

Natural Resource Curse and Fiscal Governance:

The Effect of Gold Customs Fraud on Military and Education Spending in Africa

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Abstract

In resource-rich countries, the illicit trafficking of minerals poses a growing threat to state stability and fiscal governance. This paper investigates the effect of gold customs fraud on the allocation of military and education spending, using a panel dataset of 45 African countries from 2000 to 2019. Employing an instrumental variables strategy, we find that higher levels of gold customs fraud are significantly associated with lower public spending allocations to both the military and education sectors. Results remain robust with System-GMM and Jackknife IV estimations. Moreover, we find that the marginal effect of gold customs fraud on military and education spending is negatively conditioned by armed conflict. These findings suggest that, in both peaceful and conflict-affected contexts, illicit resource flows undermine fiscal capacity and distort budgetary priorities, thereby constraining governments' ability to finance defense and invest in human capital development.

Keywords: military spending, education spending, gold customs fraud, illicit natural resource trade.

JEL Codes: H56, H26, O17, D74.

Introduction

Natural resources contribute between 30% and 50% of domestic revenue in many African countries, making them a cornerstone of national economies (UNU-WIDER,2023). Despite their strategic importance, these resources are subject to illicit exploitation and transnational smuggling, that significantly erode state revenue streams and weaken institutional capacity (Cantens, 2013). Reflecting growing international concern, the United Nations General Assembly adopted Resolution 75/196¹, which highlights the expanding scale and transnational nature of criminal activities linked to the trafficking of precious metals, gemstones, and other minerals. The illicit resources trade extends well beyond economic losses, they pose a serious threat to public finance stability (Mashiri *et al.*, 2015).

In resource-rich countries, widespread smuggling and illicit financial flows undermine tax mobilization by eroding tax revenues and distorting public financial management systems. Consequently, illicit trafficking from mineral resources weakens fiscal governance, particularly in economies dependent on extractive rents (Le Billon, 2011).

Especially, in the African context, where fiscal space is structurally limited, illicit financial and resource flows exacerbate revenue shortfalls and compel governments to arbitrarily reallocate scarce resources among competing priorities. Therefore, these fiscal pressures may reduce the fiscal space and impact allocations to essential sectors such as education, health, while expenditures on defense and security.

Indeed, in contexts characterized by mineral resource dependence and weak governance, African governments' spending decisions tend to be highly sensitive to fluctuations in mineral rents and the political economy dynamics surrounding them. In such environments, variations in resource revenues often translate into unstable fiscal behavior, rent-seeking, and short-term budget reallocations.

Governments in resource-dependent states often channel a disproportionate share of public spending toward sectors such as defense, which are viewed as strategic for maintaining control over resource-rich regions and consolidating political authority (Mohtadi *et al.*, 2003). In contrast, investments in human capital development particularly education spending are

¹ United Nations General Assembly. (2021). Resolution adopted by the General Assembly on 16 December 2020: Strengthening the United Nations crime prevention and criminal justice programme, in particular its technical cooperation capacity (A/RES/75/196). United Nations. <https://undocs.org/en/A/RES/75/196>.

frequently neglected or reduced, as they generate long-term social benefits but offer limited short-term political returns (Cockx *et al.*, 2014). In this regard, several studies have explored how natural-resource rents shape government spending on military sector and social sector (eg, Dunne & Perlo-Freeman, 2003; Conrad, 2023; Majeski, 1985; Ali, 2020).

Based on Dynamic OLS and Fully Modified OLS estimator, Ali (2020) identifies a positive and statistically significant long-term relationship between military spending and resource rents, particularly from oil and forest products.

Concerning, the relationship between natural resources wealth and social expenditures such as public health or education spending, Cockx *et al.*, 2015 have attested a reverse link between resources abundance and social spending in MENA and North Africa. Carmignani and Avom (2010), attested that natural resource dependence fall social development in developing context.

Overall, most studies support the hypothesis that resource abundance tends to increase military expenditure while reducing allocations to human capital development such as education (e.g., Bannon & Collier, 2003; Perlo-Freeman & Brauner, 2012).

However, in a context of natural resource dependence and fragile institutional settings, the impact of illicit resource trafficking on fiscal priorities and public expenditure allocation particularly in the defense and social sectors may be ambiguous, as it can generate either positive or negative effects through competing, context-specific mechanisms.

On the one hand, in line with the resource curse theory widely supported in the existing literature, illicit mineral flows, can provide critical financing for rebel groups and insurgent movements, thereby exacerbating internal conflicts and provoking cross-border clashes with state forces (Collier, 2010). Faced with these escalating security threats, governments may be compelled to increase defense spending as a means to restore political stability, and a restriction of social expenditure such as human capital. Therefore, the illegal exploitation of natural resources may be associated with higher military expenditures and a falling of public social spending, especially in countries with limited fiscal space and weak institutional safeguards.

On the other hand, increased smuggling and fraud, particularly in countries that are heavily dependent on mining revenues, may erode customs collections and undermine the broader tax base, thereby constraining the government's ability to finance public goods, including national defense and social spending. In contexts characterized by fragility and weak resource

governance, the state risks losing control over a significant share of extractive income, which can ultimately result in lower budgetary allocations to the military sector, even as security challenges intensify.

However, in stable countries, institutions are stronger and public financial management systems are more robust and sustainable. Despite revenue losses caused by illicit resource trade and volatility in mineral earnings, such states are often better equipped to maintain fiscal balance, support education and health budgets, and reduce excessive military expenditure. Stronger institutional oversight and transparent governance mechanisms enable these governments to absorb external shocks, safeguard social investments, and prioritize long-term human capital development over short-term security spending.

While a substantial body of literature has examined the relationship between resource abundance and public expenditure, the specific impact of illicit resource flows on government spending in the defense and social sectors remains largely underexplored. Addressing this empirical and analytical gap constitutes the main objective of the present research project, which seeks to provide new evidence on how illicit mineral trade shapes fiscal spending and influences the allocation of public resources in African countries.

In this goal, the paper investigates in a first step, how the illicit mineral trade proxied by gold customs fraud affects the allocation of public expenditure on (1) military spending and (2) social public spending, proxied by education spending. In a second step, we explore the marginal effect of gold customs fraud on education expenditure and military spending, as a function of armed conflict. The analysis relies on a panel dataset covering 45 African countries from 2000 to 2019.

This study is significant for two main reasons. First, it provides new empirical evidence on the fiscal consequences of illicit resource extraction, particularly by examining its differentiated effects on social and defense spending. By investigating why some African governments allocate disproportionately large shares of their budgets to the defense sector, especially in contexts characterized by weak institutions and large informal economies, this research deepens our understanding of how illicit natural resource flows shape fiscal priorities and contribute to the persistence of fragile statehood.

Second, examining the nexus between resource-related criminal economies and public expenditure offers valuable insights for the design of more coherent and effective public policy responses. The trafficking of mineral resources is not merely an economic challenge but also a major security threat, as illicit revenues frequently finance non-state armed groups and fuel regional instability. Understanding these dynamics is therefore crucial for developing strategies that simultaneously strengthen fiscal capacity, improve resource governance, and enhance security outcomes.

We use two main dependent variables in our analysis. First, we consider military spending as a share of GDP, which reflects the share of the public budget allocated to the Ministry of Defense, security agencies, and other institutions responsible for territorial protection.

Second, we use public education spending as a proxy for social government allocation, measured as education expenditure as a share of GDP, alongside general government expenditure as a share of GDP. Education spending serves as an appropriate proxy for social investment, as it reflects the government's long-term commitment to social development and capacity building. Also, compared to health spending, education expenditure is more responsive to fluctuations in financial crimes such as illicit financial flows, particularly in fragile and resource-dependent settings (Remeikienė *et al.*, 2023). Moreover, health expenditures are generally supported through donor funding and external aid, reducing their direct dependence on government revenues and insulating them, to some extent, from the fiscal impacts of illicit financial flows (Lewin, 2020).

Our key explanatory variable is gold customs fraud, constructed through mirror data analysis. This approach has been widely used in academic research to detect illicit trade flows (e.g., Chalandar *et al.*, 2019). Concretely, for each country in the sample and for each year, we calculate the gap between the value of gold imports recorded by trading partners ("mirror exports") and the value of gold exports declared by the country under consideration. The resulting discrepancy serves as an indicator of customs fraud. The focus on illicit gold trade is motivated by its dual significance: gold mineral serves both as a key source of fiscal revenue for most of African countries and as a strategic commodity frequently exploited by rebel groups and transnational smuggling networks (Cantens *et al.*, 2021). For instance, customs data from the United Arab Emirates revealed that in 2018, an estimated \$15.1 billion worth of gold suspected of being illegally smuggled out of Africa entered the country (Lewis *et al.*, 2019).

The empirical analysis covers an unbalanced panel of 45 African countries over the period 2000–2019. This time frame was selected not only because reliable data are available, but also because it coincides with a period of resurgent conflict, fragility, and instability across the continent, making it a particularly relevant window for examining the fiscal–security nexus. We employ a panel fixed-effects model with an instrumental variable strategy to address potential endogeneity issues. To further assess the robustness of our findings, we apply the Generalized Method of Moments (System GMM) approach proposed by Blundell and Bond (1998) and jackknife estimation to test the stability of the estimated coefficients.

Our baseline results indicate that a 1% increase in gold customs fraud is associated with a 0.086% decrease in military spending and a 0.15% decrease in education spending. These findings underscore the erosion of fiscal space caused by illicit resource flows, which in turn constrains public expenditure on defense and education sector.

The expansion of illicit gold trafficking significantly undermines the state’s fiscal capacity by weakening customs revenues and diverting extractive income away from formal public budgets. Consequently, as fiscal space narrows, governments struggle to sustain adequate levels of investment in both education and defense, thereby reducing their ability to deliver essential public services and to respond effectively to national security challenges. This fiscal constraint reflects how illicit resource flows exacerbate structural weaknesses in domestic revenue mobilization.

Moreover, the results indicate that illicit gold trade distorts fiscal priorities by disproportionately reducing government allocations to education relative to military spending. This pattern suggests that, under conditions of fiscal stress, resource-rich governments tend to shield defense budgets while compressing social investments. In essence, gold smuggling reshapes fiscal choices in a way that constrains resources available for human capital formation and ultimately weakens the state’s institutional and developmental capacity.

Furthermore, our findings reveal that armed conflict amplifies the adverse effects of gold customs fraud. We show that fragility and insecurity exacerbate the fiscal consequences of illicit trade, as governments facing conflict experience additional constraints on revenue mobilization and expenditure efficiency.

This paper presents several key contributions to the existing literature. First, from a theoretical standpoint, it challenges the dominant hypothesis put forward by scholars such as Collier (2010) that resource abundance leads to higher military expenditure. While much of the existing literature emphasizes a positive correlation between resource rents and defense budgets, this study shifts the focus toward the consequences of illegal extraction and transnational smuggling. Therefore, this research project refines the debate on the “natural resource curse” theory by showing that in contexts characterized by a large informal economy, resource wealth may in fact undermine state capacity to finance defense spending. This perspective offers a more nuanced understanding of the resource military spending nexus by clearly distinguishing between legal resource exploitation and the dynamics of illicit resource economies.

Second, from a policy perspective, this study offers actionable insights for addressing the intertwined economic and security challenges posed by illicit gold trafficking. By empirically demonstrating how criminal activities constrain public expenditure, the findings underscore the urgent need to enhance the efficiency of natural resource taxation and to establish more transparent and resilient frameworks for natural resource governance.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature on the relationship between natural resources and government spending. Section 3 outlines the empirical strategy, data, and methodology. Section 4 presents the main empirical findings, while Section 5 discusses a series of robustness checks to validate the results. Finally, Section 6 concludes by summarizing the key insights and outlining policy implications.

II. Background and theoretical predictions

2.1 Natural resource abundance and public spending allocation

The theory of the natural resource curse has been one of the most influential frameworks for understanding why resource-rich countries often perform worse economically and institutionally than resource-poor ones (Collier, 2010; Plog, 2011). It posits that an abundance of natural resources, especially in contexts of weak institutional quality and fragile governance, can generate economic distortions, encourage rent-seeking and corruption, and ultimately lead to policy inefficiency and governance failures.

The resource abundance fosters rent-seeking behavior, as the large and easily accessible revenues from extractive industries reduce incentives to diversify the economy or strengthen tax systems (Collier *et al.*, 2005). The “rentier state” model captures this dynamic: governments that rely heavily on natural resource rents rather than taxation become less accountable to citizens, as they are not fiscally dependent on their tax contributions (Mohtadi *et al.*, 2003).

As a result, such states tend to prioritize patronage and clientelism over social investment, using public revenues to maintain political loyalty rather than to promote inclusive development (Auty *et al.*, 2019). This weakens fiscal accountability and the social contract, leading to a misallocation of public spending where resources are increasingly directed toward defense, administration, and elite networks, while social sectors like education or health are neglected.

In the literature, the relationship between public spending and natural resource exploitation has been analyzed through the lens of the “paradox of plenty” (Sun *et al.*, 2019).

According to this theory, governments in resource-rich countries tend to exhibit lower economic performance and weaker governance quality, coupled with higher levels of corruption (Sachs *et al.*, 1995). The weak governance can undermine effective control over resource revenues and lead to inefficient allocation of public spending, thereby limiting the developmental benefits that resource wealth could otherwise provide.

Consequently, in resource-rich countries, natural resource abundance may distort the efficiency of public spending and weaken its contribution to long-term development outcomes (Brun *et al.*, 2019).

Natural resource rents not only shape the overall size of government budgets but also may affect how resources are allocated across sectors, including defense and social investment (Abbasov, 2025).

The determinants of public military allocation have been extensively studied in the academic literature, giving rise to two dominant theoretical frameworks. The first model, known as the “arms race model”, was initially developed by Richardson (1960). According to this model, military expenditure is primarily driven by external security threats. The presence of hostile neighbors, ongoing conflicts, or regional instability tends to push states toward increasing their defense budgets in order to deter aggression or prepare for confrontation.

However, the arms race model has been criticized for its narrow focus on strategic threats, neglecting important domestic drivers of military expenditure such as economic capacity, political institutions, and governance quality factors that are particularly salient in developing and fragile states (Majeski, 1985). In response to these limitations, a second strand of the literature has emerged, emphasizing macroeconomic and structural determinants of defense spending.

This alternative perspective, developed by scholars such as Dunne & Perlo-Freeman (2003), Gadea *et al.* (2004), Yildirim & Sezgin (2005) argues that military expenditures are shaped by a combination of socioeconomic factors (GDP per capita, population size, the abundance of natural resources); Security-related factors, (internal conflict, regional instability, or transnational threats); and Political or institutional factors, (regime type, governance quality, and institutional strength).

Concerning the allocation of social public spending, empirical studies have consistently highlighted the adverse effects of natural resource wealth on improving social outcomes in resource-rich contexts. Arezki and Nabli (2012) found that resource-abundant MENA countries have historically allocated relatively limited public spending to the social sector, thus failing to significantly reduce inequality. Similarly, Apergis and Payne (2014) demonstrated that resource-rich countries tend to prioritize military expenditures over investments in human capital, reflecting a strategic preference for regime security over social development. Using fixed effects regressions, Cockx *et al.* (2015) identified a resource curse effect of oil dependence on education spending across North African countries during the period 1995–2009, showing that higher oil rents were associated with lower allocations to education. These findings collectively underscore the vulnerability of social spending to rent-seeking behavior and political priorities in resource-dependent states.

While the dominant literature supports a positive relationship between natural resource abundance and increased military expenditure, accompanied by a decline in social investment, these relationships become more nuanced and potentially contradictory when illicit resource trade is taken into account. This complexity is particularly pronounced in many resource-rich African economies, where state fragility and the widespread prevalence of informal economic activity distort the anticipated fiscal and developmental benefits of resource wealth (Dunne *et al.*, 2003; Looney, 1987).

2.2 The ambiguous impact of illicit mineral trade on public spending

First, mineral smuggling and cross-border criminal activities can significantly heighten security threats, thereby providing a compelling justification for increased allocations to military expenditure.

Indeed, in response to intensified threats, states must recruit additional forces to protect mining zones, expand customs surveillance, reinforce border control mechanisms, and combat the activities of smugglers and transnational trafficking networks (Collier, 2006). The expansion of mining activities leads governments to strengthen military infrastructure and policies aimed at protecting extractive zones and countering insurgent movements (Ali *et al.*, 2015; Tian, 2015). For instance, Musayev *et al.* (2016), using instrumental variable techniques over the period 1970–2010, find a positive association between natural resource rents and military industry development in resource-rich countries. Furthermore, revenues from natural resources can facilitate non-transparent budget financing of military operations, particularly in fragile or authoritarian regimes (Dunne & Perlo-Freeman, 2003). Such practices enable governments to channel resource rents into security expenditures outside official budgetary frameworks, thereby circumventing parliamentary oversight and weakening institutional checks and balances.

Therefore, illicit mineral trafficking can serve as a catalyst for increased military expenditure. Heightened insecurity prompts governments to respond through a reallocation of public spending in favor of defense. In such contexts, the need to finance military operations may necessitate supplementary budgets, emergency appropriations, or the use of off-budget financing mechanisms.

Conversely, the illicit mineral trade may directly undermine fiscal revenue collection, which constitute a significant portion of budgetary resources for many African states dependent on extractive exports. When valuable minerals such as gold are exported undeclared or untaxed, substantial revenue leakages occur (Geourjon *et al.*, 2013). A decline in tax collection reduces the government's capacity to fund essential sectors such as human capital development and security investment. Also, these fiscal losses compel governments not only to cut back on public services particularly in education but also to limit their capacity to sustain or enhance military capabilities.

In addition, illicit trafficking tends to flourish in contexts where customs officials, border agents, and political elites are complicit or deliberately overlook smuggling activities (Cantens *et al.*, 2019). These institutional weaknesses not only facilitate the illegal outflow of high-value resources such as gold but also erode the state’s capacity to mobilize domestic revenue, thereby constraining the fiscal space available for total public expenditure, including allocations to the defense sector. Also, revenues from natural resources can facilitate non-transparent budget financing of military operations, particularly in fragile or authoritarian regimes (Dunne & Perlo-Freeman, 2003). Such practices enable governments to channel resource rents into security expenditures outside official budgetary frameworks, thereby circumventing parliamentary oversight and weakening institutional checks and balances.

Furthermore, mineral customs fraud may significantly distort formal fiscal revenue collection at borders by strengthening criminal networks. As these parallel economies expand, they undermine the state’s capacity to channel resource rents through official budgetary mechanisms, thereby reducing the share of extractive revenues available for public use. In fragile and conflict-affected contexts, this erosion of fiscal capacity can trigger a vicious cycle: weakened border control diminishes public spending and exacerbates governance failures, which in turn fuel insecurity and create additional opportunities for smuggling and illicit trade.

In sum, illicit trade in natural resources can exert positive or negative effects on military and education spending. Therefore, the goal of this paper, is to analyze empirically whether gold customs fraud impact military and education spending across a panel of African countries over the period 2000 to 2019.

III. Methodology and Empirical Strategy

The objective of this paper is to examine the impact of gold customs fraud on the public allocation of military and education expenditures in African countries between 2000 and 2019. First, we present our empirical strategy, secondly, we describe measurable variable for the estimation:

$$\ln M_{it} = \alpha + \beta_1 \ln \text{Fraud}_{it} + \theta Z_{it} + \eta_i + \lambda_t + \varepsilon_{it} \quad (1)$$

$$\ln E_{it} = \alpha + \beta_2 \ln \text{Fraud}_{it} + \theta Z_{it} + \eta_i + \lambda_t + \varepsilon_{it} \quad (2)$$

Where $\ln M_{it}$ is the logarithm measure of the military spending by year (t) for country (i). $\ln E_{it}$ is the logarithm measure of education government spending by year (t) for country (i). $\ln \text{Fraud}_{it}$ is the logarithm measure of the gold customs fraud by year (t) for country (i). β_1 captures gold customs fraud effects on military spending. β_2 captures gold customs fraud effects on education spending. Z_{it} is the matrix of control variables. η_i is the individual country fixed effects, that is, the unobservable time-invariant country characteristics; λ_t is the individual year fixed effects, to capture, the unobservable characteristics of all countries that vary over time and ε_{it} is the error term.

We use the Military spending (% of GDP), sourced from the Stockholm International Peace Research Institute (SIPRI). This indicator captures the share of public spending allocated to national armed forces and includes expenditures by ministries of defense, security agencies, and other institutions involved in territorial protection and internal security.

The education government spending is measured as the share of general government expenditure allocated to the education sector, including current spending, capital investments, and transfers. This indicator, expressed as a percentage of GDP, encompasses all public funds directed to education, including external transfers from international donors. The term "general government" covers all levels central, regional, and local authorities responsible for public education financing. Data are extracted from world bank dataset.

In this framework, gold customs fraud (interpreted as missing gold exports) is estimated using mirror-trade data discrepancies between the declared exports of African countries and the corresponding imports recorded by their trading partners. Formally, the estimated value of gold customs fraud is defined as:

$$DX_t^i = \sum_{j=1, i=1}^{j_i} (M_{ji, t} - \beta X_{ij, t}) \quad (3)$$

DX_t^i denotes the estimated value of unrecorded gold exports for country i in year t, with j referring to the rest of the world. The term β corresponds to the CIF-FOB adjustment coefficient. Discrepancies in mirror trade statistics can result from inaccurate customs declarations, often due to deliberate undervaluation or overvaluation by exporters or importers aiming to influence the taxable base of traded goods. These inconsistencies may also reflect unrecorded cross-border flows, particularly in cases of smuggling, where gold is not documented as an official export in the country of origin but is reported as an import by the

receiving or transit country. The trade data used in this study are drawn from the UN COMTRADE database, based on product-level gold trade records classified under the Harmonized System at the 6-digit (HS6) level.

Regarding the empirical strategy, we employ Two-Stage Least Squares (2SLS) estimators to address potential endogeneity concerns. Specifically, there may be reverse causality between gold customs fraud and government spending on military and education. For instance, increased military spending could enhance border surveillance by enabling the recruitment of security personnel or the acquisition of equipment, thereby improving the state's capacity to curb illicit gold trafficking. Similarly, higher education expenditures may enhance human capital quality, which in turn can strengthen governance efficiency and institutional capacity, thereby improving natural resource management and curbing illicit trade. Conversely, a reduction in illegal gold flows might diminish the perceived need for military investment, particularly in fragile contexts where defense budgets are closely tied to evolving security dynamics. As a result, this could increase fiscal space, enabling governments to allocate more resources to education.

Therefore, we use neighboring countries' gold customs fraud as an instrumental variable for domestic gold customs fraud and government spending on military. This choice is grounded in the transnational nature of illicit trade activities, particularly in the case of gold (Cantens *et al.*, 2021). Smuggling networks operate across borders, exploiting weak points in regional surveillance systems and taking advantage of differences in enforcement capacity and border control (Banao *et al.*, 2022). By using this spatial variable, we aim to capture spillover effects in gold trafficking patterns that are exogenous to national fiscal governance decisions.

We construct our instrument for neighboring gold customs fraud by interacting the domestic gold customs fraud variable with a spatial weight matrix (Anselin, 1988). The use of a distance based spatial weight matrix is justified by the geographic and transboundary nature of illicit gold trafficking in Africa. Unlike formal trade, which follows institutional and legal routes, smuggling activities often exploit geographic proximity, porous borders, and limited state surveillance across frontier zones. As such, spatial dependence is a central feature of illicit trade dynamics: fraud and trafficking in one country can easily spillover into neighboring territories. Moreover, the distance matrix allows us to operationalize this transnational dimension by

defining neighborhood structures not on the basis of political alliances or regional blocs, but through physical proximity.

This matrix captures spatial proximity and defines neighborhood relationships between countries based on geographic distance rather than political or economic groupings. It is presented as follows:

$$\text{Fraud.NEIGH}_{jt} = \text{CJ} \times \text{Fraud}_{it}, \tag{4}$$

With Fraud.NEIGH_{jt} = neighbouring gold customs fraud, CJ = spatial weight matrix, and Fraud_{it} = gold customs fraud by year (t) in country i.

Specifically, we use a binary spatial distance matrix² (Euclidean distance), where each element of the N×N matrix equals 1 if the capital city of country j is located within 1,000 kilometers of the capital city of country i, and 0 otherwise. We set the 1,000 kilometer threshold based on empirical testing of spatial correlation significance across different distance bands (500 km, 1,000 km, and 1,500 km). The 1,000 km radius provides the minimum level of spatial dependence, reflecting the typical range of cross-border smuggling, regional trade networks, and informal transport corridors across African countries. The Moran’s I test³ reveals a positive coefficient (= 0.0141), indicating that neighboring countries tend to exhibit similar levels of customs fraud.

To validate the validity of the instrument, we first plot in Figure 1 customs fraud on the y axis versus neighbor’s customs fraud on the x axis.

² $\text{CJ} = \begin{cases} 1 & \text{if } dij < 1000 \\ 0, & \text{otherwise} \end{cases}$

³ See table A1.

Figure 1: The graph plots the scatter plots of the customs fraud and neighboring customs fraud

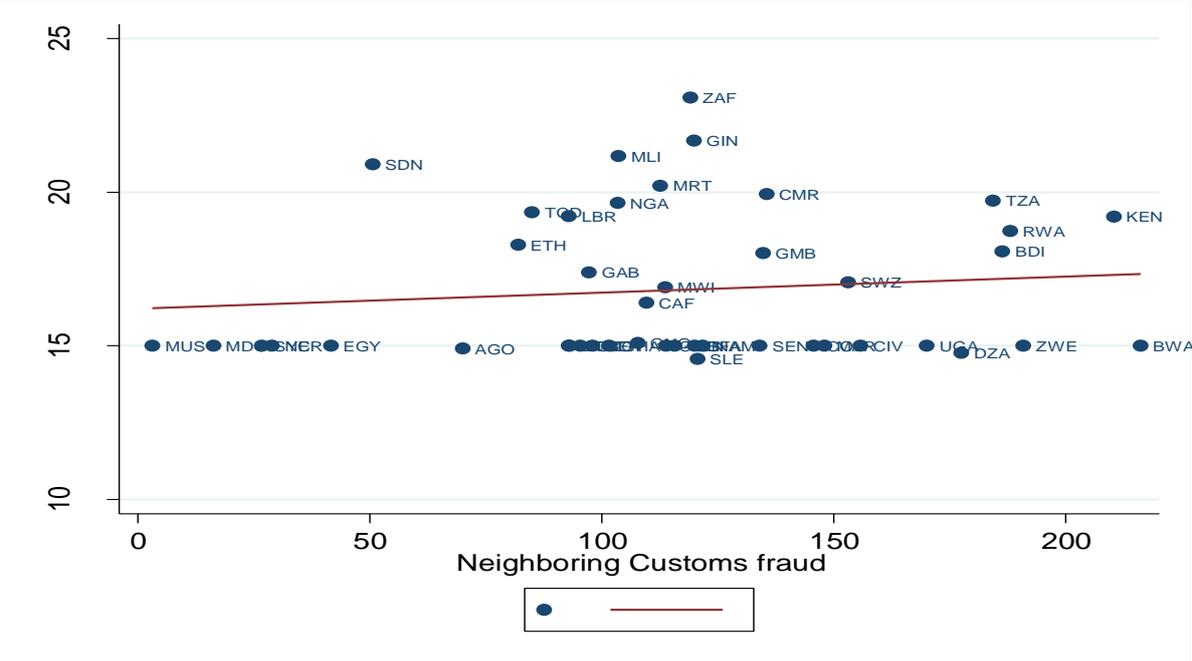


Figure 1 attests to a positive link between customs fraud and neighboring customs fraud. This suggests that neighboring customs fraud can serve as a robust predictor of domestic customs fraud in our sample.

Secondly, we estimate an ordinary least squares (OLS) regression of domestic gold customs fraud on neighboring gold customs fraud (see Table A2). The results show that neighboring gold customs fraud is a strong and statistically significant predictor of domestic fraud, thereby satisfying the relevance condition for instrumental variable estimation. Moreover, the F-statistics from the first-stage regression, with values of 13, exceed the conventional threshold of 10, which reinforces the strength of the instrument and confirms its suitability for use in a two-stage least squares (2SLS) framework.

Lastly, regarding the exclusion restriction of our instrumental variable, we argue that gold customs fraud in neighboring countries affects domestic military and education spending only through its influence on domestic gold smuggling. While regional trafficking networks may indirectly shape the scale of illicit trade within national borders by facilitating smuggling routes or influencing market dynamics, they are unlikely to directly determine how a government allocates its public budget between defense and education once domestic fraud is accounted for.

This assumption relies on the principle of fiscal sovereignty, as decisions regarding public expenditure such as adjustments in defense or education budgets are taken within the framework of national fiscal governance and parliamentary authority, rather than being driven by smuggling activity in neighboring states. The fiscal governance process that determines whether to raise or reduce public spending reflects domestic economic and political priorities, and remains the prerogative of national institutions.

Furthermore, domestic gold smuggling represents the main channel through which regional fraud could influence fiscal outcomes, controlling for domestic fraud effectively isolates this pathway. As a result, neighboring countries' levels of gold customs fraud should not exhibit any residual correlation with the second-stage error term of the estimation model.

Therefore, we treat the instrument as exogenous and assume that it satisfies the exclusion restriction necessary for valid identification within the instrumental-variable framework. Nonetheless, even with strong theoretical justification, we cannot fully rule out the possibility of residual violations of the exclusion restriction.

To mitigate omitted variable bias, we include a set of control variables: GDP per capita, mineral rents, international trade and political stability.

First, we incorporate GDP per capita in constant 2015 US dollars, (noted "Gdp per Capita"). A substantial body of literature has documented a negative and significant relationship between GDP and military spending (e.g., Mourad *et al.*, 2019; Dunne *et al.*, 1995). However, Appiah, 2017, attested a positive link between education expenditure and growth in Africa. National income also plays a key role in assessing the impact of customs performance, as higher GDP levels are generally associated with more efficient tax and customs administrations (De Wulf *et al.*, 2005). Moreover, GDP per capita acts as a proxy for broader institutional quality, capturing the economic and administrative capacity of the state.

Second, we control for mineral rents, noted "Rents", (calculated as total mineral rents (oil, gas, coal, minerals) as a percentage of GDP). Government expenditures and gold related customs fraud are closely linked to natural resource abundance.

On the one hand, higher resource rents tend to stimulate greater demand for military spending, as governments allocate more resources to secure extractive zones and maintain political stability (Dunne *et al.*, 2005). Also, increasing dependence on mineral revenues leads to a

decline in public investment in education (Ahlerup *et al.*, 2020). On other hand, resource rents are also positively associated with smuggling and fraudulent practices, (Kpognon, 2022).

Third, we include a measure of international trade (noted “Trade”), calculated as the sum of exports and imports. Trade openness is widely acknowledged in the literature as a factor influencing defense expenditure, notably through its effects on economic exposure and border vulnerabilities (Yakovlev, 2007). In addition, trade openness has been associated with changes in social spending patterns, including increased investment in education, as governments seek to enhance human capital in response to globalization pressures (Rudra, 2004). Furthermore, trade volume is inherently linked to customs performance, since higher trade flows place greater demands on border control efficiency and institutional capacity (Cagé *et al.*, 2018).

Lastly, we include a measure of political stability (noted “Political Stability”), which captures the likelihood of political unrest. Political instability often increases the perceived need for military expenditure, as governments respond to internal or external threats with heightened defense investments. Also, unstable political environments can negatively affect social sector spending, particularly in education, due to reallocation of budgetary resources and weakened institutional capacity (Poirier, 2012). Moreover, about the nexus between illicit trade and political instability, a substantial body of literature has documented a positive relationship (eg, Shaw *et al.*, 2014). Illicit trade tends to thrive in fragile governance contexts, fueling corruption, weakening state legitimacy, and exacerbating political volatility.

IV. Empirical Results

The regression results are presented in Table 1⁴. Columns (1) and (2) consistently reveal a robust and statistically significant negative relationship between gold customs fraud and the allocation of both military and education expenditures, measured as a share of general government expenditure.

Specifically, the findings indicate that a 1% increase in gold customs fraud is associated with a 0.008% decline in the military spending share and a 0.015% decline in the education spending share within the government budget allocation. These results imply that illicit gold trafficking

⁴ Table A3 presents the first-stage results of the Two-Stage Least Squares (2SLS) estimation.

erodes the government’s fiscal space and reduces its capacity to allocate resources to defense and education sector. Notably, education budgets are more adversely affected than military spending, highlighting the disproportionate vulnerability of social sectors to fiscal pressures induced by illicit trade.

Furthermore, the results suggest that in contexts of fiscal constraint triggered by customs fraud, governments tend to prioritize defense expenditures over education, likely in response to pressing security challenges.

Among the control variables, trade openness is negatively and significantly associated with military expenditure shares, suggesting that countries more integrated into the global economy may shift budget priorities away from defense. Likewise, political stability is associated with lower military spending shares, indicating that stable environments reduce the perceived need for extensive security allocations.

The Sargan test of overidentifying restrictions confirms the validity of our instrument, supporting the assumption that neighboring fraud affects domestic public spending only through its impact on local smuggling, and not directly.

Table 1: Effect of Gold Customs Fraud on Military and Education Expenditures (2LS estimations)

Variables	(1) 2SLS – Military	(2) 2SLS – Education
Customs Fraud (Ln)	–0.0085*** (0.0030)	–0.0154*** (0.0035)
GDP per capita	–0.00027** (0.0001)	–0.00002* (0.0000)
Rents	0.0002 (0.0042)	–0.0012 (0.0042)
Trade	–0.0012** (0.0005)	0.0001 (0.0006)
Political stability	–0.1545*** (0.0166)	0.0186 (0.0186)
Constant	1.6703*** (0.0744)	2.4098*** (0.0855)

Variables	(1) 2SLS – Military	(2) 2SLS – Education
Observations	723	817
R ²	0.80	0.50
Sargan test (p-value)	0.01 (Pvalue :0.90)	0.05 (Pvalue :0.82)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level (p<0.01), ** indicates statistical significance at the 5% level (p<0.05), * indicates statistical significance at the 10% level (p<0.1).

V. Robustness check

In a goal of robustness check, we first implement Generalized Method of Moments (GMM) estimations to address potential endogeneity. Second, we apply a Jackknife sample-dependence estimator to assess the sensitivity of our results to sample composition and outlier influence.

5.1 Generalized Methods Moments

As a robustness check, we employ the Generalized Method of Moments (GMM) estimator, as proposed by Blundell and Bond (1998), to examine the impact of gold customs fraud on military spending. The GMM approach is particularly well-suited for this analysis, as it effectively addresses potential endogeneity issues, including simultaneity bias, omitted variable bias, and reverse causality, by using internal instruments derived from the panel structure of the data.

The model is specified as:

$$\ln M_{it} = \alpha + \theta_1 \ln M_{it-1} + \beta_1 \ln \text{Fraud}_{it} + \theta Z_{it} + \varepsilon_{it} \quad (5)$$

$$\ln E_{it} = \alpha + \theta_1 \ln E_{it-1} + \beta_1 \ln \text{Fraud}_{it} + \theta Z_{it} + \varepsilon_{it} \quad (6)$$

$\ln M_{it-1}$, $\ln M_{it}$ represent respectively the logarithm of the lagged in one period of military spending allocation and the military spending allocation in a country (i) by year (t). $\ln E_{it-1}$, $\ln E_{it}$ represent respectively the logarithm of the lagged in one period of education spending

allocation and the education spending allocation in a country (i) by year (t) . $\ln\text{Fraud}_{it}$ is the logarithm gold customs fraud in a country (i) by year (t). Z_{it} is the set of control variables. ε_{it} is the error term.

First, the Arellano-Bond test for AR(2) yields a p-value of 0.24 for the military equation and 0.72 for the education equation, indicating no evidence of second-order autocorrelation an essential condition for the consistency of the GMM estimator. Furthermore, the Hansen J-tests return p-values of 0.504 and 0.5955, respectively, supporting the validity of the overidentifying restrictions and suggesting that our instruments are correctly specified.

Table 2 presents the results from the GMM estimation, which confirm the robustness of our baseline findings. The findings show that gold customs fraud exhibits a statistically significant and negative relationship with both military and education spending. Specifically, a 1% increase in gold fraud is associated with a 0.0026% decrease in the share of military expenditure and a 0.0142% decrease in education expenditure (both expressed as a share of general government spending). These results underscore the fiscal erosion effect of illicit trade, with a more pronounced impact on education, likely due to its political flexibility and lower prioritization in fragile settings.

Table 2: Effect of Gold Customs Fraud on Military and Education Spending (GMM Estimation)

Variables	(1) GMM – Military	(2) GMM – Education
Lagged Military Spending (Ln)	0.9602*** (0.0115)	—
Lagged Education Spending (Ln)	—	0.4743*** (0.0749)
Customs Fraud (Ln)	–0.0026*** (0.0005)	–0.0142*** (0.0021)
GDP per capita	0.0001*** (0.0000)	–0.0002 (0.0000)
Rents	0.0117*** (0.0025)	0.0191* (0.0105)
Trade	–0.0010***	–0.0003

Variables	(1) GMM – Military	(2) GMM – Education
	(0.0004)	(0.0009)
Political stability	–0.0315***	0.1733***
	(0.0069)	(0.0304)
Constant	0.0724**	3.5740***
	(0.0291)	(0.0848)
Observations (N)	789	712
AR(1) p-value	0.0153	0.0092
AR(2) p-value	0.2403	0.7154
Countries	42	42
Instruments	25	22
Hansen test (p-value)	0.504	0.5955

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level ($p < 0.01$), ** indicates statistical significance at the 5% level ($p < 0.05$), * indicates statistical significance at the 10% level ($p < 0.1$).

5.2 Jackknife Estimation

In a second step of robustness check, we implement a Jackknife instrumental variable (IV) estimation to further assess the robustness and stability of our results. This technique helps mitigate potential small-sample bias and reduces the influence of outliers or influential observations on the estimated coefficients. In this framework, we re-estimate Eq. (1) and (2), which model the impact of gold customs fraud on military spending and education spending, respectively.

The results, presented in Table 3, confirm the robustness of our baseline findings: a 1% increase in gold customs fraud is associated with a 0.009% decrease in the share of military expenditure and a 0.018% decrease in the share of education expenditure, both expressed as a percentage of general government spending.

These findings reinforce the core argument that illicit gold trade erodes the state’s capacity to allocate resources to essential public functions, particularly military and education spending.

Table 3: Effect of Gold Customs Fraud on Military and Education Spending (Jackknife Estimation)

Variables	(1) 2SLS – Military	(2) 2SLS – Education
Customs Fraud (Ln)	–0.009** (0.0036)	–0.018*** (0.0037)
GDP per capita	–0.000027 (0.00002)	–0.00002** (0.0000)
Rents	0.0002 (0.0040)	–0.0012 (0.0048)
Trade	–0.0012* (0.0006)	0.0001 (0.0005)
Political stability	–0.1545*** (0.0304)	0.0186 (0.0160)
Constant	1.6703*** (0.1073)	2.4098*** (0.0859)
Observations (N)	723	817
R²	0.80	0.52
Sargan test (p-value)	0.01 (0.90)	0.05 (0.82)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level ($p < 0.01$), ** indicates statistical significance at the 5% level ($p < 0.05$), * indicates statistical significance at the 10% level ($p < 0.1$).

VI. Extension: How armed conflict Conditions the Effect of gold customs fraud on Military and Education spending?

In the final step of the analysis, we explore how armed conflict conditions the relationship between gold customs fraud, military and education spending. The African continent is particularly marked by persistent fragility and conflict, making this dimension highly relevant for understanding public finance dynamics.

Increased insecurity linked to rebel activity and cross-border smuggling networks may lead governments to reallocate scarce resources toward defense priorities, often at the expense of social sectors like education. Conversely, conflict settings may also undermine the state’s capacity to mobilize revenues and execute spending plans particularly when tax bases are eroded by illicit flows and administrative disruption.

Therefore, understanding the interaction between gold customs fraud and armed conflict is essential to assess how fragility amplifies the fiscal consequences of illicit trade and reshapes sectoral spending priorities.

We present our equation as follows:

$$\ln M_{it} = \alpha + \beta_1 \ln \text{Fraud}_{it} + \beta_2 \text{Conflict}_{it} + \beta_3 \ln \text{Fraud}_{it} \times \text{Conflict}_{it} + \theta Z_{it} + \eta_i + \lambda_t + \varepsilon_{it} \quad (7)$$

$$\ln E_{it} = \alpha + \beta_4 \ln \text{Fraud}_{it} + \beta_5 \text{Conflict}_{it} + \beta_6 \ln \text{Fraud}_{it} \times \text{Conflict}_{it} + \theta Z_{it} + \eta_i + \lambda_t + \varepsilon_{it} \quad (8)$$

Where $\ln M_{it}$ is the logarithm measure of the military spending by year (t) for country (i). $\ln E_{it}$ is the logarithm measure of education government spending by year (t) for country (i). $\ln \text{Fraud}_{it}$ is the logarithm measure of the gold customs fraud by year (t) for country (i). Conflict_{it} measures the number of civil deaths due to armed conflict year (t) for country (i). $\ln \text{Fraud}_{it} \times \text{Conflict}_{it}$ is the interaction of gold customs fraud and armed conflict by year (t) for country (i). β_1 captures gold customs fraud effects on military spending. β_3 captures the marginal effect of gold customs fraud effects as function of armed conflict on military spending. β_4 captures gold customs fraud effects on education spending. β_6 captures the marginal effect of gold customs fraud effects as function of armed conflict on education spending. Z_{it} is the matrix of control variables. η_i is the individual country fixed effects, that is, the unobservable time-invariant country characteristics; λ_t is the individual year fixed effects, to capture, the unobservable characteristics of all countries that vary over time and ε_{it} is the error term.

Armed conflict are measured by Number of conflict-related fatalities per country and year, including battles, explosions, and civilian-targeted violence. We extract data from ACLED dataset.

Note the signs of the coefficient of the interaction term, evaluate if armed conflict enhances or distorts the marginal effect of gold customs fraud on military and education spending:

$$\frac{\partial \ln M_{it}}{\partial \ln \text{Fraud}_{it}} = \beta_1 + \beta_3 \text{Conflict}_{it} \quad (9)$$

$$\frac{\partial \ln E_{it}}{\partial \ln \text{Fraud}_{it}} = \beta_4 + \beta_6 \text{Conflict}_{it} \quad (10)$$

The key parameters of interest are **β_1 , β_3 , β_4** and **β_6** .

We hypothesize that gold customs fraud reduces both military and education spending, with the magnitude of this effect increasing in countries more severely affected by conflict.

To empirically test this hypothesis, we employ the same estimation strategy used in the baseline analysis (Two-Stage Least Squares (2SLS)).

The results show that gold customs fraud alone exert a statistically significant negative effect on both military spending (-0.0107) and education spending (-0.0132), reinforcing our baseline finding: illicit mineral trafficking undermines the state's ability to allocate resources to core public functions (see table 4).

More importantly, the marginal effect of gold customs fraud on education and military spending, conditioned on armed conflict, is statistically significant and negative (see table 5). Specifically, Figure 3 illustrates a negative relationship between the marginal effect of gold customs fraud on education spending, across all levels of conflict intensity. Figure 2 shows that the marginal effect of gold-related customs fraud on military spending remains negative, although its magnitude slightly decreases as conflict becomes more severe.

Therefore, results show that armed conflict has a modest moderating effect on the marginal impact of gold customs fraud on military spending, especially when compared to education expenditure. These findings suggest that in contexts of heightened insecurity, education budgets are disproportionately compressed, while military allocations are maintained or even reprioritized to address escalating security demands. This underscores the vulnerability of social sectors to illicit financial flows in unstable environments.

Also, we show that under high levels of conflict, the effect of gold-related customs fraud on military spending becomes statistically insignificant. Indeed, in resource-rich countries, military spending is already driven by the need to protect mining sites, reinforce territorial security, and respond to ongoing conflict dynamics. Consequently, armed conflict provides little additional leverage in shaping the impact of illicit trade on defense budgets.

Table 4: Impact of gold customs fraud on Military and Education spending in countries affected by armed conflict(2LS Estimation)

Variables	(1) 2SLS – Military	(2) 2SLS –Education
Customs Fraud (Ln)	–0.0107*** (0.0035)	–0.0132*** (0.0039)
GDP per capita	0.00001 (0.00002)	–0.00001 (0.00001)
Rents	0.0002 (0.0046)	–0.0013 (0.0045)
Trade	–0.0009 (0.0006)	–0.0002 (0.0006)
Conflict	0.00001* (0.00001)	0.00001** (0.00002)
Customs Fraud(Ln) × Conflict	–0.0000** (0.00001)	–0.0001*** (0.00002)
Constant	1.4162*** (0.1962)	2.4765*** (0.2271)
Observations (N)	701	725
R²	0.80	0.50
Sargan test (p-value)	1.20 (P-Value :0.20)	0.04 (P-Value :0.80)
Country fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level (p<0.01), ** indicates statistical significance at the 5% level (p<0.05), * indicates statistical significance at the 10% level (p<0.1).

Table 5: Marginal effect of gold customs fraud on Military and Education spending as a function of armed conflict

Marginal Effect of Gold Customs Fraud		
Armed Conflict Level	Military Spending	Education Spending
Minimum conflict	-0.0107*** (0.0035)	-0.0132*** (0.0039)
Mean conflict	-0.0105*** (0.0036)	-0.0152*** (0.0038)
Maximum conflict	-0.0061 (0.0128)	-0.0643*** (0.0147)

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level (p<0.01), ** indicates statistical significance at the 5% level (p<0.05), * indicates statistical significance at the 10% level (p<0.1).

Figure 2: Marginal plot of gold customs fraud on military spending as a function of armed conflict (measured in percentage points). Results are based on the estimates shown in column (1) of Table 5.

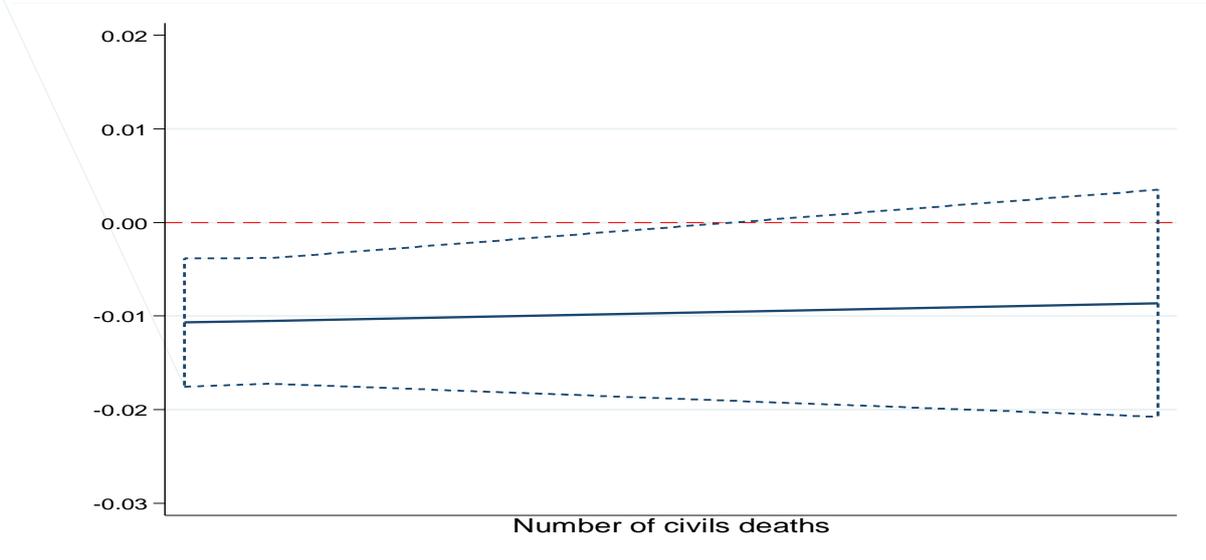
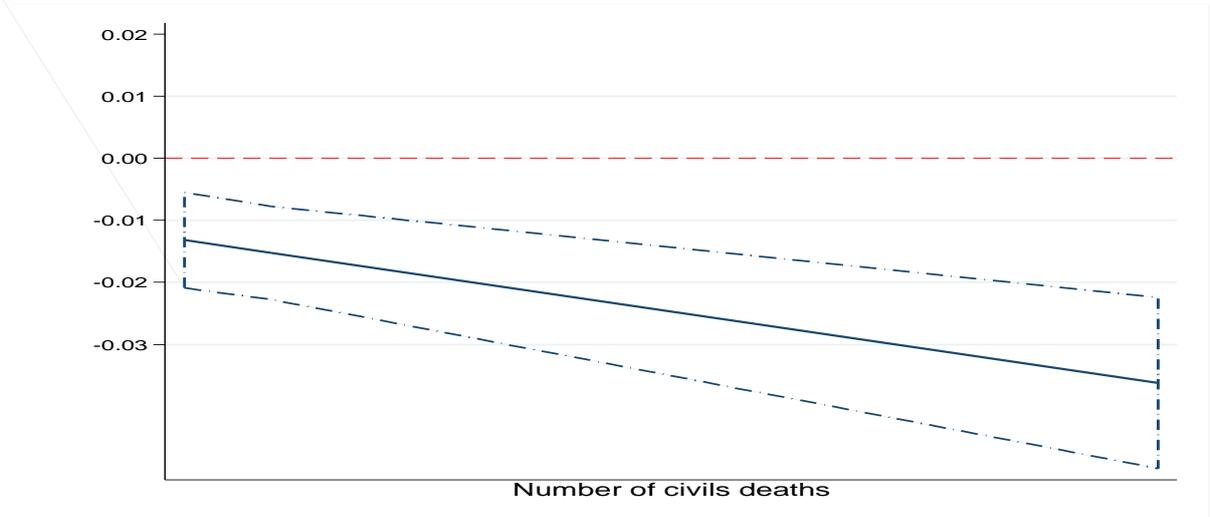


Figure 3: Marginal plot of gold customs fraud on education spending as a function of armed conflict (measured in percentage points). Results are based on the estimates shown in column (2) of Table 5.



Conclusion and Policy Recommendations

In resource-dependent economies, weak governance and the expansion of illicit resource trade create major challenges for public financial management, particularly for fiscal policy design and execution. Illicit natural resource flows can substantially reshape government spending behavior, influencing how fiscal resources are allocated between security and human capital development.

The literature on natural resources and public spending generally highlights a positive relationship between resource abundance and higher military expenditure, accompanied by reduced social investment. However, these relationships become more ambiguous when illicit resource trade is considered.

Therefore, this paper aimed to analyze the impact of gold customs fraud on the allocation of military and education expenditures in African countries over the period 2000 to 2019. As a baseline strategy, we employed Two-Stage Least Squares (2SLS) estimation to address potential endogeneity. The robustness of the findings was confirmed through additional analyses using the Generalized Method of Moments (GMM) and a Jackknife-based sensitivity test.

The results consistently demonstrate that gold customs fraud exerts a statistically significant and negative impact on both military and education spending, with a stronger adverse effect on

the education sector. Illicit flows of natural resources undermine government tax mobilization primarily by eroding customs revenues, thereby restricting the state's capacity to finance public spending and sustain security operations.

Moreover, our analysis reveals that the marginal impact of gold customs fraud on both military and education expenditures, conditioned by the level of armed conflict, is significant and negative. This finding indicates that fragility and insecurity amplify the detrimental fiscal consequences of illicit trade by further limiting governments' ability to mobilize revenues and allocate them efficiently across sectors.

This research highlights the necessity to integrate the analysis of illicit natural resource trade into public financial management frameworks across both stable and fragile African states. In many of these contexts, fiscal systems remain weak, tax bases are narrow, and informal economic activities dominate revenue generation. By demonstrating how illicit gold trafficking erodes fiscal space and distorts expenditure priorities, the study calls for a rethinking of fiscal governance strategies in resource-dependent economies.

From a policy standpoint, to effectively combat illicit trade and customs fraud, our findings highlight the existence of spatial contagion effects, indicating that smuggling and fraud tend to spread across neighboring countries. This underscores the imperative of strengthening regional cooperation among customs administrations to enhance information sharing, joint surveillance, and coordinated border security efforts. Improved cross-border collaboration would not only curb transnational smuggling networks but also reinforce fiscal governance and revenue mobilization.

Finally, regarding future research avenues, this study is limited to examining the relationship between gold customs fraud and government spending on the military and education sectors. Considering the significant volatility of international mineral prices and the critical role that gold revenues play in domestic resource mobilization; future research should expand this analysis by assessing the impact of commodity price shocks on illicit trade dynamics and fiscal behavior.

References

- Abbasov, R. (2025). The impact of military spending on government budgets: A comprehensive analysis. *International Journal of Financial Management and Economics*, 8(1), 10-33545.
- Ahlerup, P., Baskaran, T., & Bigsten, A. (2020). Gold mining and education: a long-run resource curse in Africa? *The Journal of Development Studies*, 56(9), 1745-1762.
- Ali, H. E., & Abdellatif, O. A. (2015). Military expenditures and natural resources: evidence from rentier states in the Middle East and North Africa. *Defence and Peace Economics*, 26(1), 5-13.
- Ali, H. E. (2020). Natural resource rents and military expenditures in the Middle East and North Africa: a long-run perspective. In *Research Handbook on the Arms Trade* (pp. 115-131). Edward Elgar Publishing.
- Anselin, L. (1988). Lagrange multiplier test diagnostics for spatial dependence and spatial heterogeneity. *Geographical analysis*, 20(1), 1-17.
- Appiah, E. N. (2017). The effect of education expenditure on per capita GDP in developing countries. *International Journal of Economics and Finance*, 9(10), 136-144.
- Apergis, N., and Payne, J. E. (2014). The oil curse, institutional quality, and growth in MENA countries: Evidence from time-varying cointegration. *Energy Economics*, 46(1): 1-9.
- Arezki, R., & Nabli, M. K. (2012). Natural resources, volatility, and inclusive growth: Perspectives from the Middle East and North Africa. *IMF Working Paper WP/12/111*.
- Auty, R. M., & Furlonge, H. I. (2019). *The rent curse: Natural resources, policy choice, and economic development*. Oxford University Press.
- Banao, F., Laporte, B. (2022). "Terrorism, Customs and fraudulent Gold exports in Africa", *CERDI Working Papers*, 2022/6, CERDI.
- Bannon, I. and Collier, P. (2003) Natural resources and conflict: What can we do? In *Natural Resources and Violent Conflict*, edited by I. Bannon and P. Collier. Washington, DC: World Bank, 1–16.
- Blundell R., and Bond S., 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics* 87: 115–143.
- Brun, Jean-François, Gerard Chambas, and Mario Mansour. 2015. "Tax Effort of Developing Countries: An Alternative Measure." *Financing Sustainable Development Addressing Vulnerabilities*, 205–216.
- Brun, J. F., & Compaore, C. T. (2019). Assessment of public spending efficiency on education distribution: Evidence from developing countries. No. halshs-02315717.

Cagé, J. & Gadenne, L. (2018). Tax revenues and the fiscal cost of trade liberalization, 1792-2006. *Explorations in Economic History*, 70, 1-24.

Cantens, T. (2013). Other People's Money and Goods: The Relationship Between customs Officers and Users in Some Countries of Sub-Saharan Francophone Africa, *Sociologus*, 63(12): 37-58.

Cantens, T. & Raballand, G. (2021). Taxation and Customs Reforms in Fragile States: Between Bargaining and Enforcement” International Center for Tax and Development (ICTD), Working Paper No 120.

Chalendard, C., Raballand, G., & Rakotoarisoa, A. (2019). The use of detailed statistical data in customs reforms: The case of Madagascar. *Development Policy Review*, 37(4), 546-563.

Cockx, L., & Francken, N. (2014). Extending the concept of the resource curse: Natural resources and public spending on health. *Ecological Economics*, 108, 136-149.

Cockx, L., & Francken, N. (2015). Natural resource wealth and public social spending in the Middle East and North Africa.

Collier, P. (2010). The political economy of natural resources. *Social Research: An International Quarterly*, 77(4), 1105-1132.

Collier, P. (2006). War and military spending in developing countries and their consequences for development. *The Economics of Peace and Security Journal*, 1(1).

Collier, P., & Hoeffler, A. (2005). Resource rents, governance, and conflict. *Journal of conflict resolution*, 49(4), 625-633.

Conrad, Justin. "Natural Resource Exploitation and Military Spending." *International Studies Quarterly* 67.3 (2023): sqad061.

De Wulf, L. & Sokol, J. B. (Eds.) (2005). *Customs modernization handbook*. World Bank Publications

Dunne, P., & Perlo-Freeman, S. (2003). The Demand for Military Spending in Developing Countries. *International Review of Applied Economics*, 17(1), 23–48.

Dunne, J. P., & Mohammed, N. A. (1995). Military spending in sub-saharan africa: Some evidence for 1967-85. *Journal of Peace research*, 32(3), 331-343.

Gadea, M. D., Pardos, E., Perez-Fornies, C., (2004). A long-run analysis of defense spending in the NATO countries (1960–99). *Defense and Peace Economics* 15, 231–249.

Geourjon, A. M., Laporte, B., Coundoul, O., Gadiaga, M., Cantens, T., Ireland, R., & Raballand, G. (2013). Inspecting less to inspect better: The use of data mining for risk management by customs administrations. *Reform by Numbers. Measurement Applied to Customs and Tax Administrations in Developing Countries*, Washington DC: World Bank.

- Kpognon, K. D. (2022). Effect of natural resources on the size of informal economy in subsaharan Africa: an empirical investigation. *Structural Change and Economic Dynamics*, 63, 114.
- Mashiri, E., & Sebele-Mpofu, F. Y. (2015). Illicit trade, economic growth and the role of Customs: a literature review. *World Customs Journal*, 9(2), 38-50.
- Majeski, S. J. (1985). Expectations and arms races. *American Journal of Political Science*, 217245.
- Mohtadi, H., & Roe, T. L. (2003). Democracy, rent seeking, public spending and growth. *Journal of public economics*, 87(3-4), 445-466.
- Mourad, M., & Nehme, B. (2019). Economic Determinants Affecting Military Expenditures: Panel Data Analysis. *Global Journal of Science Frontier Research:(F) Mathematics and Decision Sciences*, 19(3), 11-41.
- Musayev, V. (2016). Externalities in military spending and growth: The role of natural resources as a channel through conflict. *Defence and Peace Economics*, 27(3), 378-391.
- Le Billon, P. (2011). Extractive sectors and illicit financial flows: What role for revenue governance initiatives? *U4 Issue*, 2011(13).
- Lewin, K. M. (2020). Beyond business as usual: Aid and financing education in Sub Saharan Africa. *International journal of educational development*, 78, 102247.
- Lewis, D. & McNeill, R. (2019). How jihadists struck gold in Africa's Sahel. Special Report by Reuters.
- Looney, R. E. (1987). Determinants of military expenditures in developing countries. *Contemporary Security Policy*, 8(3), 295-324.
- Perlo-Freeman, S. and Brauner, J. (2012) Natural resources and military expenditure: The case of Algeria. *The Economics of Peace and Security Journal* 7(1) 15–21.
- Ploeg, F. V.D. "Natural resources: curse or blessing?" *Journal of Economic literature* 49.2 (2011): 366-420.
- Poirier, T. (2012). The effects of armed conflict on schooling in Sub-Saharan Africa. *International Journal of Educational Development*, 32(2), 341-351.
- Ndikumana L & Boyce JK (2018). Capital Flight from Africa Updated Methodology and New Estimates. Political Economy Research Institute (PERI).
- Remeikienė, R., & Gaspareniene, L. (2023). Effects of Economic and Financial Crime on the Government Budget and the Quality of Public Services. In *Economic and Financial Crime, Sustainability and Good Governance* (pp. 173-204). Cham: Springer International Publishing.
- Richardson, L. F., (1960). *Arms and Insecurity*. Homewood, Pittsburgh, PA.

Rudra, N. (2004). Openness, welfare spending, and inequality in the developing world. *International Studies Quarterly*, 48(3), 683-709.

Sachs, J. D., and A. M. Warner (1995): "Natural resource abundance and economic growth," Discussion paper, National Bureau of Economic Research.

Shaw, M., Reitano, T., & Exchange, S. K. (2014). *The political economy of trafficking and trade in the Sahara: Instability and opportunities*. Washington: World Bank.

Tian, N. (2015). *The economics of military spending, conflict and growth* (Doctoral thesis). University of Cape Town, South Africa.

Sun, H. P., Sun, W. F., Geng, Y., Yang, X., & Edziah, B. K. (2019). How does natural resource dependence affect public education spending? *Environmental Science and Pollution Research*, 26(4), 3666-3674.

UNU-WIDER (2023). 'Government Revenue Dataset'. Version 2023. <https://doi.org/10.35188/UNUWIDER/GRD-2023>

Yakovlev, P. (2007). Arms trade, military spending, and economic growth. *Defence and peace economics*, 18(4), 317-338.

Yildirim, J., Sezgin, S., & Öcal, N. (2005). Military expenditure and economic growth in Middle Eastern countries: A dynamic panel data analysis. *Defence and Peace Economics*, 16(4), 283-295.

Annex A

Table A1: Moran Test of Gold Customs fraud

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
Gold Customs Fraud	0.01410	-0.00114	0.00584	2.61041	0.00904

Table A2: Effect of Neighboring Gold Customs Fraud on Domestic Gold Customs Fraud

Variables	(1) OLS
Customs Fraud (Neighboring countries)	0.0071*** (0.0020)
Constant	-3.7873×10^7 (4.8393×10^7)
Observations (N)	879
R ²	0.10
F-statistic	13.00
Country fixed effects	Yes
Year fixed effects	Yes

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level ($p < 0.01$), ** indicates statistical significance at the 5% level ($p < 0.05$), * indicates statistical significance at the 10% level ($p < 0.1$).

Table A3: First Stage Results – Two-Stage Least Squares (2SLS)

Variables	(1)
Neighboring Gold Fraud	–0.6156*** (0.2194)
GDP per Capita	1.49×10 ⁵ (1.27×10 ⁵)
Rents	–5.59×10 ⁷ (3.74×10 ⁷)
Trade	1.14×10 ⁷ ** (5.07×10 ⁶)
Political Stability	3.38×10 ⁷ (1.13×10 ⁸)
Constant	–4.02×10 ⁹ * (2.25×10 ⁹)
Observations	817
R²	0.66
Country Fixed Effects	Yes
Year Fixed Effects	Yes

Notes: We applied the robust command to adjust for heteroscedasticity and intra-country correlation. t-statistics in parentheses. *** indicates statistical significance at the 1% level ($p < 0.01$), ** indicates statistical significance at the 5% level ($p < 0.05$), * indicates statistical significance at the 10% level ($p < 0.1$).

Annex B:

1. Summary Statistics

Our study uses an unbalanced panel of 45 African countries (2000–2019). Gold customs fraud, the main explanatory variable, shows high variability, with a mean of –114 million USD and values ranging from –24.3 billion to +11.1 billion USD, indicating significant discrepancies in gold trade declarations. Military spending averages 2.07, while education spending represents about 16.5% of total government expenditure, ranging from 1.7% to 35.1%. GDP per capita averages 2,449 USD, highlighting large income disparities across countries. Trade openness ranges between 1.22% and 348% of GDP, reflecting diverse levels of economic integration. Overall, the data reveal strong heterogeneity in fiscal and trade structures, consistent with differing institutional capacities and exposure to illicit gold flows across African states.

Table B1: Summary Statistics

Variable	Observations	Mean	Minimum	Maximum
Education Spending (% of total government expenditure)	895	16.573	1.705	35.006
Military Spending (% of total government expenditure)	926	2.067	0.142	32.656
Gold Customs Fraud (USD)	879	-1.14×10^8	-2.43×10^{10}	1.11×10^{10}
Political Stability (Index)	1,080	-0.589	-3.315	1.282
Trade Openness (% of GDP)	879	70.842	1.219	347.997
GDP per Capita (constant 2015 USD)	964	2,449.041	258.629	16,989.960
Natural Resource Rents (% of GDP)	943	1.194	0.000	24.834
Conflict Intensity (Total Deaths)	900	446.953	0	11,096

Source: Author's calculations.

2. Correlation Matrix

The table B1 shows the correlation matrix shows that gold customs fraud is negatively associated with education spending (−0.105) and positively with military spending (0.088), suggesting that illicit trade reduces social investment while increasing defense allocations. Education and military spending are negatively correlated (−0.151), reflecting a fiscal trade-off between both sectors. Political stability is positively correlated with education (0.238) and negatively with military (−0.177), indicating that stable countries prioritize human capital. Trade openness and GDP are strongly correlated (0.512), consistent with higher integration in more developed economies.

Table B1: Matrix of Correlation

Variables	(1) Gold Customs Fraud	(2) Education Spending	(3) Military Spending	(4) GDP per Capita	(5) Resource Rents	(6) Trade Openness	(7) Political Stability
(1) Gold Customs Fraud	1.000						
(2) Education Spending	−0.105*	1.000					
(3) Military Spending	0.088*	−0.151*	1.000				
(4) GDP per Capita	0.030*	−0.038*	0.076*	1.000			
(5) Resource Rents	−0.050*	−0.037	0.013	−0.148*	1.000		
(6) Trade Openness	0.036*	−0.019	0.061	0.512*	0.040	1.000	
(7) Political Stability	−0.016*	0.238*	−0.177*	0.389*	−0.021	0.358*	1.000

* shows significance at the .05 level. Source: Author’s calculations.

3. Stylized Facts

Figures 5 and 6 present military and education spending in countries exposed and not exposed to gold customs fraud. Figure 5 shows that countries affected by gold customs fraud allocate a higher share of their budget to defense, reflecting a reallocation of public expenditure toward

security and border control. Conversely, Figure 6 indicates that education spending is significantly lower in countries exposed to gold customs fraud. These results suggest a crowding-out effect, where rising defense needs reduce social investment.

Figure 5: Military spending without the gold customs fraud (Blue) vs. Military spending according to exposure to the gold customs fraud (Red)

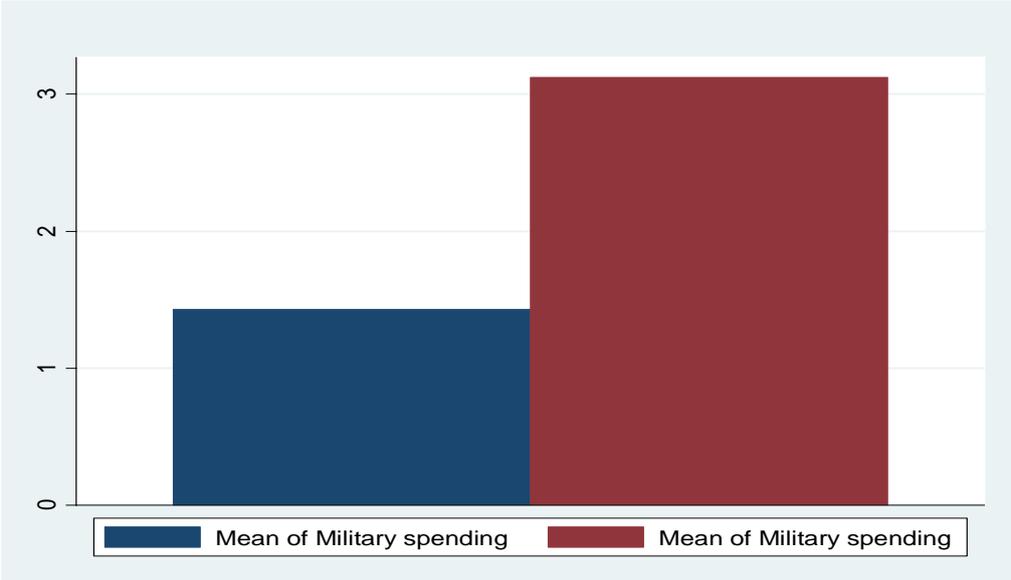


Figure 6: Education spending without the gold customs fraud (Blue) vs. Education spending according to exposure to the gold customs fraud (Red)

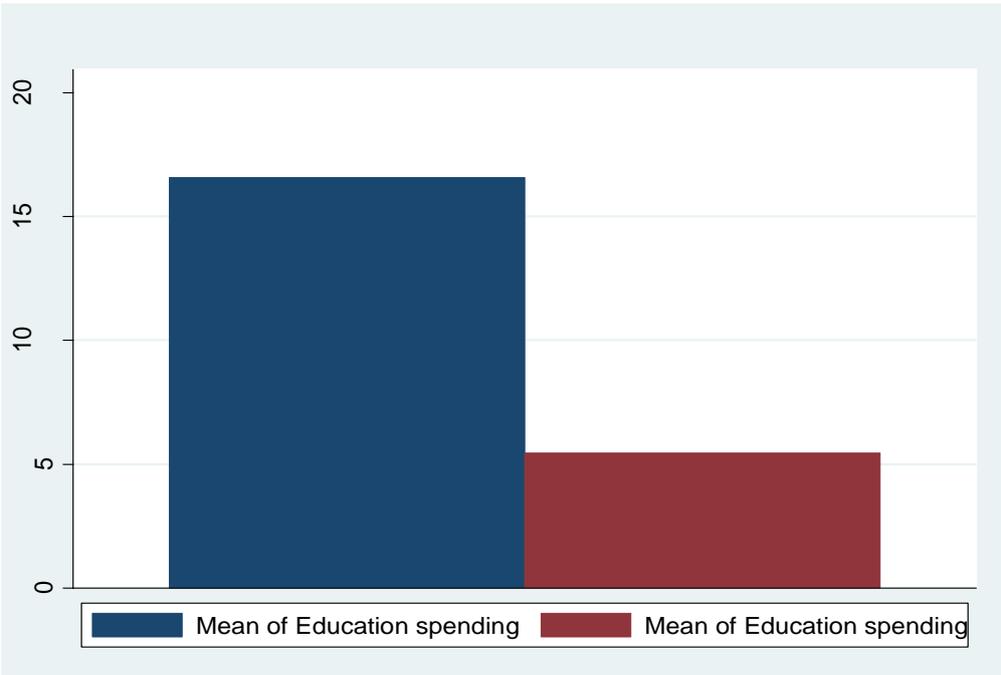


Tableau B2: Definition of Variables and Data Sources

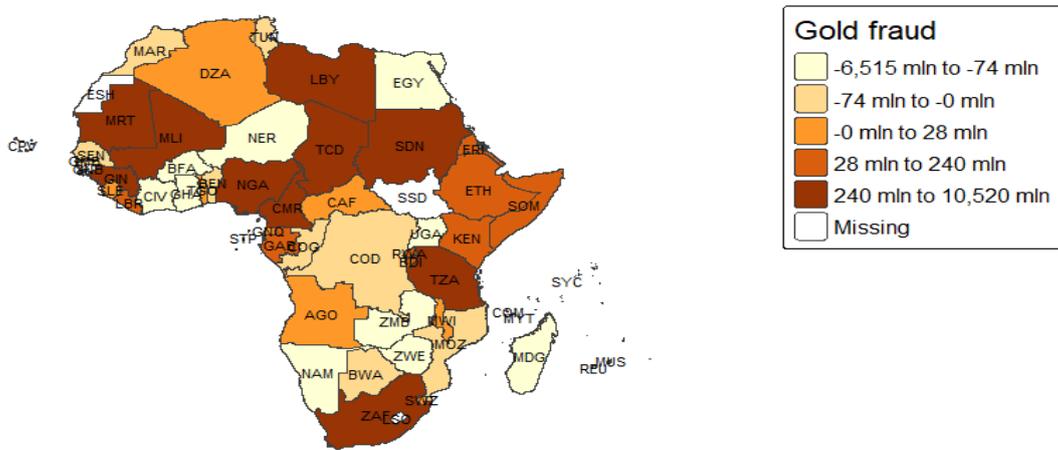
Variable	Definition	Source
Military Expenditure	Annual government expenditure on national armed forces, including defense ministries, paramilitary forces, and military aid. Expressed as a share of GDP or in constant USD.	SIPRI (Stockholm International Peace Research Institute)
Education Expenditure	Annual government expenditure allocated to the education sector, including current spending, capital investments, and transfers. Expressed as a share of GDP	World Bank, Worldwide Governance Indicators (WGI)
Gold Customs Fraud	Discrepancy between a country's reported gold exports (or imports) and the corresponding import (or export) data reported by its trading partners. Used as a proxy for illicit gold trade.	UN COMTRADE Database
Armed Conflict	Number of conflict-related fatalities per country and year, including battles, explosions, and civilian-targeted violence.	ACLED (Armed Conflict Location & Event Data Project)
Political Stability	Measures the likelihood of political instability and/or politically motivated violence, including terrorism. Higher values indicate greater stability.	World Bank, Worldwide Governance Indicators (WGI)
Mineral Rents	Total mineral rents (oil, gas, coal, minerals) as a percentage of GDP.	World Bank, World Development Indicators (WDI)
GDP per Capita	Gross Domestic Product per capita (constant 2015 US dollars).	World Bank, World Development Indicators (WDI)
International Trade (Openness)	Total value of exports and imports as a share of GDP. Used as a measure of trade openness.	World Bank, World Development Indicators (WDI)

Tableau B3: List of Countries in the Sample

Algeria, Angola, Botswana, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Republic of the Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Egypt, Gabon, Gambia, Guinea, Ghana, Kenya, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, Seychelles, Rwanda, Sierra Leone, Somalia, South Africa, South Sudan, Eswatini, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.

Figure 5: Map of Gold Customs Fraud

Customs fraud map in gold (2019)



Source: Author's calculations.

“Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner ? Sera-ce sur le caprice de chaque particulier ? Quelle confusion ! Sera-ce sur la justice ? Il l'ignore.”

Pascal

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