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Contradictory public expenditures in Low-Income Countries: revisiting the military versus health spending dilemma

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Abstract - The objective of this study is to analyze the trade-offs in the allocation of public resources between the defense and health sectors in Low-Income Countries (LICs), some of which are fragile and affected by multifaceted conflicts. Using panel data covering 22 LICs over the period 1996–2022, the study employs a simultaneous equations modeling framework, estimated using a two-stage least squares method, to account for simultaneity and endogeneity issues. Results highlight a crowding-out effect between military and health spending. Specifically, increased military spending is associated with a significant decrease in public health spending, while increased health spending also tends to constrain defense spending, thus revealing a bidirectional budgetary trade-off. This effect is significantly more pronounced in fragile and conflict-affected countries, where security pressures lead to increased military spending at the expense of investment in the health sector. Furthermore, the intensity of conflicts reinforces defense spending, further reallocating public resources toward security priorities. Further analyses distinguishing between low-and middle-income countries confirm these results.

JEL classification

C23, H53, H56

Keywords

Public expenditures
Conflict-Affected Countries
Low-Income Countries
Structural equation models

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INTRODUCTION

Low-Income Countries (LICs) experience multiple and cumulative vulnerabilities (Mawejje, 2024). While military spending in developing countries already raises complex questions regarding growth, development, security, and governance, these issues are even more acute in LICs (Deger and Sen, 1995). In these countries, the scarcity of public resources, structural deficits in human capital, and limited institutional capacity significantly exacerbate the opportunity cost of military spending. Unlike middle-income countries, where basic social investments are relatively well-established, LICs face urgent needs in education and health. In this context, increased military spending risks jeopardizing human capital accumulation and, consequently, long-term growth, without guaranteeing proportional gains in security. In LICs, institutional vulnerabilities exacerbate persistent insecurity, sometimes linked to armed conflict, and lead governments to allocate a disproportionate share of limited public resources to military spending (OECD, 2018). In turn, while conflicts destroy human and physical capital, they shrink the tax base, further constrain budgetary choices, and reinforce dependence on short-term military expenditures (Collier et al., 2003; World Bank, 2020). These structural mechanisms explain the high concentration of fragility and conflict among LICs.

More than 75% of the countries classified as low-income in 2023 were concurrently designated as fragile and affected by conflicts, with examples including Afghanistan, Mali, and Burkina Faso. Thus, allocation of public resources in these countries represents a critical and often contentious challenge, particularly when it comes to balancing the demands of defense and health expenditures (Gupta et al., 2005). National security concerns, exacerbated by conflicts, often drive defense expenditure upward, leaving little room for necessary investment in social development, such as the health sector (Azam, 2020; Iqbal, 2010). However, health expenditure is equally crucial, particularly in the face of pervasive health crises. The experience of the COVID-19 pandemic revealed that many governments reduced their defense budgets to reallocate resources to emergency public health funding (Han and Jeong, 2025). In fragile and LICs, characterized by limited tax revenues and often high levels of debt, governments tend to prioritize military spending to maintain stability, at the expense of investments in human capital (OECD, 2018).

International comparisons of public expenditures reveal that LICs allocate disproportionately limited resources to health and social protection (Chu et al., 1995), a pattern that has persisted despite growing development needs. In these settings, military expenditures frequently outweigh those allocated to health (Fan et al., 2018). For example, since 2010, Afghanistan has devoted more than one-third of its total government budget to military expenditures, compared to less than 4% allocated to social protection (Carlitz, 2022). Comparable imbalances can be observed in Burkina Faso, where the defense budget in 2020 was more than tenfold that of social protection, and in Mali, where defense expenditures in 2017 were five times higher than spending on social services. In contrast, countries not classified as conflict-affected tend to follow a markedly different pattern. Since 2010, they have allocated, on average, over 25% of public spending to social protection, while military outlays have rarely exceeded 6%. These stark differences revive the long-standing debate on the trade-off between defense spending and social welfare spending (d'Agostino et al., 2017). Previous research, however, has not yielded a clear consensus on the relationship between military and health spending.

In this study, we investigate the nexus between military and health spending for 22 LICs during the 1996-2022 period. The choice to focus on this group of countries is justified by several complementary arguments.

First, LICs are characterized by particularly limited budgetary resources and a strong dependence on public funding, making budgetary trade-offs unavoidable. In this context, any increase in military spending can come at the expense of social sectors, particularly health, whose funding is crucial for human development and poverty reduction. Analyzing these trade-offs is therefore particularly relevant in economies where fiscal space is limited.

Second, LICs often face constant security threats. These include armed conflict, political instability, and regional tension, which justify high military spending. At the same time, they cope with heavy health burdens such as infectious diseases and high mortality. Health systems are fragile. These combined needs make resource allocation tougher and highlight the need to study their interaction.

Third, the dependence of LICs on external aid, frequently directed towards social sectors, can obscure the true trade-off between military and civilian spending, thus distorting the guns versus butter debate. External aid can either mitigate or exacerbate trade-offs between military and social spending, depending on the existing institutional framework and the quality of governance.

In fine, empirical literature on the link between military and health spending in LICs remains relatively limited. By focusing on this category of countries, this study helps to fill this gap and enrich the debate on budgetary priorities in poor countries.

A few scholars have examined the relation between military spending and public health spending (Han and Jeong, 2025; Coutts et al., 2019; Fan et al., 2018; Lin et al., 2015; Kollias and Paleologou, 2011; Ali, 2011). The main differences between this work and those mentioned above, as well as the significance of the present study, are as follows.

First, it addresses the critical issue of budgetary trade-offs, which are central to policymaking in resource-constrained environments. In many LICs, fragmentation across government departments complicates the budgeting process, making resource allocation a reflection of real and often difficult choices between competing priorities.

Second, previous studies on the military and health spending nexus have presented divergent results, related to differences in geographical coverage, analysis period, methods used, and variable specification (Njifen and Anneman, 2023; Elish et al., 2023; Fan et al., 2018; Lin et al., 2015; Yildirim and Sezgin, 2002; Mintz, 1989; Russett, 1969). These contrasting findings underscore the importance and relevance of a study dedicated to LICs.

Third, the guns versus butter debate surrounding trade-offs between military and social spending is well established in the economic literature. For example, the crowding-out effect theory highlights a marked negative relationship between defense spending and public health spending. However, it remains insufficiently supported by robust empirical evidence to achieve consensus in the literature. This

subject remains largely underexplored, particularly in the case of LICs. This study attempts to address this empirical gap.

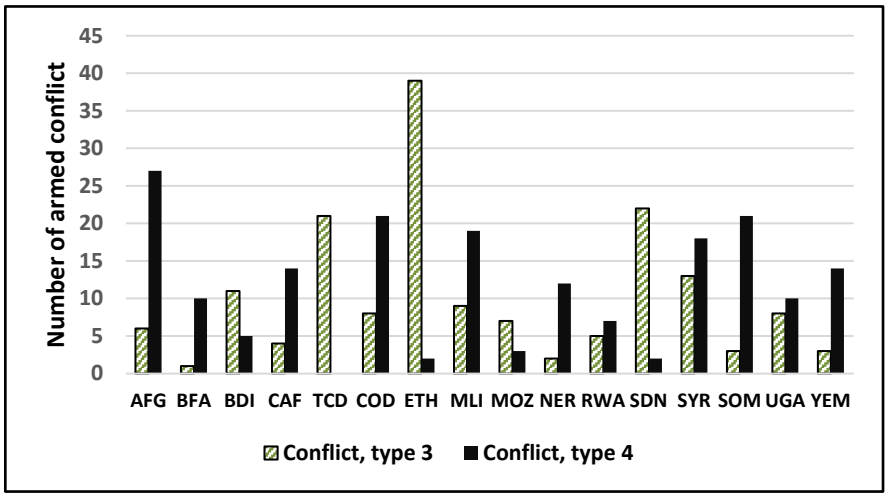
The paper proceeds as follows. Section 1 reviews the theoretical and empirical literature on the relationship between military and health spending and develops the research hypotheses. Section 2 presents data and econometric methodology. Section 3 reports and discusses the empirical results, providing insights into possible explanations for the findings.

1. LITERATURE REVIEW AND RESEARCH HYPOTHESIS

1.1. The nexus between armed conflict and military spending

Widespread poverty and recurrent armed conflicts in the LICs make military expenditure a particularly relevant area of analysis. Military spending may affect both the occurrence and intensity of conflicts through several channels, notably by strengthening military capabilities and state coercive power (Aya, 2024; Phillips, 2015). However, the effectiveness of such spending critically depends on the quality of political and economic institutions. Strong institutions play a key role in shaping military spending outcomes. Njamen Kengdo et al. (2023), examining African countries over the period 1996–2019, show that improvements in institutional quality, measured by government effectiveness, rule of law, and political accountability, are associated with a significant reduction in military spending. Furthermore, the effect of corruption on military expenditure differs by income level (Arif et al., 2019): it tends to increase the military budget in high-income countries, whereas it constrains military spending in middle- and low-income countries. Figure I illustrates the cumulative number of armed conflicts recorded in the selected LICs between 2000 and 2020.

Figure 1. Cumulated number of conflicts in the selected LICs, 2000-2020



Notes: type 3 = Internal armed conflict, Armed conflict; type 4 = Internationalized internal armed conflict.

Source: author's computation.

In accordance with the UCDP/PRIO[1] Armed Conflict Codebook, armed conflicts are classified as internal conflicts (Type 1), interstate conflicts (Type 2), non-state or transnational conflicts (Type 3), and internationalized internal conflicts (Type 4), according to the nature of the actors involved and the degree of internationalization. This study focuses on two main types of armed conflict: Type 3 conflicts, which refer to internal armed conflicts between a government and one or more domestic opposition groups, without the involvement of external states; and Type 4 conflicts corresponding to internationalized internal armed conflicts, in which external states intervene on one or both sides of a domestic conflict. These conflicts are often associated with an intensification and prolongation of defense efforts.

The prevalence and nature of these conflicts vary significantly across countries. Ethiopia, Chad, and Sudan are predominantly affected by type 3 conflicts, reflecting persistent internal instability and domestic power struggles. Conversely, countries such as Burkina Faso, Niger, Somalia, and Yemen experience high levels of type 4 conflicts, indicating the internationalization of domestic violence through foreign military interventions or transnational armed groups.

In Sub-Saharan African countries, Aya (2024) reports that military expenditure reduces the intensity of conflicts. On average, a 1% increase in the share of GDP allocated to military spending decreases the probability of armed conflict intensity by 0.012 percentage points. These findings contrast with those of Phillips (2015), who found that conflict levels are positively associated with military spending in the context of developing countries. According to Aya (2024), the impact of military expenditure on conflict is conditional on its magnitude. Military spending significantly reduces low-intensity conflicts more than high-intensity ones. Similarly, Collier and Hoeffler (2002) concluded that the effectiveness of military expenditure depends on the timing. Military spending is particularly effective during periods of active conflict, but not during times when there is only a risk of conflict.

Accordingly, based on the empirical results of prior research, the first hypothesis is formulated as follows: there is a positive association between conflict and military expenditure in LICs.

1.2. The nexus between defense and health spending

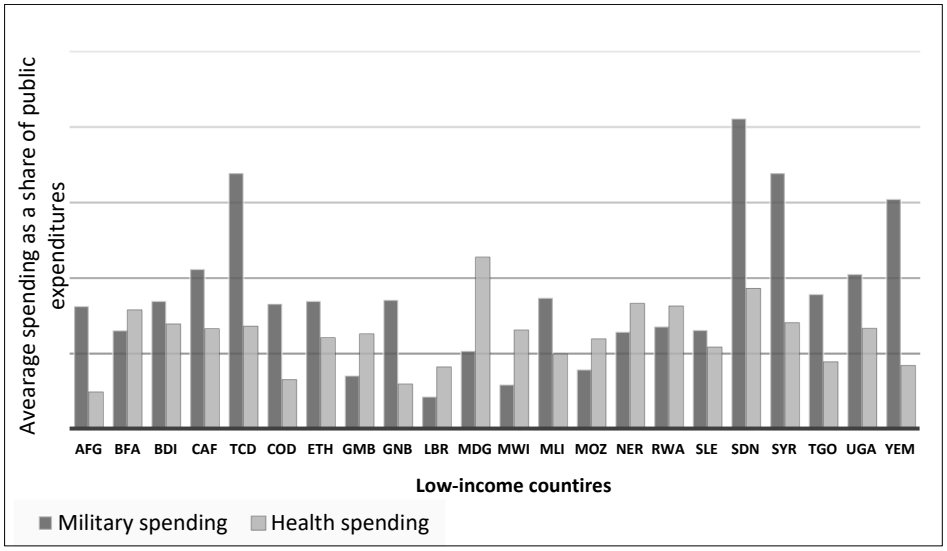
Many empirical studies have investigated the potential trade-off between military and health expenditures (Zhang et al., 2017). However, the available evidence remains inconclusive due to variations in methodologies, datasets, and country contexts. The arbitrary selection of countries in some studies has further contributed to the lack of consensus. Figure 2 below presents the average share of government expenditure allocated to the military and health sectors in 22 LICs between 2000 and 2022. The majority of these countries are either experiencing active conflict or are in post-conflict situations. Conflict tends to increase defense needs.

Documentary and research evidences show that there is a negative relationship between military and health spending. According to the crowding out effects theory, increased defense spending comes at the expense of other areas, such as public

[1] Uppsala Conflict Data Program/International Peace Research Institute, Oslo.

health, illustrating the guns versus butter dilemma (Mintz, 1989). Since the seminal study by Russett (1969) on the effects of U.S. military expenditure, numerous works have emphasized that military spending tends to negatively affect public health spending. For instance, a study by Han and Jeong (2025) contributes to a long-standing academic debate on budgetary trade-offs between competing public sectors, particularly defense and health, in 131 countries from 2000 to 2014. Methodologically, they combine fixed-effects panel models and structural equation modeling, enabling robust identification of the relationships between defense spending, health spending, incrementalism, and public debt. The empirical results highlight a crowding-out effect between defense and health spending, confirming the existence of intersectoral budgetary competition.

Figure 2. Average of the share of government expenditures on defense and health, 2000-2022



Source: WDI database.

Similarly, Golkhandan (2018) analyzed data from 25 developing countries between 1995 and 2014 to assess the relationship between military and health expenditures. Using panel co-integration techniques and the Generalized Method of Moments (GMM), the study demonstrated that increases in per capita military expenditure significantly reduce per capita health expenditure in both the short and long run. In another study, Fan et al. (2018) employed simultaneous equation modeling on pooled cross-sectional and time series data to examine the causal link between military and health spending. Their results indicated that higher military expenditure constrains governments' ability to allocate sufficient resources to the health sector, a crowding-out effect that was particularly pronounced in low- and middle-income countries compared to high-income nations. These findings are consistent with Luqman and Antonakaki (2021), who showed that military expenditures exert a negative impact on the human development index (education, health, revenue) across most quantiles in Pakistan over the period 1965-2016.

In addition, Yildirim and Sezgin (2002) analyzed the relationship between military and welfare spending using the Seemingly Unrelated Regression (SUR)

model for Turkey over the period 1924-996. Their results confirmed that military expenditure is negatively related to health. Kentor and Jorgenson (2017) examined the impact of military expenditure on two health outcomes using a series of cross-national panel models for a diverse sample of developed and developing countries from 1975 to 2000. Their results showed that military expenditures increase under-five mortality and reduce life expectancy, suggesting negative indirect effects on health. Adhikary and Khatun (2018) investigated the impact of military expenditure on health indicators in five selected SAARC countries using a panel data model for the period 1995-2015. They found that as military expenditure increased, total, public, and private health expenditures decreased, reinforcing the crowding-out argument.

In contrast, the growth-stimulating effects theory (Harris and Kally, 1988) explains the positive relationship between defense expenditure and public health expenditure (crowding-in effect). Studies in line with this paradigm highlight the complementarity between social welfare and military expenditures (Raju and Ahmed, 2019; Kollias and Paleologou, 2011; Benoit, 1978). Zhang et al. (2017) assessed the relationship between military and social spending, including public health expenditure, in both developed and emerging economies. Using panel co-integration analysis for two distinct periods (1993–2007 and 1998–2011), they concluded that military spending is positively associated with social expenditures in developed countries, specifically within the G7 group, including the United States, Japan, Germany, the United Kingdom, France, Italy, and Canada. However, the relationship appeared more ambiguous among the BRICS countries (Brazil, Russia, India, China, and South Africa), highlighting the complexity and context-specific nature of this policy trade-off.

In the same vein, Ikegami and Wang (2023) investigated whether military expenditure crowds out public health spending in 116 countries (including a subsample of 87 non-OECD countries) over the period 2000–2017. Using system GMM estimations, they found a positive and significant impact of per capita military expenditure on per capita health expenditure in the full sample. Moreover, they observed a positive and significant impact of both current and lagged per capita military expenditure on per capita health spending in the non-OECD sample. Lin et al. (2015) examined the relationship between defense and social welfare expenditure using a panel of 29 OECD countries from 1988 to 2005. Applying panel GMM estimation, their results showed a positive trade-off between military spending and health expenditure. This suggests possible complementary budgeting strategies.

After reviewing the literature and given a large number of LICs that experience internal armed conflicts, the second hypothesis can be formulated as follows: there is an ambiguous relationship between military and health spending in LICs.

2. MODEL, DATA, AND TESTS

2.1. Model specification

To analyze the trade-off between military and health spending, this study adopts an empirical approach, building on previous work on the mechanisms of public expenditure allocation. A large body of research emphasizes that government budgetary decisions are made under strict fiscal constraints, which can lead to

trade-offs between competing spending categories, particularly between social services and defense (Musgrave, 1959; Davoodi et al., 1999; Mintz and Huang, 1991).

In LICs, these trade-offs are especially pronounced due to limited fiscal capacity and high exposure to economic, demographic, and security shocks. Health spending is relatively rigid in the short term and reacts quickly to population needs, epidemiological conditions, and mortality pressures. By contrast, military spending is primarily driven by political instability, internal and external security threats, and conflict dynamics. As a result, adjustments in one spending category may mechanically constrain the other, generating potential crowding-out effects. This context makes it essential to account for simultaneity and reverse causality between health and military expenditures.

From this perspective, it is wise to consider the simultaneity and inverse causality between these two budget items. The empirical strategy relies on a system of simultaneous equations describing the joint determination of health and military spending. The econometric specification is as follows:

$$HE_{it} = \beta_0 + \beta_1 lagHE_{it} + \beta_2 ME_{it} + \beta_3 ED_{it} + \beta_4 lnPD_{it} + \beta_5 CA_{it} + \beta_6 CI_{it} + \beta_7 PO_{it} + \beta_8 GE_{it} + \beta_9 IR_{it} + \beta_{10} CO_{it} + \beta_{11} lnGD_{it} + \varepsilon_{it} \quad (1)$$

$$ME_{it} = \alpha_0 + \alpha_1 lagME_{it} + \alpha_2 HE_{it} + \alpha_3 ED_{it} + \alpha_4 lnPD_{it} + \alpha_5 CA_{it} + \alpha_6 CI_{it} + \alpha_7 CC_{it} + \alpha_8 PO_{it} + \alpha_9 GE_{it} + \alpha_{10} IR_{it} + \alpha_{11} CO_{it} + \alpha_{12} lnGD_{it} + \alpha_{13} MO_{it} + \alpha_{14} PH_{it} + \varepsilon_{it} \quad (2)$$

where HE_{it} and ME_{it} represent health spending as a share of GDP and military spending as a share of GDP for country i $(i = 1, \dots, 22)$ at time t $(t = 1, \dots, 27)$, respectively. The inclusion of lagged dependent variables ($lagHE$ and $lagME$) reflects the incremental nature of public budgeting processes, whereby spending levels gradually adjust over time. In addition to these two budget items, education expenditure (ED) as a share of GDP is explicitly included in both equations as a key control variable. Indeed, education spending, together with health expenditure, constitutes one of the largest components of social spending and reflects important intra-social budgetary trade-offs. Including education expenditure in both equations allows us to control for reallocations within the social sector and to isolate more accurately the direct interaction between health and military spending. This specification reduces potential omitted-variable bias and ensures that the estimated coefficients capture the net effect of military expenditure on health spending, and vice versa, conditional on the overall allocation of public resources to education.

GDP per capita (GD) is included in both equations as an indicator of the level of economic development and fiscal capacity, conditioning the size and composition of public spending in accordance with Wagner's Law. The variables of conflict (CA and CI), political stability, and violence (PO) are direct determinants of military spending and can also indirectly affect health expenditure through increased health needs and budgetary constraints. Inflation (IR) is included to account for cost effects impacting both the health and defense sectors, while government efficiency (GE) and corruption (CO) capture the quality of institutions influencing the allocation and efficiency of public spending. Health sector-specific variables, such as mortality (MO) and physician staffing density (PH), are included only in the health expenditure equation because they directly reflect healthcare needs. α_k and β_K are vectors of coefficients to be estimated, ε_{it} is the random error.

This joint specification explicitly accounts for the potential simultaneity of health and military expenditures, rendering ordinary least squares estimation inappropriate (Greene, 2012; Baltagi, 2011). System identification relies on exclusion restrictions based on economic and institutional arguments (Bollen and Davis, 2009). Each equation contains an endogenous variable: military spending in the health expenditure equation and, conversely, health spending in the military expenditure equation. Specifically, variables such as lagged military expenditure are included in the military expenditure equation but excluded from the health expenditure equation. Conversely, lagged health expenditure, physician density, and mortality rates are included in the health expenditure equation but excluded from the military expenditure equation. The rank condition is also satisfied insofar as these lagged variables generate sufficient independent and predetermined variation in the corresponding endogenous variables. Past levels of military spending strongly influence current military expenditure, while not directly affecting current health spending once current military expenditure is controlled for. Similarly, past health expenditure shapes current health budgets through incremental budgeting, without directly influencing current military expenditure. These lagged variables, therefore, provide valid instruments that ensure the separate identification of the two equations in the system.

Given these considerations, the system is estimated using a two-stage least squares simultaneous equations model, which corrects for the endogeneity resulting from the simultaneity and inverse causality between the two expenditure items (Zellner and Theil, 1962). While the simultaneous equation framework explicitly accounts for the joint determination of military and health expenditures, the estimated coefficients should be interpreted as conditional associations rather than strictly causal effects. Although the results are consistent with a crowding-out mechanism, the analysis does not claim to identify exogenous causal shocks. Instead, the findings highlight systematic patterns in budgetary allocation that are compatible with theoretical expectations regarding resource competition under fiscal constraints. Following Gaibulloev et al. (2014), we assume that the Cross-sectional Dependence (CD) between our panel data units is characterized by a small number of unobserved common factors and therefore address CD by adding time fixed effects in the panel data to eliminate inconsistency concerns.

2.2. Data description

The data for this research were compiled from the World Bank database. We constructed a time series cross-section of 22 LICs for the period 1996-2022 with annual frequency (see Table A1 in the Appendix for the list of countries). Due to the lack of available data over a long period of time, for some of the variables in specific LICs, our analysis is restricted to this period, and some control variables are not included in the model. The following variables are considered: health spending as a share of GDP, Military spending as a share of GDP, Education as a share of GDP, GDP per capita, government effectiveness, corruption index, mortality rate, physicians per 1000 inhabitants, political stability and absence of violence, inflation rate, intensity of conflict, and country-affected conflict status. Detailed descriptions of the variables are presented in Table I. These descriptive statistics give some ideas about the characteristics of these LICs. Indeed, the standard deviations of some variables, such as corruption, physicians per capita, and political stability, are close to zero, indicating that data points are very close to the mean.

However, other variables, such as government effectiveness and inflation, have a larger standard deviation, indicating that data points are spread further away from the mean between 1996 and 2020. The average index of political stability and absence of violence or terrorism is -1.005, indicating that the LICs present the shaded condition in terms of political stability and security; the maximum index of stability (0.826) is observed in the Gambia in 2002 and the minimum index (-2.996) in the republic of Yemen in 2018. The annual inflation rate is an average of 8.28 percent, with a minimum of -8.97 percent observed in Ethiopia in 1996 and a maximum of 92.44% observed in the Democratic Republic of Congo in 1997. The correlation analysis between variables is important for diagnosing multicollinearity issues.

Table 1. Descriptive statistics

Variable	Source	Obs.	Mean	Std. dev.	Min	Max
Public Health spending (expressed as a percentage of GDP)	WHO	594	4.652	2.718	1.465	15.53
Public Military expenditure (expressed as a percentage of GDP)	SIPRI	594	3.052	5.583	0.192	7.953
Public education spending (expressed as a percentage of GDP)	WDI	594	3.446	1.465	0.622	9.645
GDP per capita (constant 2015 US$; as a logarithm)	WDI	594	6.351	0.429	5.451	7.842
Inflation (annual percentage)	WDI	594	8.282	9.682	-8.97	92.44
Perception of corruption (1=low to 6=high)	CPIA	594	2.617	0.598	1.5	3.5
Infant mortality	WDI	594	4.572	0.521	2.939	5.593
Physicians (per 1,000 people)	WDI	594	0.148	0.285	0.011	1.52
Government effectiveness	WGI	594	12.50	7.192	0.235	43.67
Conflict intensity	UCDP	594	0.644	0.733	0	2
Public debt	WDI	594	5.592	7041	0.294	51.16
Fragile and Conflict-affected country (1 if yes and 0 otherwise)	World Bank	594	0.545	0.498	0	1
Political stability	WDI	594	-1.00	0.905	-2.99	0.826

Note: SIPRI = Stockholm International Peace Research Institute. WDI = World Development Indicators of the World Bank, WGI = Worldwide Governance Indicators of the World Bank, WHO = World Health Organization. UCDP = Uppsala Conflict Data Program, CPIA = Country Policy and Institutional Assessment.

Source: Author's calculation.

Table 2 presents the pairwise correlation coefficients between the variables mentioned above. Apart from the relationship between Public debt and Physicians per capita (R = 0,798), the correlations between different pairs of control variables

are low or statistically insignificant, suggesting that multicollinearity is unlikely to be a concern in the model to be estimated. Additionally, we apply the Variance Inflation Factor (VIF) test to further assess the presence of multicollinearity (see Table A3 in the Appendix). All VIF values are below 5, confirming the absence of multicollinearity among the independent variables.

Table 2. Correlation matrix between variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Health spending	1									
2. Military spending	-0.026	1								
3. Education spending	-0.127	0.128	1							
4. GDP per capita	0.607*	0.207*	0.128	1						
5. Inflation rate	-0.138*	0.002	-0.135	-0.080	1					
6. Corruption	-0.110	-0.154	0.188	-0.060	-0.014	1				
7. Mortality	-0.585	-0.230	0.086	-0.482	0.078	0.161	1			
8. Physicians per capita	0.412	0.065	0.029	0.448	-0.019	-0.098	-0.450	1		
9. Gov. effectiveness	0.085	0.139	0.232	-0.058	-0.129	0.096	-0.185	0.077	1	
10. Public debt	-0.109	0.672	0.283	0.389	0.015	-0.059	-0.388	0.798	0.121	1

Source: Author's computation from STATA software.

2.3. Preliminary tests

We began our empirical analysis with several data diagnostic tests, including a Cross-sectional Dependence (CD) test and unit root tests for stationarity. First, we performed the Lagrange Multiplier test developed by Breusch and Pagan (1980) to assess the presence of CD in our variables. This test is based on the average of the squared pairwise correlations of the residuals. As shown in Table 3, both specified models exhibit CD, as we reject the null hypothesis of cross-sectional independence (p-value < 0.01), and conclude that the panel exhibits CD.

Table 3. Results of the Breusch-Pagan LM test for cross-sectional dependence

	Fixed effect		Random effect	
Model	*Chi-squared statistic*	*P value*	*Chi-squared statistic*	*P value*
Equation (1)	716.5***	0.000	584.2***	0.000
Equation (2)	317.2***	0.002	287.1***	0.000
Test	Ho: no cross-sectional dependency			

*Notes: *** denotes the rejection of a null hypothesis of no cross-sectional dependency at 1% significance level. H0: Null Hypothesis in the technical language of econometrics.*
Source: Author from Stata software.

This indicates the presence of CD in both the Fixed Effects and Random Effects specifications. Based on this evidence, it is clear that ignoring CD in panel data analysis can lead to serious consequences, such as unaccounted-for residual dependence, which may result in a loss of estimator efficiency and invalid test statistics. Given the presence of CD, we re-examine the panel data using second-generation panel unit root tests. Specifically, we apply Pesaran's (2007) cross-sectionally augmented Im-Pesaran-Shin (CIPS) Z (t-bar) unit root test to assess the

stationarity of the variables, as this test accounts for CD. Table 4 presents the results of the second-generation unit root tests, namely the CIPS and PESCADF tests.

Table 4. Results of CIPS and PESCADF tests

	CIPS		PESCADF			
Variables	Level	First difference	Level		First difference	
			Z[t-bar]	p-value	Z[t-bar]	p-value
Health spending	-5.777	-6.190	-2.222	0.013	-20.24	0.000
Military spending	-4.628	-6.043	-0.834	0.202	-15.35	0.000
Education spending	-4.208	-5.768	-1.556	0.060	-6.662	0.000
GDP per capita	-4.533	-6.015	-0.771	0.220	-20.907	0.000
Inflation	-4.448	-5.770	-2.241	0.013	-17.675	0.000
Mortality	-4.413	-5.504	-7.118	0.000	-15.139	0.000
Physicians per capita	-5.084	-6.020	-3.897	0.000	-15.418	0.000
Government effectiveness	-4.794	-5.942	-4.747	0.000	-12.896	0.000
Public debt	-4.232	-5.709	-4.078	0.000	-6.254	0.000
Political stability	-4.406	-5.598	-5.97	0.000	-15.20	0.000

Notes: CIPS (Cross-sectional augmented Im, Pesaran and Shin). The critical value at the 5% level in the CIPS test is -2.15. CIPS: H_0 (homogeneous non-stationary): bi = 0 for all I. PESCADF (Pesaran's Cross-sectional Augmented Dickey-Fuller): the null hypothesis assumes all series are non-stationary in a heterogeneous panel with cross-sectional dependence.

Source: Author from Stata software.

The null hypothesis assumes homogeneous non-stationarity for CIPS and non-stationarity for PESCADF (Pesaran, 2007). The results of the CIPS test tend to reject the null hypothesis of a unit root for all variables at the 5% significance level, both in level and in first difference. Consequently, the variables are found to be stationary under this test. In contrast, the PESCADF test results show that all variables are highly significant at the 1% threshold in their first differences across all models, indicating that the variables are stationary in first differences.

3. RESULTS OF ANALYSIS

In this section, we present the estimation results obtained from the simultaneous equation models. These results provide the basis for understanding the interdependent relationships among public spending. Subsequently, we conduct a comparative analysis between LICs and middle-income countries (MICs) to highlight potential structural differences across income groups.

3.1. Results of Simultaneous Equation Models

A close examination of Table 5 reveals a negative association between military spending and health expenditure across all model specifications. This inverse

relationship persists after the inclusion of additional variables, suggesting a systematic pattern in the allocation of public resources. While the empirical strategy does not aim to identify strictly causal effects, the results are consistent with a crowding-out mechanism, whereby higher military spending is associated with lower health expenditure under binding fiscal constraints.

Specifically, the estimated association between health expenditure and military expenditure is −0.1137 in the baseline specification without additional controls (Model I) and −0.1639 when the full set of control variables is included (Model III). The magnitude of this negative association increases when accounting for conflict-affected country status and conflict intensity, indicating that the inverse relationship between the two spending categories is particularly pronounced in contexts characterized by heightened security pressures. Similarly, the estimated association between military spending and health expenditure is −0.2207 in Model IV and −0.5605 in Model VI. The consistency of the negative coefficients across both equations highlights the interdependence of budgetary decisions and points to a systematic trade-off in the composition of public expenditure.

The interaction term between conflict-affected country status and military expenditure is negative and statistically significant (−0.0646), indicating that in fragile and conflict-affected states, the negative association between military and health spending is stronger. This finding suggests that persistent security threats may intensify competition for scarce fiscal resources, leading governments to prioritize defense-related expenditures. Such prioritization may reflect increased spending on arms procurement, counter-terrorism operations, and security infrastructure. Although this result should not be interpreted as a causal effect, it provides empirical evidence consistent with the hypothesis that fragility and conflict exacerbate budgetary pressures on social sectors.

Results also indicate the dynamic persistence in public health expenditure. The coefficient on lagged health spending is positive, large, and statistically significant, implying that current expenditure is correlated with its past level. Empirically, a 1 percent increase in health expenditure in the previous year is associated with a 23.7 percent increase in current health spending (Model IV).

This finding lends robust support to the incremental budget theory, according to which public budgets evolve through gradual adjustments rather than abrupt shifts. Past expenditure levels thus serve as an important reference point in contemporary budgetary decisions, reinforcing path dependence in public health financing.

Conflict-related variables exhibit differentiated associations with public spending components. First, conflict-affected country status is positively and significantly associated with military expenditure, indicating that countries facing persistent insecurity tend to allocate a larger share of their resources to defense. This pattern is consistent with theoretical expectations and prior empirical studies emphasizing the role of security concerns in shaping public budgets. Second, conflict-affected status is negatively associated with health expenditure, suggesting that fragility is correlated with reduced investment in health systems. This relationship may reflect a combination of budgetary reallocation toward security needs, infrastructure destruction, and weakened administrative capacity in conflict environments.

Table 5. Estimation results of the effects of military outlays using the TSLS

Explicative variables	Dependent variables					
	Military spending			Health spending		
	Model I	Model II	Model III	Model IV	Model V	Model VI
Military spending				-0.2207** (0.229)	-0.4926*** (0.074)	-0.5605*** (0.103)
Health spending	-0.1137*** (0.030)	-0.1435** (0.018)	-0.1639*** (0.023)			
Lag Military spending (t-1)	-0.1282*** (0.048)	0.3023*** (0.039)	0.2376*** (0.039)			
Lag Health spending (t-1)				0.2376*** (0.275)	0.0082* (0.004)	0.0013** (0.052)
Ln Public debt			0.0408 (0.059)			0.0461** (0.241)
Interaction conflict – military spending						-0.0646*** (0.018)
Conflict-affected country status		0.7073* (0.725)	0.9042*** (0.783)		-0.0472*** (0.013)	-0.1289*** (0.282)
Conflict intensity		2.4717*** (0.526)	0.4313** (0.528)		-0.0983 (0.138)	-0.1028 (0.140)
Education spending			0.2533 (0.248)			0.5354*** (0.068)
Political stability			-3.3087*** (0.507)			-0.2901** (0.139)
Government effectiveness			0.1213** (0.050)			-0.0643*** (0.013)
Inflation			0.0343 (0.034)			-0.0146* (0.008)
Corruption			-1.8164*** (0.602)			-0.2035*** (0.031)
Ln GDP per capita			2.2443*** (1.002)			0.2416*** (0.2416)
Mortality rate						-0.2461*** (0.022)
Physicians per capita						0.2807 (0. 582)
Constant	-9.750** (0.482)	7.209*** (0.928)	6.620*** (0.643)	0.933*** (0.102)	14.686*** (1.312)	20.892*** (2.059)
R^2	0.1295	0.2735	0.4378	0.2426	0.3375	0.5673
Observations	567					

Note: (*), (**), (***) indicate significance at the 10%, 5%, and 1% levels, respectively.
The standard deviations are in parentheses.
Source: Author from Stata software.

Conflict intensity further reinforces this pattern. Higher levels of conflict intensity are positively and significantly associated with military spending, indicating that escalating violence is accompanied by increased defense allocations. This finding reflects a short-term budgetary response focused on managing immediate security threats. In contrast, the association between conflict intensity and health expenditure is negative but not statistically significant, suggesting that health spending may be less responsive in the short run to variations in conflict severity.

Public debt appears to play an important role in shaping government expenditure patterns. The results indicate that higher public debt levels are positively associated with both military and health expenditures. In particular, an increase in public debt is associated with a rise in health expenditure, with a coefficient of 0.0461 significant at the 5 percent threshold. This positive association may reflect governments' reliance on borrowing to sustain essential public services under fiscal pressure, as well as the role of external and concessional financing earmarked for social sectors in LICs. These findings suggest that public debt does not necessarily crowd out social spending and may instead function as a fiscal adjustment and stabilization mechanism.

Economic development, proxied by GDP per capita, is positively and significantly associated with both military and health expenditures. This result shows that as income rises, governments increase public spending. This applies to both defense and social sectors. It reflects greater fiscal capacity. It also indicates rising demand for public services. The higher elasticity of military expenditure suggests a stronger response to economic growth than health spending in LICs. This pattern, which is consistent with Wagner's law, aligns with broader theories linking economic growth and public expenditure (Wagner, 1958; Keynes, 1936).

Government effectiveness, as defined by Kaufmann et al. (2011), exhibits a statistically significant but asymmetric association with public spending components. Higher government effectiveness is associated with increased military expenditure and lower health expenditure. This pattern may reflect strategic or geopolitical considerations that lead more effective governments to prioritize defense-related investments. This finding differs from the results of Bunyaminu et al. (2024) for 33 African countries. Alternatively, the negative link with health spending may signal efficiency gains. Better governance may improve health outcomes without increasing spending proportionally. This interpretation suggests that spending levels alone do not fully reflect public sector performance.

Education expenditure is positively associated with both military and public health spending, although the magnitude and statistical significance of this relationship differ across sectors. The estimated coefficient for military expenditure is positive (0.25) but not statistically significant, suggesting that education spending is not systematically related to defense budget allocations. In contrast, education expenditure exhibits a strong and statistically significant positive association with public health spending (0.535 at the 1 percent significance level). This pattern indicates that higher investment in education tends to coincide with higher health expenditure, implying complementarities in public investment in human capital development. Rather than reflecting a direct causal effect, this association likely captures coordinated budgetary priorities and shared underlying determinants of social sector spending.

Corruption is negatively associated with both military and health expenditures, indicating that countries characterized by higher levels of corruption tend to allocate a smaller share of public resources to these sectors. This result is consistent with previous empirical evidence on the role of institutional quality in shaping public expenditure patterns. For instance, Arif et al. (2019) show that corruption is associated with higher military spending in high-income countries, but with lower military expenditure in MICs and LICs. In the context of LICs, corruption may constrain public spending through its adverse effects on government revenues, budget execution, and allocative efficiency, ultimately reducing resources available for both defense and health sectors.

Infant mortality is negatively associated with public health expenditure. In LICs, higher infant mortality rates are correlated with lower levels of health spending (Model VI). This inverse relationship may reflect structural weaknesses in health systems, limited fiscal capacity, and governance constraints that simultaneously contribute to poor health outcomes and low public investment in health. While this association should not be interpreted causally, it is consistent with findings in the literature documenting a strong negative correlation between health expenditure and infant mortality. For example, Shetty and Shetty (2014) and Ude and Ekesiobi (2014) report a significant inverse relationship between health expenditure and infant mortality in Asian countries. Similarly, Bashir (2016) finds a negative association between government health expenditure and infant mortality in Nigeria.

4.2. Analysis of the Robustness of the Results

To assess the robustness of the baseline estimates, two additional specifications are estimated. Measuring public spending as a percentage of GDP may introduce a cyclical bias. Macroeconomic fluctuations can mechanically generate correlations between military and healthcare expenditures. To verify that the baseline results are not driven by this specification, the estimations are replicated using the same set of variables expressed in logarithmic terms.

Table 6. Estimation results using variables in logarithms

	Dependent variables			
Explicative variables	Ln Military spending		Ln Health spending	
	Model I	Model II	Model III	Model IV
Ln Military spending			-0.1869*** (0.050)	-0.0925** (0.039)
Ln Health spending	-0.8196*** (0.470)	-0.2011 (0.295)		
Lag ln Military spending (t-1)	0.3812*** (0.051)	0.1732*** (0.038)		
Lag ln Health spending (t-1)			0.4647 (0.060)	0.0428 (0.029)
		Explicative variables		*Explicative variables*
Constant	5.4678 *** (0.135)	5.2549*** (0.952)	0.933*** (0.102)	0.2043** (0.438)
R^2	0.218	0.614	0.414	0.788
Observations	567			

Note: (*), (**), (***) indicate significance at the 10%, 5%, and 1% levels, respectively. The standard deviations are in parentheses.

Source: Author from Stata software.

Table 6 reports the results obtained from the log-log specifications. In this framework, the estimated coefficients can be interpreted as elasticities, capturing the strength of the association between military and healthcare expenditures rather than direct causal effects. The results from Models I and II suggest a negative association between health expenditures and military expenditures. In Model I, the coefficient on health expenditures is negative and statistically significant at the 1% level (−0.8196), indicating that higher health spending is associated with lower military spending. However, this coefficient loses statistical significance in Model II, highlighting the sensitivity of the estimated relationship to model specification and the inclusion of additional control variables.

Table 7. Results of SEMs by category of countries

Explicative variables	Low-Income Countries		Middle-Income Countries	
	Military spending	Health spending	Military spending	Health spending
Military spending		-0.5605*** (0.103)		-0.0846*** (0.024)
Health spending	-0.1639*** (0.023)		-0.6114*** (0.526)	
Lag Military spending (t-1)	0.2376*** (0.039)		0.1659 (0.053)	
Lag Health spending (t-1)		0.0013** (0.052)		0.0046 (0.0142)
Ln Public debt	0.0408 (0.059)	0.0461** (0.241)	-0.1111*** (0.021)	-0.0080* (0.004)
Interaction conflict – military spending		-0.0646*** (0.018)		
Conflict-affected country status	0.9042*** (0.783)	-0.1289*** (0.282)		
Conflict intensity	0.4313** (0.528)	-0.1028 (0.140)	-0.3905*** (0.120)	-0.0569*** (0.018)
Education spending	0.2533 (0.248)	0.5354*** (0.068)	-0.6317*** (0.204)	-0.1068*** (0.028)
Political stability	-3.3087*** (0.507)	-0.2901** (0.139)	-1.0477*** (0.135)	-0.0583* (0.035)
Government effectiveness	0.1213** (0.050)	-0.0643*** (0.013)	-0.0302** (0.012)	0.0012 (0.002)
Inflation	0.0343 (0.034)	-0.0146* (0.008)	-0.0512*** (0.009)	-0.0082*** (0.001)
Corruption	-1.8164*** (0.602)	-0.2035*** (0.031)	0.1988 (0.122)	-0.0155 (0.019)
Ln GDP per capita	2.2443*** (1.002)	0.2416*** (0.2416)	2.4346*** (0.371)	0.4462 (0.059)
Mortality rate		-0.2461*** (0.022)		0.0019*** (0.0005)
Physicians per capita		0.2807 (0. 582)		-0.1101 (0.092)
Constant	6.620*** (0.643)	20.892*** (2.059)	19.7326*** (2.966)	0.2043** (0.438)
R^2	0.4378	0.5673	0.667	0.794
Observations	567		1040	

Note: (*), (**), (***) indicate significance at the 10%, 5%, and 1% levels, respectively. The standard deviations are in parentheses.

Source: Author from Stata software.

Models III and IV highlight the reverse relationship. They show a negative and statistically significant association between military and health expenditures. The estimates suggest that a 1% increase in military spending is associated with a reduction in healthcare spending of between 0.09% and 0.19%. These results

support the existence of a budgetary trade-off between defense and health sectors. Overall, the estimations using logarithmic specifications confirm the robustness of the negative relationship observed in the benchmark models. The sign of the association remains stable across most specifications. However, the magnitude and statistical significance of the coefficients vary across models.

To explore potential heterogeneity in this relationship, the analysis is extended by distinguishing countries according to income level. A comparative assessment between LICs and MICs is conducted to identify possible structural differences in the association between military and health expenditures. Table 7 indicates a significant bidirectional negative association between military and health spending in LICs.

On the one hand, higher military spending is associated with a significant decrease in health spending, as reflected by the statistically significant negative coefficient (−0.56). On the other hand, health spending is also negatively associated with military spending (−0.16), suggesting a strong inverse relationship between these two budget components in a context of tight fiscal constraints. In MICs, the negative association between military and health spending persists but appears less pronounced. Military spending is negatively and significantly associated with health spending (−0.08), suggesting the presence of budgetary trade-offs, although these seem less binding than in LICs. Conversely, the association between health spending and military spending is larger in magnitude and negative (−0.61), implying that higher health expenditure shares tend to coincide with lower military spending levels. This pattern may reflect differences in fiscal space, institutional arrangements, and social priorities.

Overall, these results reveal heterogeneity in the inverse relationship between military and health spending across income groups. The association appears stronger and more balanced in LICs, where fiscal constraints are more severe, whereas it is weaker and more asymmetrical in MICs. This variation underscores the importance of accounting for countries' levels of economic development when examining budgetary trade-offs between security and health expenditures, as well as when designing public policies tailored to the specific constraints faced by different groups of countries.

CONCLUSION

This article aims to provide new empirical evidence on the relationship between military and health spending in LICs. Budgetary constraints are often severe in many LICs, especially in those classified as fragile or conflict-affected countries. To explore this relationship, the study focuses on panel data from 22 countries spanning 1996 to 2022. The data were suspected to exhibit cross-sectional dependence, which was confirmed through appropriate tests. There is a potential simultaneity problem between health and military expenditures, implying possible endogeneity and reverse causality in their relationship. To address this issue, the study employs a Simultaneous Equation Model. The empirical results consistently point to a robust negative association between military and health spending across a wide range of specifications. This inverse relationship is observed in both directions, suggesting patterns that are consistent with a fiscal trade-off between defense and health expenditures. While the methodological approach strengthens confidence in the empirical findings, the results should be interpreted as evidence of correlation rather than definitive causal effects.

The analysis indicates that the inverse relationship between military and health spending is particularly pronounced in LICs, and even more so in fragile and conflict-affected states. In these contexts, higher levels of military spending, often associated with persistent security challenges and ongoing conflicts, tend to coincide with lower levels of investment in the health sector. These findings highlight a central dilemma confronting low-income country governments: balancing immediate security needs with the preservation of investments essential for human capital development. The study also underscores the important role played by macroeconomic and institutional factors in shaping public expenditure allocation.

Robustness tests, based on the use of logarithmic variables and disaggregation by income level, confirm the stability of the main findings. Across these alternative specifications, the sign and statistical significance of the estimated coefficients remain broadly unchanged, suggesting that the observed inverse relationship between military and health spending is not driven by the choice of expenditure measure or functional form. Nevertheless, the comparative analysis points to substantial heterogeneity across income groups. The negative association appears stronger and more balanced in low-income countries, whereas it is weaker and more asymmetrical in middle-income countries.

These findings carry several important policy implications. First, in low-income and conflict-affected countries, security strategies should be embedded within a broader human security framework, recognizing that persistent underinvestment in the health sector can undermine social stability and compromise long-term peace. Second, technical and financial partners should place greater emphasis on protecting essential social spending in fragile contexts, including through concessional and conditional financing mechanisms to limit budgetary crowding-out. Third, strengthening the governance and effectiveness of public institutions is critical to improving the trade-off between defense spending and human capital investment. Finally, the results highlight the close interdependence between development and security policies: a more balanced allocation of public resources is likely to foster inclusive growth, strengthen health system resilience, and enhance long-term state stability.

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Appendix

Table A1. Sample of low-income countries

Afghanistan	Madagascar
Burkina Faso	Malawi
Burundi	Mali
Central African Republic	Mozambique
Chad	Niger
Congo, Dem. Rep.	Rwanda
Eritrea	Sierra Leone
Ethiopia	Syrian Arab Republic
Gambia	Togo
Guinea-Bissau	Uganda
Liberia	Yemen, Rep.

Source: World Bank.

Table A2. Sample of middle-income countries

1	Albania	21	Malaysia
2	Algeria	22	Mauritania
3	Angola	23	Mauritius
4	Bangladesh	24	Mexico
5	Bolivia	25	Morocco
6	Botswana	26	Namibia
7	Brazil	27	Nigeria
8	Bulgaria	28	Pakistan
9	Cameroon	29	Peru
10	China	30	Romania
11	Congo, Rep.	31	Russian Federation
12	Côte d'Ivoire	32	South Africa
13	Djibouti	33	Thailand
14	Egypt, Arab Rep.	34	Tunisia
15	Indonesia	35	Turkey
16	Jordan	36	Venezuela, RB
17	Kenya	37	Vietnam
18	Kosovo	38	Zambia
19	Lebanon	39	Ghana
20	Lesotho	40	India

Source: World Bank.

Table A3. Variance inflation factor test

Variable	VIF
Equation 5 (HEP)	1.7352
Equation 6 (MIL)	2.6476

Source: computed by author.

Arbitrage dans l'affectation des dépenses publiques dans les pays à faible revenu : le dilemme dépenses militaires – dépenses de santé revisité

Résumé **-** L'objectif de cette étude est d'analyser les arbitrages dans l'allocation des ressources publiques entre les secteurs de la défense et de la santé dans les pays à faible revenu (PFR), dont certains sont fragiles et affectés par des conflits multiformes. À partir de données de panel couvrant 22 PFR sur la période 1996–2022, l'étude mobilise un modèle à équations simultanées, estimé à l'aide de la méthode des doubles moindres carrés, afin de tenir compte des problèmes de simultanéité et d'endogénéité. Les résultats mettent en évidence un effet d'éviction entre les dépenses militaires et les dépenses de santé. Plus précisément, l'augmentation des dépenses militaires est associée à une diminution significative des dépenses publiques de santé, tandis qu'une hausse des dépenses de santé tend également à contraindre les dépenses consacrées à la défense, révélant ainsi un arbitrage budgétaire bidirectionnel. Cet effet est nettement plus prononcé dans les pays fragiles et affectés par les conflits, où les pressions sécuritaires entraînent une augmentation des dépenses militaires au détriment des investissements dans le secteur de la santé. En outre, l'intensité des conflits renforce les dépenses militaires, accentuant la réallocation des ressources publiques vers des priorités sécuritaires. Des analyses complémentaires distinguant les pays à revenu faible et intermédiaire confirment ces résultats.

Mots-clés
Dépenses publiques
Pays touchés par un conflit
Pays à revenu faible
Modèles d'équations structurelles