On the effect of military spending on education in Africa: what role does institutional quality play?

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**Abstract**

**Purpose** – This study explored how institutional quality influences the relationship between military spending and education in Africa.

**Design/methodology/approach** – This study used data from 43 African countries spanning the years 2000–2021. Two estimation methods were employed to address various issues: Fixed Effects with Driscoll-Kraay standard errors and the Two-Step System Generalised Method of Moments. The Fixed Effects with Driscoll-Kraay standard error method was used to obtain reliable standard errors and inferences from the estimated coefficients of the fixed effects model. Meanwhile, the problem of endogeneity between military spending and education was addressed using the Two-Step System Generalized Method of Moments (GMM).

**Findings** – The results indicated that military spending negatively impacts both the quality and quantity of education. However, both institutional quality and the interaction term (institutional quality*military spending) have positive effects on both measures of education, suggesting that better institutional quality mitigates the negative effect of military spending on education outcomes.

**Practical implications** – This study shows that institutional quality dampens the negative effect of military spending on education, especially the quality of education. Hence, African countries should prioritize strengthening their institutions to ensure optimal allocation and utilization of government funds for the benefit of their citizens.

**Originality/value** – This is the first study to examine the moderating role of institutional quality in the relationship between military spending and education, focusing on both the quantity and quality of education.

**Keywords** Institutional quality, Military spending, Quality of education, Quantity of education

**Paper type** Research paper

1. **Introduction**

Defense economists have long been interested in the economic impact of military spending (Alptekin and Levine, 2012). Consequently, numerous studies have examined the impact of military spending on various socioeconomic issues, including GDP (Raifu and Aminu, 2023), investment (Raifu, 2022), unemployment (Raifu et al., 2022; Raifu and Afolabi, 2023a), poverty

**JEL Classification** — H50, H56, I20, P30

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In a world with limited resources, governments must allocate financial resources efficiently among multiple competing needs to avoid overfunding one sector at the expense of another. Insufficient resource allocation to other sectors of the economy, particularly education, can result in poor educational quality (Russett, 2015). Some scholars argue that a trade-off exists between military spending and social welfare expenditures. According to Perlo-Freeman (2016), increased military expenditure is detrimental to the economy as it crowds out spending on more productive sectors like health and education (Shin, 2020).

Drawing from the aforementioned arguments, this study aims to address the following question in Africa: How does the quality of African institutions influence the impact of military spending on education? We approach this research question in two distinct ways. First, we examine how military spending affects both the quantity and quality of education in Africa. Second, we investigate the moderating role of institutional quality in the relationship between military spending and education. Most studies to date have concentrated on the connection between social welfare spending and military spending (Yildirim and Sezgin, 2002; Adebiyi and Oladele, 2005; Obasi et al., 2018; Shin, 2020). Rather than focusing solely on education expenditure, it is critical to analyse how military spending affects education quality and quantity (Hanushek and Woessmann, 2008). This is because education quality impacts cognitive development, determining whether a country’s population is creative and competent enough to contribute to economic progress. The second goal is to examine how the quality of African institutions influences the linkages between military spending and education. Institutions play important roles in shaping long-term economic outcomes, as proven empirically (Acemoglu et al., 2005). It is not enough to have institutions; their quality is what matters. A country with high-quality institutions would properly distribute resources to the most essential economic sectors. Poor institutional quality conditions may lead to the misuse of budgeted funds for personal gain (Raifu, 2021; Raifu et al., 2021b). Thus, both weak and strong institutions can influence the distribution of military and other socioeconomic funds (Arvin et al., 2021). The quality of institutions impacts a country’s educational quality. According to Adams-Kane and Lim (2016), poor institutional quality can negatively affect education quality due to poor instruction delivery and a poor learning environment, both of which have negative consequences for educational outcomes.

This study focuses on African economies for three reasons. First, most African countries have recently increased their military spending in response to ongoing terrorist threats. According to the Stockholm International Peace Research Institute (SIPRI), military spending in Africa rose by 5.1% (3.5% in Sub-Saharan Africa) in 2020, surpassing other regions except for the Middle East (6.5%), such as Europe (4.0%), the Americas (3.9%) and Asia and Oceania (2.5%). Among African countries, Uganda increased its military budget the most (46%), followed by Chad (31%) [1]. Various factors such as the fight against terrorist organizations like Boko Haram, the Islamic State of West African Province (ISWAP), as well as kidnappers and unknown gunmen, have driven the rise in military spending in numerous African countries.

Second, while nearly half of African countries allocate a larger share of their budgets to education, the efficiency of this spending is often low, negatively affecting the continent’s education quality. According to the African Development Bank’s (AfDB) 2020 African Economic Outlook report, African countries spent an average of 5% of their GDP and 16% of their budgets on education between 2010 and 2017, far exceeding the UN’s recommended minimum of 4 and 15%, respectively. However, Africa has the lowest per capita education spending per student, the AfDB’s 2020 report shows that annual expenditures on basic and secondary education in Africa are $533 and $925 respectively. This low per capita schooling spending is affected by the rising population of young people, affecting both education quantity (school enrolments) and education quality (test scores on international exams).
Third, the quality of governance or institutions impacts long-term economic outcomes (Acemoglu et al., 2005). Good institutions ensure the optimal use of resources, while weak institutions lead to inefficiencies. Thus, the optimal distribution and use of resources, influenced by high institutional quality, can influence the relationship between military spending and education in Africa. However, a brief analysis reveals that institutional quality in Africa remains extremely low when compared to the rest of the world. According to the 2020 Transparency International’s Corruption Perception Index, corruption is widespread across Africa. Out of the 43 Sub-Saharan African countries rated in 2020, only six made progress, scoring above the global average. These countries are the Seychelles (66%), Botswana (60%), Cabo Verde (58%), Rwanda (53%), Mauritius (53%) and Namibia (51%). Sub-Saharan Africa had the lowest average corruption index score, with an average of 32%, compared to Western Europe and the European Union (66%), South Asia (45%), the Americas (43%), the Middle East and North Africa (39%), and East Europe and Central Asia (36%). Beyond corruption, African countries continue to perform poorly on other institutional criteria such as the enforcement of property rights. Figure A1 (see Appendix) depicts the regional enforcement of property rights and rule-based governance in 2020, with Sub-Saharan Africa (SSA) outperforming only the MENA region. This suggests that the misuse of public resources is more prevalent in SSA.

The remaining sections of the study are organized as follows. Section 2 reviews the existing literature. Section 3 presents the methodology and data sources. Section 4 presents and discusses the findings while section 5 offers policy recommendations and concludes the study.

2. Theoretical and empirical review

The empirical literature on the relationship between military spending and education is based on three primary hypotheses. The first hypothesis is the crowding-in hypothesis, aligned with the Keynesian perspective. This perspective posits that increased military spending, as a critical component of government spending, fosters positive economic development and, in turn, boosts spending on welfare goods, including health and education. Benoit (1978) argued that military expenditures by providing education, valuable skills, and research and development, enhance workforce capabilities, while also ensuring security. Some empirical studies supported this hypothesis (Adebiyi and Oladele, 2005).

The second hypothesis is the crowding-out hypothesis which posits a trade-off between key components of a national budget. The hypothesis suggests that increased military allocation displaces equivalent public investment, such as education (Yildirim and Sezgin, 2002). According to Ajala and Laniran (2021), governments impose high taxes because military expenditures consume scarce taxpayer revenue, leading to a probable trade-off between military spending and private sector investment in socio-economic activities, particularly health and education. Several empirical studies also substantiated this hypothesis (Obasi et al., 2018).

The third hypothesis is the neutrality hypothesis, which presupposes that there is no substantial correlation between military spending and education expenditure. It posits that the negative crowding-out effect and the positive spillover effect are ambiguous and vague (Ajala and Laniran, 2021). Huang and Ho’s (2018) study confirmed this hypothesis, finding no evidence of defense spending crowding-out education expenditures in Taiwan.

Regarding the role of institutional quality in military spending, Aizenman and Glick (2006) demonstrated that differences in socioeconomic and security challenges across countries are linked to institutional disparities. Compton and Paterson (2016) stated that the impact of military spending varies in economics plagued by pervasive corruption and rent-seeking compared to those without these problems. According to D’Agostino et al. (2012), corruption
influences the impact of military expenditure on growth. This indicates that the impact of military expenditure on education is shaped by the type of institution and, by extension, the form of government (Bel and Elias-Moreno, 2009). Benoit (1978) noted that high-quality institutions effectively administer spending and ensure that funds are used for their intended purposes.

On how institutional quality affects education, Ouedraogo et al. (2020) argued that improving institutional quality is essential for boosting access to high-quality education. Fomba et al. (2023) contended that the absence or deterioration of some institutional characteristics, through corruption or political instability, hinders the effectiveness of government spending on education. This suggests a relationship between education quality and institutional quality. Compton and Paterson (2016) noted that strong political and economic institutions lessen the negative effects of defense spending. Ouedraogo et al.'s (2020) study emphasized the importance of institutions in magnifying the relationship between military spending and education spending. Thus, institutional differences can explain variations in educational quality between countries. Despite these findings, the role of institutions in the relationship between military and education outcomes, particularly education quantity and quality, has not received adequate attention. Thus, this study aims to unravel how institutions affect the relationship between military spending and education (both quantity and quality) in Africa.

3. Methodology and data sources

3.1 Methodology
This study employs two estimation methods for robustness: fixed effects with Driscoll-Kraay standard errors and a Two-Step System Generalized Method of Moments (GMM). These two estimation methods address issues pertinent to panel data. Fixed effects with Discoll-Kraay standard error mitigate panel issues such as cross-sectional dependence or spatial dependence, heteroscedasticity and autocorrelation in the errors. The Two-Step System GMM addresses the endogeneity problem in the nexus between military spending and education.

We begin by specifying the fixed effects model to illustrate how military spending and other control variables influence education in Africa. This model follows Mintz and Huang's (1991) theoretical framework on the direct nexus between military spending and education spending or outcomes.

\[ ED_t = \alpha_i ED_{t-1} + \chi_i MS_t + \beta_i X + u_t + v_t + \epsilon_t \quad i = 1...N; \quad t = 1...T \]  

where \( i = 1, \ldots, N \) represents the countries and \( t = 1, \ldots, T \) represents the periods. \( ED \) denotes education (either quality or quantity). Education quantity is represented by secondary school enrolment (SSENROL), while education quality is proxied by the expected years of schooling (EYS). \( MS \) is the military expenditure as a percentage of GDP (MS_GDP). \( X \) denotes other control variables such as government expenditure on education (GSOEDU), infant mortality rate (MR), GDP per capita (GDPPCAP), and population growth (POPGR). These control variables are chosen based on their theoretical nexus with education. \( \epsilon \) is the error term, assumed to be independently and identically distributed with zero mean and constant variance.

The second objective of this study is to examine the moderating role of institutional quality in the nexus between military spending and education outcomes in Africa. Using Principal Component Analysis (PCA), the institutional quality index is constructed from six governance indicators: control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, and voice and accountability. Following Raifu et al. (2021a, 2024), the minimum and maximum methods normalize the institutional
quality index to range from 0 (poor institutional quality) to 1 (good institutional quality). The model incorporates the institutional quality and its interaction with military spending and is specified as follows:

$$ED_{it} = \alpha_i ED_{it-1} + \chi_{it} MS_{it} + \phi_{it} INST_{it} + \phi_{it}' (INST^{*} MS)_{it} + \beta_{it}' X + u_{it} + v_{it} + \epsilon_{it} \quad (2)$$

$INST$ represents institutional quality while $INST^{*} MS$ is the interaction between military spending and institutional quality.

We hypothesize that military spending negatively impacts both education quality and quantity. According to Mintz and Huang (1991), military spending affects education directly through a trade-off between military and education expenditure and indirectly by discouraging investment, thereby slowing growth and limiting government funds for social welfare projects. A high infant mortality rate is expected to harm educational outcomes, as it indicates a loss of human capital that may impact future growth (Azarnert, 2006). Economic development, indicated by GDP per capita, is positively correlated with education attainment and human capital development (Rani and Jegan, 2022). Increased government expenditure on education is expected to improve education outcomes (Farayibi and Folarin, 2021). Population growth affects education outcomes diversely, as suggested by numerous empirical findings. However, theoretically, population increase has a detrimental effect on education quantity and quality (Simon and Pilarski, 1979). Good institutional quality and its interaction with military expenditure are expected to improve education outcomes by mitigating the negative impact of military expenditure on education outcomes, while poor institutional quality may exacerbate these negative effects (Fomba et al., 2023).

Driscoll and Kraay’s (1998) method works well even when there is serial correlation, heteroscedasticity, and spatial and temporal dependence. However, it cannot solve the issue of endogeneity in the functional relationship between education spending and military spending. Better education can influence military spending, notwithstanding the well-established reality that increased military spending crowds out resources used to improve both the quantity and quality of education. For instance, a country with better education can improve its technology, which in turn could lead to advancements in military capabilities and a stronger military base (Elish et al., 2023). Furthermore, Equations (1) and (2) represent dynamic models that capture the lag of the dependent variable which is typically correlated with error terms. This also creates an endogeneity problem, which the fixed effects model with Driscoll-Kraay standard errors might not be able to handle. The estimated parameters of the fixed effects with Driscoll-Kraay standard errors may suffer from Nickell bias, known as dynamic panel bias. To address the issue of endogeneity, there is a need to remove the individual fixed effect by differencing Equation (2). Consequently, we re-specify Equation (2) as follows:

$$\Delta ED_{it} = \alpha_i \Delta ED_{it-1} + \chi_{it} \Delta MS_{it} + \phi_{it} \Delta INST_{it} + \phi_{it}' (INST^{*} MS)_{it} + \Delta \beta_{it}' X + \Delta u_{it} + \Delta v_{it} + \Delta \epsilon_{it} \quad (3)$$

Despite resolving the endogeneity issue, the fixed effects model with Driscoll-Kraay standard errors remains unsuitable for estimating Equation (3) due to the persistent link between the lagged dependent variable and the equation’s error term. To address this issue, we use the Two-Step System Generalised Method of Moments (GMM). The system GMM outperforms difference GMM because difference GMM results in a significant sample bias when the independent variables exhibit persistence across time (Blundell and Bond, 1998). The system GMM addresses this problem using two methods. It uses lagged differences of the dependent variable as instruments for the level equations and employs lagged values of the dependent
variable as instruments for the equations involving the first difference. However, in practice, this can lead to instrument proliferation (Roodman, 2009a). Roodman (2009b) recommends using the collapse option to address the issue while estimating system GMM models.

3.2 Data sources and description

3.2.1 Data sources. The study employs panel data from 43 African countries from 2000 to 2021 to investigate how institutional quality affects the relationship between military spending and education in Africa. Military spending is sourced from SIPRI. Two indicators of education, namely, secondary school enrolment and the expected year of schooling, are sourced from the World Development Indicators (WDI). Indicators of institutional quality are selected from the World Governance Indicators (WGI) developed by Kaufmann et al. (2011). Additional control variables such as government expenditure on education, GDP per capita, infant mortality rate, and population growth, are also extracted from WDI.

3.2.2 Data description: stylised facts about education, military spending and institutional quality. The stylized facts of the data used are described below. Figure 1 shows the average yearly secondary school enrolment among selected African countries. The average yearly secondary school enrolment in each of these countries ranges from 15.5 to 97.1%. Algeria has the highest average yearly enrolment of 97.1%, followed by South Africa with 95.5% and Mauritania with 90.6%. In contrast, Niger has the lowest enrolment, averaging 15.5% within the period. Many factors, including differences in education investment and institutional quality, contribute to the variability in the quantity of education or the level of secondary school enrolment.

Figure 2 presents the expected years of schooling in selected African countries, a measure of education quality, which ranges from 4.9 to 14.5 years. Students in Tunisia spend the highest number of years in school before graduation, about 14.5 years. Mauritius, South Africa, and Algeria follow with averages of 14.1, 13.5, and 13.4 years, respectively. This demonstrates that Mauritania, South Africa, and Algeria perform better in terms of both quality and quantity of education than other African countries. Conversely, students in Niger spend the least number of years in school in Africa, averaging just 4.9 years, making Niger the lowest in both education quantity and quality.

Figure 3 depicts the share of military spending in GDP among selected African countries. According to the figure, none of the countries spend more than 5% of their GDP on military spending each year. Except for Algeria and Sudan, which allocate up to 4% of GDP, the rest remain below 3%. In addition, Algeria dedicates a significant portion of its resources to military funding and has the largest yearly average secondary school enrolment in Africa, along with the highest number of years spent in school among African students. In other

![Source(s): Authors’ own work](image-url)
words, Algeria has the highest quality and quantity of education, as well as substantial military expenditure.

Figure 4 shows the average quality of institutions across African countries. The chart clearly shows that institutional quality differs among countries; around 23 countries have low institutional quality, while 21 have reasonably high institutional quality over the threshold of 0.5. Countries with an institutional quality of 0.8 or higher include Namibia, Botswana, South Africa, Mauritius, and Cape Verde. In Africa, Sudan has the lowest institutional quality (approximately 0.05%) and the second-highest percentage of military spending relative to GDP.
GDP. This may contribute to the country’s shorter schooling years. Corruption is a major factor in Africa’s declining institutional quality.

4. Preliminary analysis and empirical findings

4.1 Preliminary analysis

4.1.1 Descriptive statistics. The descriptive statistics of the variables of relevance, showing the variability and distribution, are presented in Table 1. Secondary school enrolment ranges from 6 to 134% of the population within the corresponding age group for secondary education, with an average of 48% per country in Africa. The expected years of schooling range from 3 to 15 years, with an average of 10 years for students in secondary schools across Africa. Military spending as a percentage of GDP averages about 2%, with a minimum of 0% and a maximum of 8% for at least one country. This indicates a significant dispersion in military spending across African countries. Similarly, the average institutional quality value of 0.47% suggests that, on average, countries have low institutional quality compared to the threshold of 0.50%. Government expenditure on education ranges between 0.1 and 13%, with an average value of 2.5%. The variability, represented by the standard deviation of 2%, points to heterogeneity between the mean and extreme values of government expenditure on education. The infant mortality rate ranges from 11.7 to 138.6 per 1,000 live births, with an average of 55.2. This means that, on average, 55 out of every 1,000 African infants die. GDP per capita ranges from $255.1 to $16992.0, with an average of $2129.3. The average population growth rate is 2.4%, with at least one country experiencing growth as high as 5.8%, indicating significant population growth in Africa. However, at least one country also experiences a population decline of about 2.6%.

4.1.2 Correlation analysis. Table 2 displays the correlation matrix results. The correlation test serves two purposes. Firstly, it examines the relationship between the variables of interest. Secondly, it investigates the possibility of multicollinearity among the regressors (Raifu and Afolabi, 2023c). The results show a significant positive association between the proxy for education quality (EYS) and military spending (RMS_GDP) and a negative correlation between the quantity of education (SSENROL) and military spending. Similarly, mortality rate and population growth exhibit significant negative correlations with measures of education and other variables. A strong positive linear correlation is observed between education indicators (SSENROL and EYS) and other control variables (institutional quality (INST), government expenditure on education (GEOEDU), and GDP per capita (GDPPCAP)). As shown in the table, the correlations among the regressors are moderate, indicating that multicollinearity is not an issue.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSENROL</td>
<td>946</td>
<td>48.052</td>
<td>24.022</td>
<td>6.2</td>
<td>133.53</td>
<td>0.684</td>
<td>2.953</td>
</tr>
<tr>
<td>EYS</td>
<td>946</td>
<td>10.003</td>
<td>2.527</td>
<td>2.8</td>
<td>15.43</td>
<td>-0.199</td>
<td>2.6</td>
</tr>
<tr>
<td>RMS_GDP</td>
<td>946</td>
<td>0.018</td>
<td>0.013</td>
<td>0</td>
<td>0.08</td>
<td>1.463</td>
<td>5.807</td>
</tr>
<tr>
<td>GDPPCAP</td>
<td>946</td>
<td>2129.281</td>
<td>2582.134</td>
<td>255.1</td>
<td>16992.029</td>
<td>2.716</td>
<td>11.997</td>
</tr>
<tr>
<td>GEOEDU</td>
<td>946</td>
<td>4.09</td>
<td>2.131</td>
<td>0.11</td>
<td>13.22</td>
<td>0.915</td>
<td>3.979</td>
</tr>
<tr>
<td>MR</td>
<td>946</td>
<td>55.191</td>
<td>24.664</td>
<td>11.7</td>
<td>138.6</td>
<td>0.374</td>
<td>2.871</td>
</tr>
<tr>
<td>POPGR</td>
<td>924</td>
<td>2.353</td>
<td>0.945</td>
<td>-2.63</td>
<td>5.79</td>
<td>-0.61</td>
<td>4.102</td>
</tr>
<tr>
<td>INST</td>
<td>946</td>
<td>0.47</td>
<td>0.242</td>
<td>0</td>
<td>1</td>
<td>0.291</td>
<td>2.142</td>
</tr>
</tbody>
</table>

Note(s): SSENROL, EYS, RMS_GDP, GDPPCAP, GEOEDU, MR, POPGr, and INST are secondary school enrolment, expected year of schooling, military spending as % of GDP, GDP per capita, government spending on education, mortality rate, population growth and institutional quality respectively.

Source(s): Authors’ own work
4.2 Empirical findings

This study used two educational indicators: secondary school enrolment (SSENROL), which measures the quantity of education, and expected mean years of schooling (EYS), which measures the quality of education. We created two models, one integrating SSENROL and the other incorporating EYS. Military spending as a percentage of GDP (MS_GDP) is used as a proxy for military spending, also known as a military burden, as it accounts for the socioeconomic costs of sustaining armed forces and military expenditure in a country (Raifu and Afolabi, 2023b; Raifu et al., 2023).

Each model is divided into four sub-models. The first model examines how military spending affects the quantity or quality of education. Institutional quality is introduced in model 2. Model 3 introduces an interactive term, the product of military spending and institutional quality from model 2. The fourth model controls for other variables theoretically linked to both the quality and quantity of education. These variables include government expenditure on education, infant mortality rate, GDP per capita, and population growth. The results are based on two estimation methods: Fixed Effects regression with Driscoll-Kraay Standard Error and a Two-Step System GMM analysis.

4.2.1 Fixed effects with Driscoll-Kraay standard error results.

Table 3 (upper part) presents the results regarding military spending, institutional quality, and secondary school enrolments (Quantity of Education).

Table 2. Pairwise correlations

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) SSENROL</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) EYS</td>
<td>0.821*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) RMS_GDP</td>
<td>0.078*</td>
<td>-0.001</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) GDPPCAP</td>
<td>0.678*</td>
<td>0.573*</td>
<td>0.237*-</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) GEOEDU</td>
<td>0.386*</td>
<td>0.406*</td>
<td>0.155*</td>
<td>0.261*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) MR</td>
<td>-0.669*</td>
<td>-0.656*</td>
<td>-0.078*</td>
<td>-0.668*</td>
<td>-0.437*</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) POPGR</td>
<td>-0.567*</td>
<td>-0.537*</td>
<td>-0.113*</td>
<td>-0.557*</td>
<td>-0.431*</td>
<td>0.550*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>(8) INST</td>
<td>0.306*</td>
<td>0.277*</td>
<td>-0.256*</td>
<td>0.327*</td>
<td>0.351*</td>
<td>-0.382*</td>
<td>-0.332*</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note(s): ***p < 0.01, **p < 0.05, *p < 0.1

ssenrol, eys, rms_gdp, gdppcap, geoedu, mr, popgr, and instn are secondary school enrolment, expected year of school, military spending as % of GDP, GDP per capita, government spending on education, mortality rate, population growth and institutional quality respectively.

Source(s): Authors’ own work

Table 3 (upper part) presents the results regarding military spending, institutional quality, and secondary school enrolment (quantity of education). In the first model, a 1% increase in military spending leads to a 0.46% reduction in secondary school enrolment. This represents the opportunity cost of increased military spending on secondary education enrolment. This suggests that military expenditure has a crowding-out effect on secondary school enrolment. When institutional quality is added in model 2, a similar result is observed: a 1% increase in military spending results in a 0.45% decline in secondary school enrolment, while a 1% increase in institutional quality improves secondary school enrolment in Africa by 0.13%.
While the outcomes of models 1 and 2 align with a priori expectations, they are not individually significant. However, in model 3, the interaction between military spending and institutional quality results in all variables (military spending, institutional quality, and their interaction) having a positive and significant effect on the quantity of education in Africa. Secondary school enrolment increases by 0.13, 0.55, and 0.14% as the shares of military spending in GDP, institutional quality, and the interaction of both variables increase by 1%, respectively. These results align with the findings of Fomba et al. (2023), that good
institutional quality increases the efficiency of public funding for education. It also suggests that without quality institutions and their moderating effect, Africa’s level of education is not significantly impacted by military spending.

Model 4 incorporates control variables (government expenditure on education, GDP per capita, infant mortality rate, and population growth). The results show a statistically significant connection between secondary school enrolment and all variables, including military spending, institutional quality, and their interaction. Additionally, all variables except mortality rate have positive effects on secondary school enrolment. This implies that increases in variables other than infant mortality rate lead to a significant improvement in the level of secondary school enrolment in Africa. These relationships are consistent with empirical expectations (See Fomba et al., 2023).

(2) Military Spending, Institutional Quality, and Expected Year of Schooling (Quality of Education)

The results regarding military spending, institutional quality, and expected years of schooling (quality of education) are also presented in Table 3 (lower part). Military spending has an adverse and statistically significant impact on Africa’s educational standards. Specifically, a 1% increase in military spending reduces Africa’s education quality by 0.05%. This finding aligns with existing literature, suggesting that allocating more funds to the military can deprive critical sectors like education of necessary investment (Kollias and Paleologou, 2013; Aghion et al., 2019).

In model 2, with only institutions and military spending as explanatory variables, the effect of military spending remains negative and significant, while institutional quality significantly improves education quality. Evidence from Model 3 indicates that military spending, institutional quality, and their interactive term have positive effects on education quality in Africa. A 1% increase in military spending, institutional quality, and their interactive variable improves education quality by 0.03%, 0.30%, and 0.06%, respectively. In Model 3, the impact of military spending is not statistically significant, hence, only institutional quality plays a role in enhancing education quality in the model.

The inclusion of control variables in the fourth model shows that all variables, including military spending, institutions, their interactive terms, government expenditure on education, GDP per capita, and population growth, except the mortality rate, have a positive relationship with education quality. In other words, an increase in any of these variables leads to improvements in education quality, while a reduction in mortality rate also enhances education quality. Except for military expenditure as a percentage of GDP and population growth rate, the relationships between education quality and all other variables are significant in Model 4.

4.2.2 Two-step system GMM results. This section presents the results of the two-step system GMM, employed to address the endogeneity between military spending and education and the issue of serial correlation (Badmus et al., 2024).

(1) Military Spending, Institutional Quality, and Secondary School Enrolments (Quantity of Education)

Table 4 (upper section) presents the results regarding military spending, institutional quality, and secondary school enrolment (educational quantity). The lagged dependent variable (lagged SSE) in all four models (1, 2, 3, and 4) significantly and positively influenced secondary school enrolments in Africa. This suggests that high levels of past secondary school enrolments in African countries serve as a solid foundation for current enrolments.

Our analysis also shows the absence of second-order serial correlation, as shown by the AR2 results. Similarly, the number of instruments (22, 23, 24, and 24) is relatively low
<table>
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<tr>
<th>Variables</th>
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<th>Model 2</th>
<th>Model 3</th>
<th>Model 1</th>
</tr>
</thead>
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<tr>
<td>LAGGED SSE</td>
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</tr>
<tr>
<td>RMS_GDP*INST</td>
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<td>−0.055***</td>
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<tr>
<td>RMS_GDP</td>
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<td></td>
<td></td>
</tr>
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<td>GDP PER CAPITA</td>
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<td></td>
<td>0.019***</td>
<td>0.043***</td>
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</tr>
<tr>
<td>POPULATION GROWTH</td>
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<td></td>
<td></td>
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<tr>
<td>YEAR EFFECT</td>
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<td>0.001***</td>
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<td>831</td>
<td>831</td>
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<td>24</td>
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<tr>
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<tr>
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<td>0.0423</td>
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<td>0.4710</td>
<td>0.4710</td>
<td>0.4706</td>
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<tr>
<td>Sargan-Hansen (p-value)</td>
<td>0.3481</td>
<td>0.2685</td>
<td>0.4113</td>
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</table>

<table>
<thead>
<tr>
<th>Quality of education: expected year of schooling</th>
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</thead>
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<tr>
<td>LAGGED EYS</td>
</tr>
<tr>
<td>RMS_GDP</td>
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<tr>
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<td>POPULATION GROWTH</td>
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<td>COUNTRY EFFECT</td>
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<td>CONSTANT</td>
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<tr>
<td>OBS.</td>
</tr>
</tbody>
</table>

Table 4. Two-step system GMM results (continued)
compared to the number of countries (42, 42, 42, and 41) in models 1, 2, 3, and 4, respectively. This implies that instrument proliferation does not bias the models (Ashraf, 2017). The validity of the instruments is confirmed by the insignificance of the Sargan tests, satisfying the exogeneity condition of the lagged variables.

There is evidence that military expenditure negatively and significantly impacts secondary school enrolment in Africa across all four models. In model 2 where institutional quality is an explanatory variable, military spending still has a negative impact, while institutional quality has a positive effect. As a result, a 1% increase in military expenditure is associated with a 0.03% decrease in secondary school enrolment.

After controlling for the interactive term and all variables in models 3 and 4, military spending reduces secondary school enrolment by approximately 0.10 and 0.11%, respectively. These results corroborate the crowding-out effect of military spending on education, as found by Kollias and Paleologou (2013) and Aghion et al. (2019). In other words, allocating additional financial resources to military activities decreases the public resources available to improve secondary education enrolment in Africa.

The impacts of control variables on the quantity of education in Africa reveal a positive correlation between education quantity and government expenditure on education and population growth. This implies that population growth and government spending on education are critical for increasing the quantity of education in Africa. This finding is consistent with Farayibi and Folarin (2021), who demonstrated that government expenditure in sub-Saharan African countries enhances educational outcomes. In contrast, the mortality rate and GDP per capita negatively affect secondary school enrolment.

(2) Military Spending, Institutional Quality, and Expected Year of Schooling (Quality of Education)

As with secondary school enrolment, the lagged estimates of expected years of schooling in all four models (1, 2, 3, and 4) contribute positively and significantly to the current level of expected years of schooling. This suggests that past education quality has positively contributed to the current quality of education in African countries. The AR2 results in all four models indicate the absence of second-order serial correlation in the models. Thus, we fail to accept the null hypothesis of serial correlations. Furthermore, the Sargan test p-values are not significant, so we reject the alternative hypothesis of over-identification. This implies that our results can be relied on for statistical inferences (Djeri et al., 2020).

The findings indicate that military spending negatively and significantly impacts expected years of schooling in Africa, even when combined with institutional quality, the interacting term, and control variables in models 2, 3, and 4 respectively. The consistent negative impacts of military spending across all models show that institutional quality and its moderating effect (the interaction term) are ineffective in mitigating the negative impact of

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
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<th>Model 3</th>
<th>Model 1</th>
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<tbody>
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<td>Number of country</td>
<td>42</td>
<td>42</td>
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<td>41</td>
</tr>
<tr>
<td>No. of instruments</td>
<td>23</td>
<td>23</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>AR1 (p-value)</td>
<td>0.0574</td>
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<td>0.3906</td>
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<td>0.4099</td>
</tr>
<tr>
<td>Jochmans Portmanteau test</td>
<td>0.4710</td>
<td>0.4710</td>
<td>0.4710</td>
<td>0.4706</td>
</tr>
<tr>
<td>Sargan-Hansen (p-value)</td>
<td>0.3809</td>
<td>0.4340</td>
<td>0.6570</td>
<td>0.9820</td>
</tr>
</tbody>
</table>

Source(s): Authors’ own work
military spending on education quality in Africa. As a result, higher military spending reduces the quality of education in Africa. In model 2, institutional quality significantly enhances education quality. However, including the interaction term and additional control variables in models 3 and 4 results in no significant impact. Moreover, the moderating effect (the interaction term) had a positive but non-significant influence on secondary school enrolment in models 3 and 4.

5. Conclusion and policy recommendations

The increase in military spending has become a concern in African countries due to its detrimental effects on other socioeconomic expenditures, especially education, which significantly impact the quality and quantity of education in Africa. This study addresses two main questions: First, how does military spending affect the quality and quantity of education in Africa? Second, can institutional quality mitigate the negative effect of military spending on education quality and quantity in Africa?

Using data from 43 African countries and employing two distinct estimation methods, our results show that military spending negatively impacts both the quality and quantity of education in Africa. However, the mitigating role of institutional quality varies with the estimation technique used. For example, with fixed effects and Driscoll-Kraay standard errors, institutional quality mitigates the negative effect of military spending on both the quantity and quality of education. Conversely, when using the Two-Step System GMM, institutional quality only mitigates the negative effect of military spending on the quality of education. Nevertheless, our finding underscores the crucial role of institutional quality in fostering educational quality, as it helps attenuate the adverse influence of military spending on education in Africa. Regarding the impact of additional control variables, GDP per capita negatively affects both measures of education. Consequently, the effects of government expenditure on education, population growth, and mortality rate depend on the education measure applied.

The key policy implication of this study is that while ensuring the security of lives and property through military spending is important, it must not come at the expense of other socioeconomic needs in African countries. Thus, institutional quality in Africa must be strengthened to ensure the optimal allocation of resources across different sectors for the proper development of the continent. Specifically, to improve the quality of African education, there is a need to strengthen existing institutions and build new ones. This can be achieved by strengthening the rule of law, implementing anti-corruption measures, promoting good governance, investing in capacity building, and encouraging civic engagement.

Note
1. https://www.sipri.org/sites/default/files/2021-04/fs_2104_milex_0.pdf

References


**Appendix**

![Figure A1. Property rights and rule based governance indicator in 2020](image)

**Source(s):** Authors’ own work
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