, CNE MMA, host nation support, military expenditure, mobility infrastructure investments, GDP growth rate, linear model for panel data.*

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1. Introduction

The European Union (EU) and the North Atlantic Treaty Organisation (NATO) are currently prioritizing not only the augmentation of member states' organic military capabilities but also the increasingly critical sphere of military mobility assurance. A pivotal initiative aimed at dismantling procedural impediments and fostering interoperability is the Central Northern European Military Mobility Area (CNE MMA). The multilateral framework was established in November 2025 and comprises eight member states (Belgium, Germany, Lithuania, Luxembourg, the Netherlands, Poland, the Slovak Republic and the Czech Republic) that have decided to improve defence readiness and military mobility in Europe. It harmonizes the legal, administrative, and logistical frameworks relating to military mobility and creates a framework for cooperation aimed at ensuring that, in the future, equipment and personnel can be deployed across sovereign borders with greater speed, fluidity, and operational efficiency [1, 2, 3].

However, the effectiveness of such an agreement depends not only on political will but on the economic capacity to fund the necessary equipment (as a tool to deter and defend) and infrastructure (as an enabler to deploy and sustain force). Covering the critical period from 2010 to 2024, the analysis bridges the gap between the post-global financial crisis era of fiscal austerity and the current imperative of high-intensity territorial defence.

Particular emphasis is placed on the disaggregation of military expenditure into the equipment and infrastructure categories, investigating how Gross Domestic Product (GDP) fluctuations impact these investment vectors through regression and correlation logic. Furthermore, the study integrates these fiscal trends with the strategic requirements of NATO Military Mobility initiative, assessing whether economic growth has translated into the logistical resilience required for rapid force deployment.

Europe's security architecture has undergone a fundamental transformation over the past fifteen years, reflecting a strategic shift from the fiscal austerity characteristic of the early 2010s to the pronounced militarization and accelerated defence investment of the 2020s. Within the NATO framework, the initial pledge by member states to allocate a minimum of 2% of GDP to military expenditure has progressively evolved into a more ambitious target of 5% of GDP.

In 2014, NATO heads of state and government agreed that individual countries would spend 2% of their GDP on military expenditure to help ensure the Alliance's continued military readiness. This decision was taken in response to Russia's annexation of Crimea and also in light of the instability in the Middle East. The 2% target followed on from a commitment agreed by NATO defence ministers in 2006 as an important indicator of political commitment to contribute to NATO's collective defence efforts [4].

In 2025, a new official target was adopted to contribute 5% of GDP by 2035 to basic defence needs and defence and security-related expenditures. The Alliance argues that the security environment is deteriorating dramatically, European armies have been underfunded for a long time, and there is a need for modernization, air defence, and logistics. Based on the agreed definition of military spending, at least 3.5% of GDP should be allocated annually to basic military capabilities (purchase and modernization of equipment, ammunition and expansion of its production, supplies, army operations, training, personnel, investment in infrastructure, etc.) and 1.5% will be spent on critical infrastructure protection, network defence, innovation, and strengthening the defence industrial base. This objective serves as a response to the deteriorating security environment, the imperative to bolster deterrence, the increasing demands of collective defence, and the necessity of scaling up investments in advanced technologies, logistics, and collaborative projects [4].

According to NATO defence expenditure definitions, infrastructure is classified as a distinct spending category, separate from expenditures on equipment. The 2014 Wales Summit Declaration stipulates a 20 % guideline exclusively for the equipment category, encompassing major equipment and research and development. It follows that infrastructure requirements are determined based on specific Capability Targets within the NATO Defence Planning Process, rather than through a flat-rate percentage indicator. Building upon recent studies investigating the proportion of defence spending dedicated to equipment and the associated investment gap, this paper extends the analysis to encompass infrastructure expenditures [4].

2. Economic Impacts of Military Spending: Research Overview

The question of the relationship between economic growth (measured by GDP) and the size of military spending has been present in the public sphere, and especially in academic and professional discussions, for more than five decades. Research focuses on different groups of countries, different time periods, and uses different methodological approaches.

In his pioneering work, Benoit [5] demonstrated a positive correlation between military spending and economic growth. Based on correlation analysis, he concluded that military spending has a positive effect not only on economic growth but also on investment, especially in developing countries. Dimitriou et al. [6] confirm the positive correlation between military spending and economic growth in NATO member states, while a negative relationship is observed in non-member states. The positive relationship between GDP and the level of military spending in seven of the countries studied is further confirmed by a study by Nikolaidou [7]. Solarin [8], based on an analysis of eighty-two countries between 1989 and 2012, also reports a positive impact of economic performance on military spending. Brizgalová et al. [9] confirm a significant positive link between GDP and military spending in Poland and, to some extent, in Hungary, but this link was not confirmed in the remaining two V4 countries. Ferraz [10] examined the long-term relationship between military spending and economic growth in fifteen NATO countries over the past fifty years. The results showed a positive and statistically significant relationship in Belgium, Canada, France, Greece, Italy, Sweden, Turkey, and the United States.

The neutral impact of military spending on economic growth is mentioned in the works of Biswas and Ram [11] and Mintz and Stevenson [12], for example. Alptekin and Levin [13] conducted a meta-regression analysis, which yielded several conclusions: there is a positive relationship between military spending and economic growth, a negative relationship was not confirmed even in the least developed countries, and the hypothesis of the nonlinear nature of this relationship was confirmed. The authors also found that differences in the samples of countries studied and in the time period contribute to the different results of individual studies.

Azam [14] found a negative impact of military spending on economic growth in his study covering thirty-five countries outside of the Organization for Economic Co-operation and Development (OECD) between 1988 and 2019. His findings suggest that non-OECD countries are developing countries with limited resources that cannot use military spending to support economic growth. The negative impact of military spending on economic growth was also confirmed by Simpartl [15] in his meta-analysis from sixty-seven studies.

This brief overview shows that individual studies have not reached a clear conclusion regarding the relationship between military spending and economic growth. The differences in results are related to the characteristics of the countries studied, the time period observed, and the methods or methodological approaches used. In recent years,

researchers have increasingly focused on the impact of specific military expenditure categories on economic growth. Becker and Dunne [16] highlight significant heterogeneity across these categories, citing the negative correlation between military spending and mandatory expenditures as a primary example.

In the context of the CNE MMA, the authors propose a synthesis of these perspectives. While expenditures on personnel or imported munitions may yield lower multipliers, investments in dual-use infrastructure, such as railways, bridges, and ports, typically exhibit high fiscal multipliers, thereby supporting the civilian economy while simultaneously fulfilling military requirements. Furthermore, Kofroň [17] argues that military capability represents a "variable stock"—the cumulative result of years of investment in equipment. Consequently, a single year of spending at 2% of GDP is insufficient; sustained cumulative investment is required to restore the capital stock depleted during the era of austerity between 2010 and 2014. Müllner and Nečas [18], who analysed military investments in equipment, using the example of the Bucharest Nine, concluded that between 2004 and 2022, there was first a sharp increase in the gap in defence investments and then, after 2014, its partial repayment occurred, when the investment gap was reflected in both the volume and the condition of military equipment.

3. Methodological Framework and NATO Defence Expenditure Definitions

NATO employs a specific methodology for defining defence expenditures that differs significantly from standard national budgetary definitions and the Classification of the Functions of Government (COFOG) defined by OECD and applied by the United Nations (UN) [19]. This NATO rigorous definition is essential for ensuring data comparability across member states and for the transparent assessment of burden-sharing commitments.

Defence expenditures are defined as payments made by a national government specifically to meet the needs of its armed forces, those of its Allies, or the Alliance as a whole [4]. Crucially, the methodology is based on actual cash payments made during the fiscal year rather than mere budgetary allocations or future commitments—a distinction particularly relevant for multi-year infrastructure projects [19].

Infrastructure expenditures are meticulously partitioned to reflect both the specific requirements of sovereign states and their contributions to collective security. In NATO reporting, infrastructure is understood as the aggregate of *National Military Construction (NMC)* and the net *contribution to NATO's Common Infrastructure* [20, 4].

National Military Construction category includes capital construction projects funded directly through national budgets to serve the specific needs of a member state's armed forces. The breakdown typically includes:

1. Construction and modernization of barracks, housing, and administrative facilities.
2. Development of training areas, firing ranges, and simulation centres.
3. Storage facilities for equipment, ammunition, and strategic reserves.
4. Airfield and maritime port installations of national significance [21].

NATO Common Infrastructure Category represents the apex of Alliance cooperation regarding physical and technical capabilities. These expenditures are included in a state's total defence spending only to the extent of its net contribution. The decomposition of category includes:

1. Expenditure as Host Nation: Payments made by a national government for projects on its own territory that have been approved as Alliance priorities for collective use.
2. Payments to Other Nations: Direct financial transfers to NATO common funds or bilateral payments for shared infrastructure.
3. Receipts from Other Nations: These are deducted from total expenditure and represent reimbursements received from Allies for the use of national facilities.
4. Land and Utilities: Costs associated with land acquisition and the provision of critical utility networks (power, water, and data) necessary for Alliance infrastructure [20].

The NATO Security Investment Programme (NSIP) is the primary mechanism for realizing collective investments that exceed the requirements or capacities of individual members. It focuses on installations and Command and Control (C2) systems vital for Alliance-wide integrity [21]. The scope of NSIP expenditures specifically includes:

1. Air Defence Systems: Radars, Communication and Information Systems (CIS), and the Alliance's digital backbone.
2. Military Headquarters: Both static and deployable elements of the NATO Command Structure.
3. Logistical Support and Mobility: Critical airfields, deep-water ports, the NATO Pipeline System (NPS), and Prepositioned Equipment Storage (PES) facilities [21, 22].

NSIP funding adheres to the "Over and Above" principle, meaning collective funding is restricted to requirements that exceed national needs. Projects must also meet the Minimum Military Requirement (MMR), defined as the most austere facility capable of fulfilling an identified military need [21, 22].

Expenditure across all specified categories are fundamental to ensuring military mobility. In many instances, it is impossible to clearly assign a developing capability to a single financial framework, leading to functional overlaps and mutual reinforcement. For example, national infrastructure investments cannot be categorically separated from the development of member states' Host Nation Support (HNS) capabilities, even if these are not officially designated as NATO-declared capabilities for the Reinforcement and Sustainment Network (RSN).

Military infrastructure serves a multi-faceted role: it supports Alliance training activities, provides contingency areas for deployed NATO units, and offers capacities allocated under bilateral agreements or as facilities for Host Nation units involved in providing movement support. Consequently, these investments are vital for ensuring military mobility. Currently, NATO—through the Joint Support and Enabling Command (JSEC)—is conducting a gap analysis of the RSN to identify infrastructure essential for the deployment and sustainability of forces under the NATO Force Model within the Supreme Allied Commander Europe’s (SACEUR) Area of Responsibility (AOR) [23]. Identified capability gaps may be addressed through national development projects or supplemented via co-financing requests, such as through NSIP.

4. CNE MMA - European Military Mobility Catalyst

The primary goal of the CNE MMA is to establish an environment where military forces and equipment can transit seamlessly, eliminating administrative and technical friction. This objective necessitates the synchronization of infrastructure development, the unification of border-crossing regulations, and the streamlining of information exchange. Serving as a concrete regional implementation of RSN principles, the CNE MMA functions as a strategic model for the wider Alliance. Within this framework, each member state assumes a specific role dictated by its geostrategic position and national capabilities, ensuring the corridor operates as a unified whole (see Table 1). To fully contextualize the findings of this analysis, it is essential to define the individual responsibilities and relevant example activities of each member within the system.

Table 1.

Member Roles within the CNE MMA

State	Strategic Role	Responsibility/Activity
Germany	Central Hub and primary transit nation	Management of backbone road/rail networks, provision of Convoy Support Centres.
Netherlands	Gateways to Europe	Operating major ports (Rotterdam, Antwerp) and simplifying port customs procedures.
Belgium		
Poland	Vital transit and Staging Area for the Eastern Flank	Infrastructure development toward Lithuania, supporting Suwalki Gap units, rail terminal modernization.
The Czech Republic	Central transit and connecting corridors	Ensuring flow between West, East, and South; modernizing D5/D11 motorways; rapid permit issuance.
The Slovak Republic		
Lithuania	Forward area and Baltic integrator	Modernizing Via Baltica and the Lazdijai–Alytus–Vilnius route to reinforce the Suwalki Gap.
Luxembourg	Specialized support and network management	Participation in CEPS (pipeline) and implementation of the National Action Plan on Military Mobility.

5. Method of investigation

The authors formulated research questions aimed at identifying the interrelationships between the primary economic determinant (GDP growth) and military expenditure, specifically focusing on equipment and infrastructure, as these two subcategories are pivotal to the investigated subject matter. To evaluate these relationships, a correlation analysis was conducted individually for each respective state.

To analyse broader tendencies within the statistical sample of countries throughout the 2010–2024 period, two linear models for panel data were developed.

Panel data, which combine time series and cross-sectional data, allow for capturing the dynamics of changes over time as well as the specifics of individual states, thus providing more robust results than simple regression models. All calculations were performed in the R statistical environment using the specialized PLM package.

To analyse the relationship between GDP growth rates and the structure of military expenditure, a linear fixed model for panel data was utilized. This model is designed to control for unobserved individual heterogeneity. The basic specification of the model in levels is defined by the following equation [24]:

$$(y_{it} - \bar{y}_i) = \beta^T + \beta^T(x_{it} - \bar{x}_i) + (\epsilon_{it} - \bar{\epsilon}_i) \quad (1)$$

Where i represents the country and t denotes the time period. The variable y_{it} is a vector of dependent variables (military expenditure or equipment), while $\bar{y}_i$ represents the average value of the dependent variable for a given country across all years under study. The symbol β denotes an estimated parameter, and x_{it} is a vector of independent variables, including GDP growth and the share of military expenditure in GDP. The variable $\bar{x}_i$ then represents an average value

of the independent variable for a given country across all years under observation. The ε_{it} represents the random error for a given country in each year and $\bar{\varepsilon}_i$ is the average random error for that country.

This approach eliminates bias caused by time-invariant factors, such as geographical location or historical determinants of strategic culture, by focusing on within-group variation. Parameters were estimated using the Ordinary Least Squares (OLS) method after the within-transformed data as shown in equation (1), which removes individual effects by subtracting time-averaged values from each observation [24].

In parallel with the levels models, first-difference (FD) models were estimated as shown in equation (2) to capture short-term dynamic responses and eliminate potential non-stationarity in the time series. This model reveals the dynamic sensitivity of GDP growth to year-on-year changes in military expenditure. The differenced equation takes the form [24]:

$$(\Delta y_{it} = \beta^T \Delta x_{it} + \Delta \varepsilon_{it}) \quad (2)$$

Where the Δ operator denotes the year-on-year change of the given variable. This model is particularly sensitive to sudden budgetary shocks and shifts in political priorities, enabling the identification of whether annual fluctuations in economic performance trigger an immediate reaction in equipment procurement or infrastructure investment. The robustness of the results was verified by testing the statistical significance of coefficients at the 5% levels, with the first-difference specification serving to validate the stability of long-term structural relationships identified in the fixed effects models.

This study is grounded in economic data pertaining to GDP, specifically utilizing constant prices and annual percentage change as provided by the OECD [25]. Data regarding military expenditure and the share of infrastructure spending were retrieved from the Stockholm International Peace Research Institute (SIPRI) database [26] and official NATO reports [27, 20].

6. Investigation Results

The data presented in correlation heat map (see Fig. 1) reveals a striking dichotomy in expenditure strategies among the CNE MMA nations. While there is a nearly universal strong positive correlation between the share of GDP dedicated to defence and investments in equipment—with coefficients exceeding 0.80 for Germany, Poland, Czechia and the Slovak Republic—infrastructure spending follows a divergent path. A clear decoupling phenomenon is observable in key powers like Germany (-0.32) and Poland (-0.16), where increased defence burdens correlate with reduced infrastructure prioritization, suggesting a crowding-out effect where equipment procurement consumes available fiscal space. Conversely, countries such as Belgium (0.84) and Lithuania (0.77) demonstrate a synchronized approach, where infrastructure investments grow in tandem with the overall budget, likely reflecting their roles as logistical hubs or frontline states necessitating robust receiving capabilities.

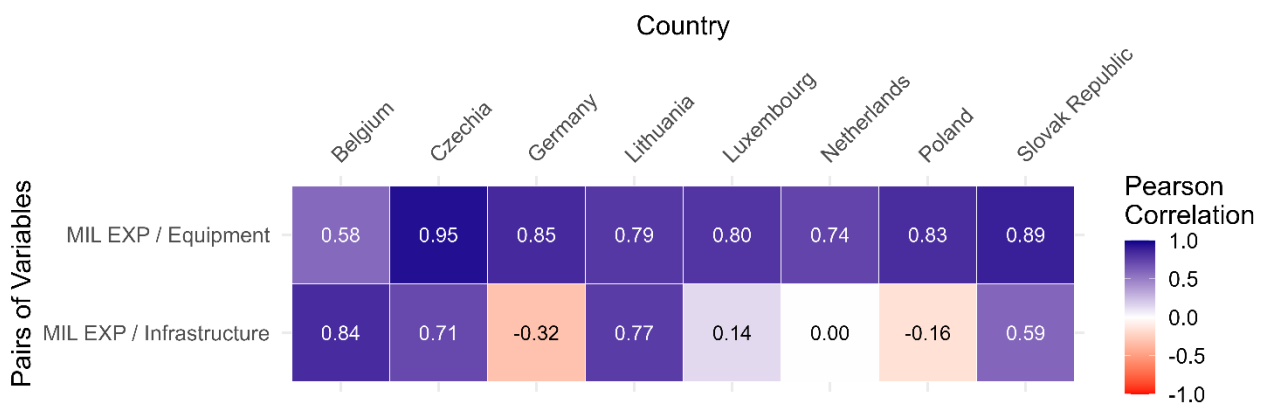


Fig. 1. Correlation between Military Expenditure Share of GDP (MIL EXP) and NATO Expenditure Categories (Equipment, Infrastructure)

Note: Blue indicates strong positive correlation; red indicates negative correlation.

The results of the regression analysis (see Table 1) demonstrate that fluctuations in the GDP growth rate exert no economically or statistically significant influence on total military expenditures, equipment acquisitions, or infrastructure spending. Conversely, a higher total share of defence expenditures relative to GDP has a positive effect on increased investment in both equipment and infrastructure, with a distinct prioritization of the former. Specifically, a one percentage point increase in the total defence-to-GDP ratio results in an average long-term growth of 15.80% in equipment spending, while the short-term year-on-year impact is even more substantial, reaching 29.33%. In contrast,

infrastructure expenditures exhibit a notably lower sensitivity to defence budget growth, increasing by an average of only 1.79% over the evaluated period and 2.40% on a year-on-year basis. Interestingly, the model indicates that an increase in the total defence share does not have a statistically significant effect on the combined sum of equipment and infrastructure expenditures, a result primarily attributed to diverging national capability priorities and the rigorous pressure exerted by NATO guidance to meet the 20% threshold specifically for equipment.

Furthermore, while equipment investments show immediate responsiveness to budget changes, infrastructure projects are governed by significantly longer planning horizons and technical requirements. This statistical evidence reinforces the observation that NATO states prioritize modernizing their equipment over secondary infrastructure categories.

Table 1.
Estimates and p-values for Panel Linear Models for the CNE MMA Countries

Model	Estimate	p-value
<i>MIL EXP ~ GDP Growth Rate</i>	-0.04	0.024
<i>MIL EXP ~ GDP Growth Rate – FD</i>	-0.01	0.585
<i>Equipment ~ GDP Growth Rate</i>	-0.52	0.166
<i>Equipment ~ GDP Growth Rate – FD</i>	-0.12	0.624
<i>Infrastructure ~ GDP Growth Rate</i>	-0.08	0.276
<i>Infrastructure ~ GDP Growth Rate – FD</i>	-0.01	0.971
<i>Equipment ~ MIL EXP</i>	15.80	< 0.001
<i>Equipment ~ MIL EXP – FD</i>	29.33	< 0.001
<i>Infrastructure ~ MIL EXP</i>	1.79	< 0.001
<i>Infrastructure ~ MIL EXP – FD</i>	2.40	0.011
<i>Equipment + Infrastructure ~ GDP Growth Rate</i>	-0.60	0.125
<i>Equipment + Infrastructure ~ GDP Growth Rate – FD</i>	-0.12	0.633

Note: The Table includes normal Panel linear model and First-difference (FD) specifications. Statistically significant p-values are highlighted in bold.

7. Limitations

The analysis was constrained by the use of a single economic indicator to assess the relationship between economic status and military spending. Consequently, the influence of other critical macroeconomic factors, such as inflation rates, public debt levels, or fiscal deficits, was not integrated into the models. This may restrict the comprehensive understanding of budgetary constraints and the broader economic environment in which military spending decisions are made.

Furthermore, this report does not include an analysis of strategies and project financing from the European Union specifically designed to address military mobility solutions. Mechanisms such as the Permanent Structured Cooperation (PESCO) or the Connecting Europe Facility (CEF), which are critical for funding cross-border infrastructure, were outside the scope of this work, which focused primarily on national expenditures and NATO benchmarks.

8. Conclusions

In conclusion, this study has investigated the economic determinants of military modernization within the CNE MMA during the transformative period of 2010 to 2024. By analysing the relationship between GDP growth and disaggregated military expenditure across eight member states, the research identifies a critical systemic challenge: the infrastructure decoupling phenomenon. While the escalation of regional threats has successfully catalysed a surge in equipment procurement—demonstrated by a 15.80% long-term growth sensitivity to defence budget increases—investments in the military infrastructure required to move this equipment remain significantly stagnant, with a sensitivity of only 1.79%.

The empirical findings from linear models for panel data reveal that major powers like Germany and Poland exhibit a negative correlation between defence budget share and infrastructure investment (-0.32 and -0.16 respectively), suggesting a crowding-out effect where "hard power" acquisitions consume the fiscal space intended for logistical resilience. This distinguishes the current work from traditional defence economics literature, which often focuses on aggregate spending. By isolating dual-use infrastructure as a specific variable within the RSN framework, this study provides a disaggregated evidence base for the strategic mobility gap that might demonstrate threat to the operational speed of NATO's eastern flank.

Furthermore, the analysis integrates the newly established 5% GDP NATO target, emphasizing that the success of the 1.5% allocation for defence-related resilience is contingent upon reversing these decoupling trends. For example Lithuania's synchronized approach, with a 0.77 infrastructure correlation, might serve as a strategic model for regional stakeholders. The identified infrastructure decoupling presents a direct challenge to the new NATO investment pledge adopted at the 2025 Hague Summit. Under this framework, Allies committed to a 5% GDP target by 2035, specifically

allocating up to 1.5% of GDP for resilience and critical infrastructure protection. The findings suggest that without a fundamental shift in national budgeting priorities, this 1.5% allocation risks being absorbed by equipment procurement, further exacerbating the strategic mobility gap. For the CNE MMA to fulfil its mandate of rapid force deployment, political decision-makers must ensure that logistical enablers are prioritized alongside kinetic capabilities, bridging the divide between fiscal input and sustainable operational output in the contemporary geopolitical environment.

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