

MILITARY LOGISTICS, FISCAL CAPACITY AND INSTITUTIONAL EFFICIENCY: A COMPARATIVE ANALYSIS OF IMPERIAL DEFENCE BURDENS IN MACEDONIA (MACEDONIAN, ROMAN, BYZANTINE AND OTTOMAN EMPIRES)

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Abstract: This study examines the relationship between military logistics, fiscal capacity, and imperial defence burdens through a comparative analysis of four major empires that governed the territory of Macedonia: the Macedonian Empire under Philip II and Alexander III, the Roman Empire, the Byzantine Empire, and the Ottoman Empire. The research challenges the conventional assumption that a higher percentage of economic output allocated to military purposes necessarily corresponds to greater military power or long-term state stability. The central hypothesis advanced in this paper is that imperial military strength and political durability were not primarily determined by the proportion of GDP devoted to defence, but rather by the degree of institutional coordination, fiscal mobilization capacity, and logistical efficiency embedded within the governing structure of each empire.

Given the absence of continuous and directly measurable GDP data for ancient and medieval societies, the study adopts a methodologically cautious framework that distinguishes between reconstructed economic output, documented state revenues, and military expenditure as a share of public budgets. The research relies on comparative historical analysis, secondary quantitative reconstructions from economic historians, fiscal documentation where available, and institutional-military literature. Particular attention is given to differentiating between military expenditure as a share of total state revenue and its estimated share of reconstructed GDP, thereby avoiding false statistical precision in premodern contexts.

The analysis demonstrates that although the military sector constituted the dominant component of public expenditure in all four empires, their logistical architectures and fiscal integration mechanisms differed substantially. Macedonian military expansion relied on high mobility, minimal logistical encumbrance, and resource extraction through conquest. Roman defence was sustained through institutionalized provisioning systems (*annona militaris*), standardized infrastructure, and integrated fiscal administration. Byzantine military organization combined decentralized thematic land grants with centralized reserves and advanced communication networks. The Ottoman system initially achieved cost-efficient military mobilization through the *timar* structure before gradually shifting toward centralized and fiscally heavier models of modernization.

The findings indicate that imperial sustainability correlated more strongly with institutional-logistical coherence and adaptive fiscal structures than with the absolute magnitude of military expenditure. Empires in which military systems exceeded the adaptive capacity of fiscal and administrative institutions experienced structural vulnerability, regardless of the percentage of economic output allocated to defence. The study contributes to fiscal-military state theory and imperial political economy by proposing an Institutional-Logistical Efficiency perspective for evaluating premodern defence burdens within a historically grounded analytical framework.

Keywords: *military logistics, fiscal capacity, state capacity, defence expenditure, institutional efficiency, imperial political economy, Macedonia, Macedonian Empire, Roman Empire, Byzantine Empire, Ottoman Empire*

Field: Social Sciences.

1. INTRODUCTION

The relationship between military expenditure and long-term state stability represents a central issue in the political economy of empires. Traditional interpretations frequently assume that a higher share of national output allocated to defence directly strengthens military power and secures political durability. Such an approach, however, tends to reduce complex state dynamics to a single fiscal indicator and neglects the institutional and logistical dimensions that sustain military systems over time.

The territory of Macedonia provides a rare historical setting for comparative analysis. Over a long temporal span, it was governed successively by four major imperial systems: the Macedonian Empire, the Roman Empire, the Byzantine Empire, and the Ottoman Empire. Each of these polities developed a distinct model of fiscal extraction, administrative organization, and military logistics. The comparative

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continuity of territorial space allows for structural comparison across different institutional configurations. The central hypothesis of this study is the following: Imperial military power and state stability are not directly correlated with the percentage of GDP allocated to defence, but with the degree of institutional coordination and logistical efficiency within the state apparatus.

Given that GDP is a modern analytical construct, its application to ancient and medieval societies requires methodological caution. For premodern polities, economic aggregates are reconstructed through demographic estimates, fiscal records, wage proxies, and secondary quantitative models (Broadberry et al., 2015; Scheidel, 2019). Accordingly, this research does not rely on artificial statistical precision. Instead, it differentiates between reconstructed economic output, state fiscal capacity, and military expenditure as a share of public revenue.

The objective of the paper is to examine how military logistics interacted with fiscal capacity in the four imperial systems that governed Macedonia and to assess whether variations in defence burden were decisive for imperial resilience. By focusing on institutional coordination, administrative integration, and logistical architecture, the study seeks to contribute to the broader debate on fiscal-military states and the structural foundations of durable political power.

2. MATERIALS AND METHODS

This study applies a comparative historical methodology grounded in economic history, fiscal sociology, and military-logistical analysis. Given the absence of direct national accounts for ancient and medieval polities, the research relies exclusively on secondary quantitative reconstructions, fiscal documentation, and peer-reviewed historical scholarship.

Reconstructed economic output is derived from established databases and scholarly models, including the Maddison Project Database (2020), Milanovic (2023), and recent revisions in long-run economic measurement (Broadberry et al., 2015; Scheidel, 2019). These reconstructions are based on demographic estimates, income per capita proxies, wage data, agricultural productivity models, and documented fiscal capacity. For the Ottoman period, additional quantitative insight is drawn from Karaman and Pamuk (2022), who provide updated fiscal-military state estimates within a comparative European framework.

Fiscal capacity and imperial revenue structures are examined through classical and contemporary fiscal studies, including Duncan-Jones (1994) for Roman public finance, Pamuk (2000) for Ottoman monetary and fiscal systems, and Treadgold (1997) and Haldon (1999) for Byzantine administrative-military structures. Military-logistical organization is analyzed through Engels (1978) on Macedonian campaigning systems, Murphey (1999) on Ottoman warfare and logistics, and recent contributions in strategic studies and defence management literature, including *Strategic Analysis: A Monthly Journal of the IDSA* and contemporary frameworks such as the Defense Logistics Management Standards (DLMS), which provide conceptual benchmarks for understanding supply-chain integration and institutional coordination in military systems.

The study further integrates recent scholarship on state capacity, war finance, and fiscal-military theory (Besley & Persson, 2022; Dincecco, 2023; Scheve & Stasavage, 2016; Karaman & Pamuk, 2022), situating imperial defence burdens within broader debates on taxation, administrative centralization, and institutional adaptability.

Analytically, the research differentiates three distinct but interrelated levels:

1. Reconstructed aggregate economic output (GDP or income estimates expressed as historical intervals);
2. State fiscal revenue as a share of reconstructed economic output;
3. Military expenditure as a share of total state revenue.

Where numerical values are referenced, they are treated as interval estimates derived from peer-reviewed reconstructions rather than as precise statistical measurements. Percentages of GDP for premodern empires are therefore interpreted as modeled approximations and are explicitly presented within scholarly ranges.

In addition, the paper introduces an original analytical framework termed the Institutional-Logistical Efficiency Model (ILEM). This model evaluates imperial defence sustainability not primarily through the magnitude of defence expenditure, but through institutional coordination, administrative integration, fiscal adaptability, transport infrastructure, and logistical standardization. The ILEM framework is used as a qualitative-comparative instrument to assess structural resilience across the four imperial systems under examination.

This methodological design ensures analytical rigor, reproducibility of sources, and conceptual

clarity while avoiding false statistical precision in the treatment of premodern economic aggregates.

3. RESULTS AND DISCUSSION

The comparative analysis across the four imperial systems governing Macedonia demonstrates that military expenditure consistently constituted the dominant component of public finance. However, the decisive variable was not the absolute share of economic output devoted to defence, but the degree of institutional coordination and logistical integration that structured military mobilization.

Macedonian Empire

The Macedonian state of the fourth century BCE functioned as a highly militarized expansionist monarchy. Reliable macroeconomic aggregates do not exist for this period; therefore, any calculation of defence expenditure as a percentage of GDP would be methodologically indefensible. Available evidence indicates that royal revenues derived primarily from mining (notably silver and gold), tribute, confiscations, and war plunder. During the campaigns of Alexander III, the majority of available state resources were directed toward military operations.

The logistical architecture was characterized by extreme mobility and minimal baggage trains. As demonstrated in classical military studies (Engels, 1978), Macedonian forces were capable of rapid marches—often exceeding 25–30 kilometers per day—supported by decentralized supply, requisitioning, and local extraction. This model reduced immediate fiscal burdens but structurally tied sustainability to continued territorial expansion. Once expansion ceased, the system lacked an institutionalized taxation and provisioning framework capable of maintaining long-term equilibrium.

The Macedonian case therefore illustrates a model of military power based on operational efficiency and expansionary extraction rather than bureaucratic fiscal capacity.

Roman Empire

The Roman Empire offers comparatively stronger fiscal documentation and modern economic reconstructions. During the Principate, state revenue is estimated at approximately 4–7% of reconstructed GDP (Duncan-Jones, 1994; Scheidel, 2019). Of this revenue, roughly 60–70% was allocated to the military establishment. This suggests that defence expenditure in stable periods likely represented between 2–4% of total economic output, acknowledging the reconstructed nature of such estimates.

What distinguished Rome was not merely the scale of expenditure but its institutional embedding. The *annona militaris* system integrated taxation in kind with logistical supply chains; an extensive road network—estimated at over 400,000 kilometers—facilitated rapid troop movement; centralized depots and professional supply officers standardized provisioning procedures. Military logistics were structurally embedded within administrative and infrastructural frameworks.

Despite a relatively moderate defence burden in GDP terms, Rome maintained political cohesion and military dominance for centuries. This indicates that institutionalized fiscal extraction and logistical integration, rather than high military ratios, underpinned durability.

Byzantine Empire

For the Byzantine Empire, particularly between the eighth and eleventh centuries, available fiscal reconstructions suggest that approximately 50–70% of public revenue was devoted to defence (Haldon, 1999; Treadgold, 1995). Reconstructed income levels indicate that total state revenue may have equaled 4–8% of economic output in stable periods. Defence expenditure therefore likely ranged between 3–5% of reconstructed GDP.

The thematic system constituted an innovative form of decentralized military-fiscal organization. Soldiers were granted land in exchange for service, effectively linking agrarian productivity to defence capacity. This arrangement reduced immediate cash outlays while embedding military obligations within provincial structures. Central reserves and sophisticated communication networks complemented this decentralized model.

Periods of Byzantine resilience coincided with institutional coherence and territorial integration. Conversely, fragmentation of administrative control—rather than excessive military percentages—proved decisive in moments of systemic crisis, particularly after 1204.

Ottoman Empire

Ottoman fiscal records, particularly from the classical and early modern periods, are comparatively robust. In the fifteenth and sixteenth centuries, military expenditures absorbed approximately 60–75% of central government expenditures (İnalçık, 1973; Pamuk, 2000). The *timar* system externalized cavalry costs to land-based revenue assignments, thereby reducing direct fiscal pressure on the central treasury.

During this classical phase, defence expenditure likely remained within a moderate reconstructed range relative to total economic output. However, in the eighteenth and nineteenth centuries, processes

of centralization and military modernization significantly increased fiscal demands. Recent economic-historical studies suggest that state revenue may have reached 15–20% of economic output in later periods (Karaman & Pamuk, 2022). With roughly half of this allocated to defence, the military burden may have approached 8–10% of GDP during peak militarization phases.

The transition from decentralized land-based military provisioning to centralized, cash-based armies generated increasing fiscal strain. The erosion of institutional flexibility and administrative coordination contributed to long-term structural vulnerability.

Comparative Synthesis and the Institutional-Logistical Efficiency Model (ILEM)

Across all four cases, the military sector dominated public budgets. Yet no linear correlation emerges between the reconstructed percentage of GDP allocated to defence and imperial longevity.

The Macedonian Empire exhibited extreme militarization and operational brilliance, but structural dependence on expansion limited durability. Rome maintained relatively moderate defence ratios but achieved long-term stability through infrastructural integration and administrative coherence. Byzantium demonstrated that decentralized military-fiscal mechanisms could sustain equilibrium when institutional cohesion remained intact. The Ottoman experience reveals that rising defence burdens became destabilizing primarily when institutional coordination weakened and fiscal adaptability declined.

These findings support the Institutional-Logistical Efficiency Model (ILEM), according to which long-term imperial stability is a function of:

- institutional coordination between fiscal and military organs,
- logistical autonomy and supply integration,
- fiscal adaptability to changing strategic demands,
- infrastructural and administrative coherence.

The absolute percentage of economic output devoted to defence is therefore an insufficient explanatory variable. What determines sustainability is the system's capacity to absorb, manage, and integrate military expenditure within a coherent institutional architecture.

The comparative evidence indicates that empires declined not simply when they spent “too much” on defence, but when military demands exceeded the adaptive capacity of their fiscal and institutional frameworks.

4. CONCLUSIONS

The comparative examination of the Macedonian, Roman, Byzantine, and Ottoman imperial systems confirms the central hypothesis of this study: the percentage of economic output allocated to defence is not, in itself, a sufficient indicator of military strength or long-term state stability. While in all four cases the military sector absorbed the majority of public fiscal resources, the decisive variable was the structure through which those resources were mobilized, coordinated, and sustained.

The Macedonian model achieved remarkable operational effectiveness through mobility and extraction, yet its sustainability depended on continuous expansion rather than institutionalized fiscal integration. The Roman Empire maintained long-term durability not because of an exceptionally high defence burden in GDP terms, but due to the integration of taxation, infrastructure, and professional logistics within a coherent administrative framework. Byzantine resilience rested on the balance between decentralized thematic structures and centralized coordination, linking agrarian productivity to military obligation. The Ottoman experience demonstrates that durability was strongest under decentralized, land-based provisioning systems, while later centralization and costly modernization generated fiscal rigidity and institutional strain.

Across these cases, military expenditure became destabilizing not when it reached a specific quantitative threshold, but when it exceeded the adaptive capacity of fiscal institutions and logistical systems. Premodern defence burdens must therefore be interpreted within reconstructed intervals and institutional contexts, rather than through mechanically applied economic ratios.

This study contributes to the political economy of empires by advancing the concept of Institutional-Logistical Efficiency as a primary explanatory variable in assessing imperial sustainability. Military power proved durable where fiscal extraction, administrative coordination, and logistical organization formed an integrated system capable of absorbing strategic pressures. Where such integration weakened, structural vulnerability followed—regardless of the nominal level of defence spending.

The findings suggest that imperial longevity was determined less by how much was spent on war, and more by how effectively states organized the institutions that sustained it.

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