Three essays on the empirics of conflict and resource mobilization in Africa

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Trois essais sur l'empirisme des conflits et la mobilisation des ressources en Afrique

These presentée et soutenue par Fawzi Banao le 20 Decembre 2024

en vue de l'obtention du diplôme de Docteur en sciences économiques et de gestion (ULB) et du diplôme de Docteur en sciences économiques et de gestion (Université Clermont Auvergne, CNRS, IRD, CERDI, F-63000 Clermont-Ferrand, France)

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Summary

In a rapidly changing world, financing African economies remains a major challenge. The issue of resource mobilization is particularly alarming for countries in conflict. During periods of conflict, the ability to mobilize resources is crucial for the survival of the state. Therefore, the aims of this thesis are to analyze the effect of conflicts on resource mobilization in Africa, through three chapters.

Chapter 2 examines the link between migrant remittances, political stability, and domestic tax revenues (both direct and indirect) from 2000 to 2019. The dependent variable represents direct and indirect tax revenues, while the explanatory variable is the interaction between political stability and migrant remittances, measured as a percentage of GDP per capita. Using an instrumental variables strategy, the results show that stable countries more effectively capture domestic revenues from migrant remittances.

Chapter 3 explores the effect of terrorism in neighboring countries on gold customs fraud in Africa from 2000 to 2019, using ordinary least squares (OLS) and two-stage least squares (2SLS) estimators. The dependent variable is measured by gold customs fraud, while the variable of interest is neighboring country terrorism. The results indicate that a 1% increase in deaths related to terrorism in neighboring countries corresponds to a 3.65% increase in gold customs fraud. These results suggest that the rise in terrorist incidents in neighboring countries destabilizes border security and reduces customs performance.

Chapter 4 analyzes the impact of mineral price variations on armed conflicts in Africa at the local level from 1997 to 2019. The explanatory variable is the fluctuation in world prices of 14 minerals, while the dependent variable represents armed conflicts (battles, violence against civilians, explosions and remote violence, protests, and riots). Using the ordinary least squares (OLS) method, the study reveals a positive relationship between armed conflicts and increasing mineral prices at the local level. Specifically, a doubling of mineral prices is associated with a 7.5% to 3.8% increase in local conflicts. However, this link is notably attenuated when cells with discovered but unexploited mines are used as a control group, thus reducing the impact of mineral prices on conflicts by 20% to 40%.

Keywords: Domestic Tax Revenues, Migrant Remittances, Political Stability, Customs Fraud, Terrorism, Neighborhood Effect, Mirror Analysis, Active Mines.

Résumé

Dans un monde en pleine mutation, le financement des économies africaines demeure un défi majeur. La problématique de la mobilisation des ressources est particulièrement alarmante pour les pays en situation de conflit. En période de conflit la capacité de mobilisation de ressources représente une question de survie pour l'état. Ainsi, le principal objectif de cette thèse est d'analyser l'effet des conflits sur la mobilisation des ressources en Afrique, à travers trois chapitres.

Le chapitre 2 examine le lien entre les transferts de fonds des migrants, la stabilité politique et les recettes fiscales domestiques (directes et indirectes) de 2000 à 2019. La variable dépendante représente les recettes fiscales directes et indirectes, la variable explicative est l'interaction entre la stabilité politique et les transferts de fonds des migrants mesurée en pourcentage du PIB par tête. En utilisant la stratégie des variables instrumentales, les résultats montrent que les pays stables captent plus efficacement les recettes domestiques issues des transferts de fonds des migrants. Le chapitre 3 explore l'effet du terrorisme dans les pays voisins sur la fraude douanière en or en Afrique de 2000 à 2019, en utilisant les estimateurs des moindres carrés ordinaires (OLS) et des doubles moindres carrés ordinaires (2SLS). La variable dépendante est mesurée par la fraude douanière en or, tandis que la variable d'intérêt est le terrorisme de voisinage. Les résultats indiquent qu'une augmentation de 1 % des décès liés au terrorisme dans les pays voisins correspond à une hausse de 3,65 % de la fraude douanière sur l'or. Ces résultats suggèrent que l'augmentation des incidents terroristes dans les pays voisins déstabilise la sécurité des frontières et diminue les performances douanières. Le chapitre 4 analyse l'impact des variations des prix des minéraux sur les conflits armés en Afrique à l'échelle locale de 1997 à 2019. La variable explicative est la fluctuation des prix mondiaux de 14 minéraux, tandis que la variable dépendante représente les conflits armés (batailles, violence contre les civils, explosions et violences à distance, protestations et émeutes). En utilisant la méthode des moindres carrés ordinaires (OLS), l'étude révèle une relation positive entre l'augmentation des prix des minéraux et les conflits armés à l'échelle locale. Plus précisément, un doublement des prix des minéraux est associé à une augmentation de 7,5 % à 3,8 % des conflits au niveau local. Cependant, ce lien est notablement atténué lorsque des cellules avec des mines découvertes mais non exploitées sont utilisées comme groupe de contrôle, réduisant ainsi l'effet du prix des minéraux sur les conflits de 20 % à 40 %.

Mots-clés : Recettes fiscales domestiques, Transferts de fonds des migrants, Stabilité politique, la fraude douanière, Terrorisme, Effet de voisinage, Analyse miroir, Mines actives.

Contents

Chapter 1. General Introduction and Overview

African countries face a plethora of challenges, particularly on the economic front, where there is a critical need for financing in areas such as infrastructure, access to health and education services, access to finance for SMEs, and sustainable development. The African Development Bank estimates that Africa needs an annual investment in infrastructure of between 130 and 170 billion dollars to support its economic growth.

However, the African continent is characterised by the predominance of a large informal sector and under-performing tax administrations, resulting in a limited capacity to mobilise domestic resources (Chambas et al, 2007; Brun et al, 2006). For example, the tax collection rate in developing countries, and more specifically in Africa, is between 18 and 21 per cent, compared with the average of 34 per cent observed in OECD countries (OECD/ATAF/AUC, 2019). As a result, tax and parafiscal revenues totalled $310 billion in 2017, well below the Sustainable Development Goals (SDGs) set at $1 trillion (Jacquemot et al, 2018).

At the Third United Nations International Conference on Financing for Development in Addis Ababa in July 2015, all the countries on the African continent agreed on a series of measures to reform financial practices and generate the investment needed to meet economic, social and environmental challenges. The Addis Ababa Action Agenda, adopted at the Conference, most of whose measures were confirmed at the United Nations Summit on Sustainable Development in September 2015 at the organisation's headquarters in New York, stresses that effective resource mobilisation is one of the priorities for achieving the 2030 sustainable development goals. This objective implies, in particular, strengthening tax capacities by improving the performance of tax systems and combating tax evasion. A key recommendation of the conference is to promote transparency through better governance of tax administrations. The mobilisation of resources is therefore an imperative not only for sustainable development but also for the socio-economic stability of the African continent.

The evolution of resource mobilization in African countries has been gradual since independence, marking a major turning point in the management of public finances on the continent. After decolonization, most African states inherited public revenue systems primarily based on two pillars: development aid, mainly provided by former colonial powers and international institutions, and border revenues, that is, customs duties collected at the borders, which constituted a significant share of public budgets. For example, in the 1960s and 1970s, around 70% of

domestic revenues in most African countries came from import taxes (Jacquemot et al., 2018), highlighting a lack of diversification in national revenue sources.

Moreover, there is a marked disparity among African countries in terms of their capacity to mobilize domestic resources. These differences allow for the distinction of two major categories: on the one hand, middle-income countries such as the North African states (Morocco, Tunisia, Egypt) and South Africa, which exhibit relatively high ratios of non-resource revenues as a percentage of GDP. For example, in 2021, Morocco managed to mobilize around 27% of its GDP in non-resource fiscal revenues, while South Africa reached a similar ratio at about 26% (Amutabi, 2023).

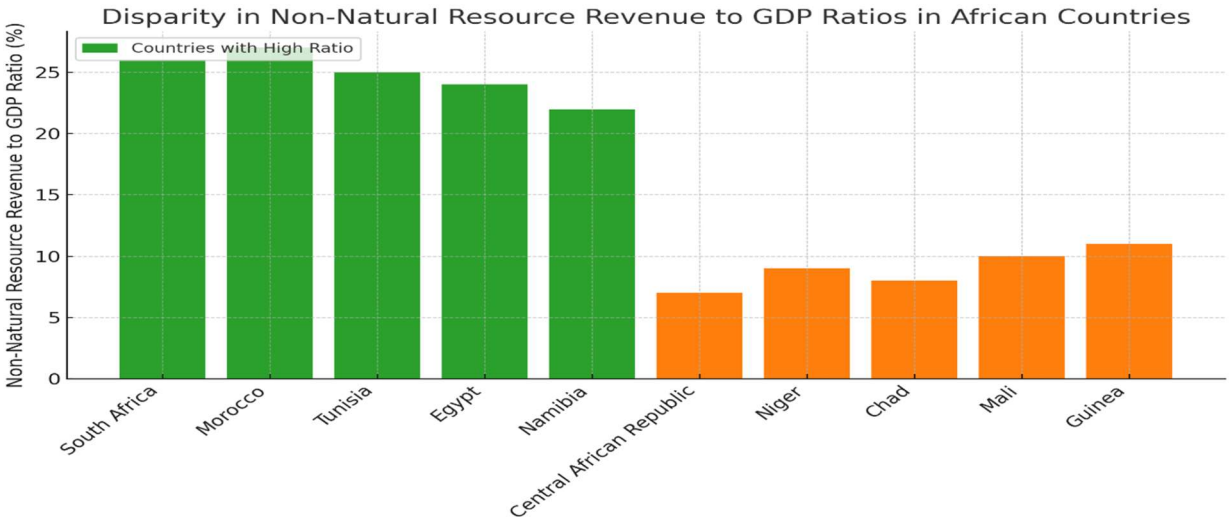


Figure 1-1: Disparity in Non-Natural Resource Revenue to GDP Ratios in African Countries. Countries with high ratio of non-natural resource to GDP (green), Countries with low ratio of non-natural resources (orange). Source: Author's calculations.

Figure 1-1 presents a comparison of countries' ability to mobilize domestic resources, with green bars representing nations with a high ratio, such as South Africa and Morocco, and orange bars representing those with a low ratio, such as the Central African Republic and Niger. The green bars indicate a stronger capacity in these countries to generate revenues independently of natural resources, reflecting more diversified economies and robust tax collection systems.

In contrast, the orange bars highlight countries with a limited capacity to raise domestic revenues, often relying heavily on natural resources or external assistance. The differences between the green and orange bars emphasize the disparity in economic structures and fiscal policies across

these nations.

On the other hand, there are countries with a low capacity for mobilizing domestic resources, primarily in sub-Saharan Africa in fragile context. States such as the Central African Republic, Chad, and Niger struggle to exceed 10% of non-resource fiscal revenues in relation to their GDP. In 2020, the Central African Republic recorded a ratio of about 7%, while Niger was around 9% (World Bank, 2021). This low capacity results from several factors, including informal tax systems, and warfare economy that decrease the state ability to levy tax collection.

In this subject, the mobilisation of resources comes up against several obstacles, among which conflicts play a significant role. The African continent is still largely affected by conflicts, the causes of which are political, ethnic or ideological. During periods of conflict, the ability of states to mobilise national resources and operate tax systems can be hampered. Nations in conflict face the disruption of tax and customs administrations, exacerbated by attacks from belligerent armed groups (Collier et al., 2004). In addition, during periods of instability, the state encounters difficulties in implementing structural tax policies and reforms.

Figure 1-2: Evolution of Total of Domestic Taxes Revenues and Conflict (number of fatalities) in Africa. Source: Author's calculations.

Figure 1-2 depicts the evolution from 2000 to 2019 of total domestic tax revenues and conflict, measured by the number of fatalities. The blue line represents the total domestic taxes (combining direct and indirect taxes), while the red line tracks the number of fatalities from conflict during

this period. An upward trend in the blue line indicates growth in tax revenues, signalling improvements in tax collection or economic performance, while spikes in the red line reflect periods of heightened conflict and instability.

Several studies in the literature have analysed the effect of conflict on the ability to mobilise resources. Tilly (1985) argues that war enables state-building, particularly through reforms implemented to collect more taxes to finance the war. Brewer (1989, 2002) and Addison et al (2002) argue that conflict situations can lead to an increase in the mobilisation of tax revenues. Indeed, the urgency of the conflict encourages the state to develop strategies to combat tax evasion in order to increase the tax base, introduce new tax systems, and improve the performance of domestic collection administrations with a view to financing the war effort.

In contrast, Collier et al (2004), Besley et al (2008), and Van Den Boogaard et al (2018) argue that conflict has a detrimental effect on resource mobilisation. They argue that the destruction of critical infrastructure and the disorganisation of tax administration systems during conflict hamper tax collection. War could therefore reduce the state's ability to mobilise tax revenues due to the inefficiency of tax administration. Furthermore, the state's loss of territorial control may compromise tax collection from citizens in conflict zones (Besley et al., 2008). Finally, in a context of instability, border controls can be disrupted. Armed groups exploit control loopholes to move war booty across borders. These practices reduce the efficiency of domestic resource collection at customs posts (Cantens et al, 2017). Despite the abundance of studies in the literature, the impact of conflict on the state's resource mobilisation capacity thus remains ambiguous.

In addition, most studies have focused on the effect of conflicts on total domestic resources, without taking into account the nature of the various taxes, duties and levies collected. Tilly (1980) and Van Den Boogaard et al (2018), for example, discuss the effect of conflicts on total revenues collected by the state. However, a more detailed analysis is needed to better understand the link between conflict and state revenue, in particular by distinguishing between direct and indirect taxes, and also between taxes levied on natural resources and those levied outside natural resources. In many African countries rich in natural resources, domestic revenue from natural resources makes up a large proportion of total government revenue, and is therefore essential for ensuring a budget balance that is always fragile, particularly in times of conflict. For example, they will account for 19.3% and 22.3% of total domestic revenue in Burkina Faso and Mali

respectively in 2021 (EITI Reports, 2023). These natural resources are also coveted by armed groups because they are their main source of funding. Collecting domestic resources from natural resources in times of crisis is therefore a major challenge for the state.

Moreover, direct and indirect tax revenues are affected by conflicts to varying degrees and through different mechanisms. Security issues disrupt economic activities, limiting business production and reducing household consumption, which in turn diminishes the tax base. The impact on state tax revenues is clear, but it occurs through different transmission channels depending on the structure of the tax system in each country. For instance, states that rely heavily on regional and international trade activities (with a significant proportion of indirect taxes) are particularly vulnerable to the effects of conflict. Border security challenges and the loss of control over intra-regional borders, which are common during conflicts, can severely disrupt trade and, consequently, reduce tax revenues (Cantens et al., 2017).

In a similar vein, migrant remittances, which are often captured by domestic taxes, can also be affected by conflict. Remittances are a crucial source of revenue for many African countries, supporting household purchasing power, especially during periods of instability, such as war. As conflicts can increase the dependence on remittances, they play a significant role in stabilizing domestic economies. The influx of remittances can help sustain household consumption and indirectly contribute to state revenues, even in times of conflict.

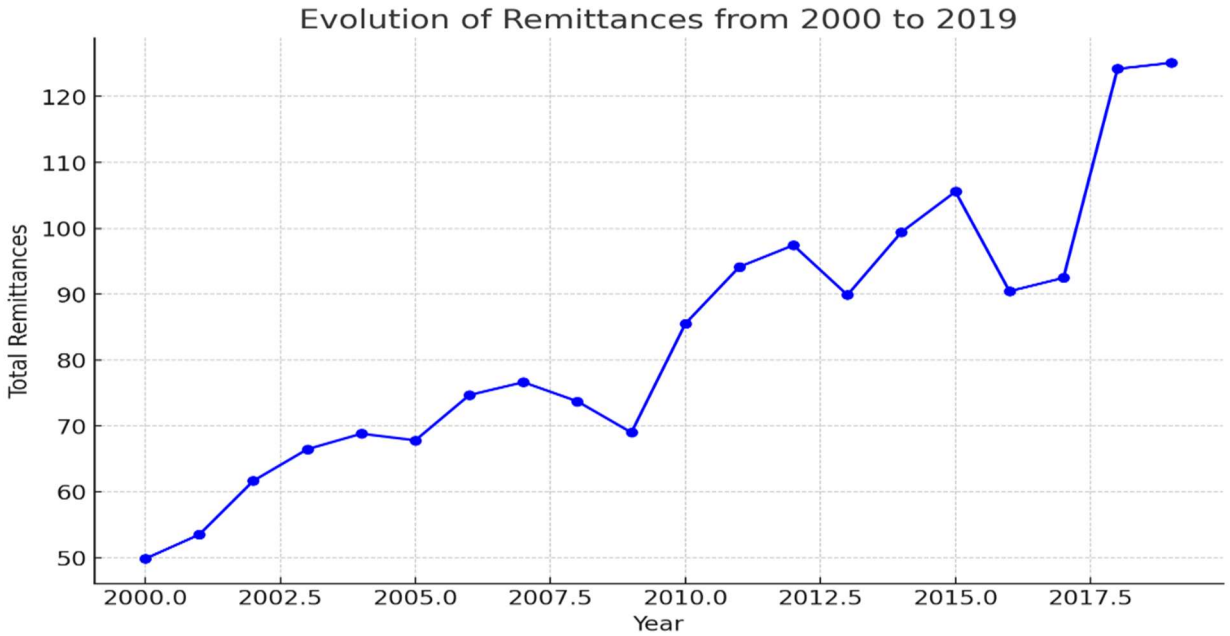


Figure 1-3: Evolution of Migrant Remittances in Africa (2000-2019). Source: Author's calculations.

In sum, the goal of this thesis is to investigate the impact of conflicts on the capacity for domestic resource mobilization in Africa. The choice to study conflicts as a determining factor in resource collection is justified by several reasons.

First, conflicts act as an external factor impacting state productivity, disrupting macroeconomic stability and directly reducing the capacity of states to mobilize both fiscal and non-fiscal revenues. Conflicts disorganize institutional structures, destroy productive and human capital, and drive economic activities towards the informal sector, making resource collection even more challenging. The exogenous nature of conflicts thus allows for a more robust identification of their effects on resource mobilization, limiting endogeneity biases.

Conversely, it is economically more complex to demonstrate that resource mobilization is a triggering factor for conflicts, as it is an endogenous process influenced by multiple structural and contextual variables. Therefore, investigating the influence of conflicts on resource mobilization is methodologically more precise and conceptually stronger.

Finally, this thesis contributes to the academic debate between opposing schools of thought regarding the effects of conflicts on public resource collection. On the one hand, authors such as Collier et al (2004), argue that conflicts have a net negative effect on states' ability to mobilize resources, due to economic destruction and institutional weakening. On the other hand, some researchers (eg, Tilly, 1985) suggest that, under certain conditions, conflicts may paradoxically increase resource mobilization, particularly through increased military spending and fiscal levies to fund the war effort. This study aims to enrich this debate by providing an in-depth empirical analysis of the African case, where specific economic and institutional dynamics can alter the relationship between conflicts and resource mobilization.

Therefore, with a view to contributing to the debate on the effect of conflict on resource mobilisation, this thesis investigates three particular aspects of the link between conflict and domestic resource mobilisation:

- Chapter 1. The relationship between migrant remittances, domestic tax revenues (direct and indirect) and political instability.
- Chapter 2. The spillover effects of terrorism on customs revenues.
- Chapter 3. The relationship between the presence of natural resources and the outbreak of

conflict.

Chapter 1: Political instability reduces the effect of migrant remittances on tax revenues.

In 2021, migrant remittances represented approximately 5 to 6% of the GDP of African countries (World Bank, 2021). These transfers represent considerable potential for collecting public resources in African countries. On the one hand, migrant remittances affect household consumption, thereby increasing the collection of indirect taxes such as value added tax (VAT). On the other hand, remittances encourage private investment by households, which increases the base for direct taxes such as the corporate tax by increasing production capacity (Ebeke, 2014).

However, even if the relationship between migrant remittances and domestic taxation (direct and indirect) is positive, it can be conditioned by political instability. The disorganisation and deterioration of tax administrations resulting from this instability can reduce the state's ability to capture resources from migrant remittances.
The aim of this chapter is therefore to study how political instability affects the relationship between migrant remittances and tax revenues in Africa.

The issue is important because direct and indirect taxation are the main tools for collecting domestic resources. Consequently, this study enables us to gain a better understanding of the determinants of domestic revenue in a context marked both by an increase in remittances from the diaspora and political instability on the African continent.

The study covers 40 African countries from 2000 to 2019. The variable of interest represents the interaction between migrant remittances measured as a percentage of GDP and political stability, while direct and indirect tax revenues are the dependent variable.

In the empirical strategy, it is crucial to take into account the possibility of an inverse causal relationship between migrant remittances and domestic revenues captured by the state. On the one hand, an increase in migrant remittances can increase indirect revenues by increasing household consumption, as well as direct revenues by increasing private investment. On the other hand, the

government can introduce tax reforms aimed at targeting the collection of remittances, such as increasing transfer fees, which could discourage migrants from sending remittances. This could, in turn, reduce domestic revenues collected from remittances.

To address the endogeneity bias, we use the two-stage least squares (2SLS) estimator, employing migrant remittances from neighbouring countries as an instrument. We empirically demonstrate the significant relationship between remittances from migrants in neighbouring countries and domestic remittances. As far as the exclusion criterion is concerned, remittances from neighbouring countries cannot directly affect domestic taxation without going through migrants' domestic remittances. This is because tax decisions are taken at the national level without any direct influence from remittances from migrants in other countries. Consequently, remittances from migrants in neighbouring countries do not directly affect domestic taxation, which means that the exclusion criterion is met.

To ensure the robustness of our results, we first carried out a second estimation with the two-stage least squares estimator, adding a second instrument, the political stability of neighbouring countries. We then used the Generalized Method of Moment (GMM) estimator for an additional robustness test.

Our results suggest that migrant remittances increase direct and indirect tax revenues in countries with stable institutions, but not in unstable countries. Our study therefore shows empirically that countries with stable institutions are in a better position to take advantage of remittances, thereby increasing their tax revenues. Thus, we contribute to the literature by proving that political stability improves the ability of states to capture domestic revenues from migrant remittances.

Our results make an essential contribution to the conflict literature by confirming the theory defended by Collier et al. (2004), according to which political instability has a negative effect on the state's ability to collect resources.

Chapter 2: Terrorism in neighbouring states increases customs fraud

Resource-rich countries on the African continent derive most of their domestic revenue from mining (Laporte et al., 2016). However, precious minerals such as gold are often subject to

smuggling (Cantens et al., 2021).

The customs administration, the national institution responsible for collecting customs duties, plays a crucial role as an essential interface between trade players, national authorities and border security (Cantens et al., 2021). In conflict-ridden countries, border control is of crucial importance for internal security and the mobilisation of domestic resources. At the same time, armed groups, particularly terrorist groups, seek to smuggle goods across borders and develop cross-border trade, not hesitating to attack customs posts to extend their territorial reach.

So the following question arises: does the destabilisation of borders by terrorist groups have an impact on customs fraud and, consequently, on the mobilisation of internal resources?

This is an extremely important issue, as customs administrations play a crucial role in both tax revenue collection and national security. The phenomenon of customs fraud is not limited to the financing of terrorist activities, but also leads to a significant reduction in domestic resources (Munshi, 2021).

In our study, the dependent variable is gold customs fraud, estimated through a detailed analysis of gold mirror data using COMTRADE data. The variable of interest is neighbourhood terrorism, measured by the number of deaths in terrorist incidents in neighbouring countries (spatial lag). We thus assess gold-related customs fraud by examining missing gold exports for 50 African countries over the period 2000 to 2019.

For our empirical analysis, we used both the ordinary least squares (OLS) estimator and the two-stage least squares (2SLS) estimator. We identified concerns about the possible endogeneity between terrorist incidents in neighbouring countries and customs performance. The spread of terrorist incidents across borders increases the illicit trafficking of gold and thus reduces the effectiveness of customs controls. At the same time, poor customs performance facilitates smuggling, which fuels the financing of terrorist groups and contributes to an increase in terrorist incidents.

To solve the endogeneity problem, we used an instrument, namely the lagged temperature of neighbouring countries. An increase in the temperature of neighbouring countries increases the

probability of conflict. As a result, we empirically show a positive relationship between the temperature of neighbouring countries and neighbourhood terrorism.

Regarding the exclusion criterion, we argue that domestic customs fraud is independent of the temperature of neighbouring countries. National trade and customs policies are determined by the authorities of each country and are not influenced by the variability of neighbouring temperatures.

The results are robust to the use of Generalized Method of Moments (GMM).

The paper empirically demonstrates that the spatial contagion of terrorism between countries increased customs fraud on gold in Africa between 2000 and 2019. We show that a 1% increase in terrorism-related deaths in neighbouring countries leads to a 3.65% increase in gold customs fraud.
Our study confirms the theory put forward by Cantens et al (2017), according to which terrorist activities increase border porosity, having a negative effect on customs performance. Thus, we enrich the literature by validating the existence of spatial contagion of terrorist activities, affecting domestic customs fraud. In addition, we contribute to the empirical literature by creating an original database on customs fraud in 50 African countries.

Chapter 4: Do the prices of minerals influence conflict in Africa?

Despite the abundant literature on the causes of conflict in Africa, particularly in the context of the natural resource curse theory, a number of grey areas remain. In this regard, the study by Berman et al (2017) assessed the relationship between mineral price variation and conflict using the ordinary least squares estimator. The authors observed that mineral price fluctuations have a positive impact on conflict at the local level. However, the authors used undifferentiated local mining zones. We therefore suspect the existence of an estimation bias caused by unobserved heterogeneity. At the local level, mining areas are unevenly distributed, with some being active and others inactive (Bhattacharyya et al, 2021).

The aim of our study is to reassess the relationship between commodity prices and conflict at the local level. We use cells, which are grids subdivided into geographical areas measuring 0.5 × 0.5

degrees in latitude and longitude.

In the first part, we analyse the effect of mineral prices on armed conflicts using all the cells in the geographical zones in an undifferentiated manner, without a control group. Then, in the second part, we assess the effect of mineral prices on conflict by using cells where mines have been discovered but remain unexploited as a control group. This will allow us to distinguish more precisely the effect of mineral price fluctuations on conflict by taking account of actual mining activity. In this way, our approach minimises potential biases and provides more robust estimates.

The study is important because mineral resources represent one of the main internal resources of African countries. In addition, the study allows us to methodologically reassess the relationship between commodity prices and conflicts by using cells where mines have been discovered but remain unexploited as a control group.

For our empirical strategy, we use an ordinary least squares estimator to study the effect of mineral price variation on armed conflict in Africa, using cells with discovered mines as a control group, over the period 1997-2019. The variable of interest is world commodity prices. We measure the conflict variable by different types of conflict events. The types of event considered in our study are as follows: Battles, Violence against civilians, Explosions and remote violence, Protests and Riots. We use geo-localised data on conflicts and mines from 14 minerals.
The units of analysis are grid cells measuring 0.5 × 0.5 degrees in latitude and longitude, encompassing all datasets with country- and year-specific fixed effects, as well as grid cell fixed effects.

First, without the use of control groups, our results show that a doubling of mineral prices leads to an increase in local conflicts in Africa, ranging from 7.5% to 3.8%. Thus, we confirm the results of Berman et al. (2017).
However, we observe that the impact of mineral prices on conflict is significantly attenuated when we use the control group of undeveloped mine discoveries, reducing it from 20% to 40% when prices double. Our findings thus suggest that mine discoveries act as inhibitors, reducing the effect of mineral price fluctuations on the risk of conflict at the local level in Africa.

Our study makes a methodological contribution by addressing the sampling bias that can arise

from disparities between active and non-active mines. We demonstrate that the use of cells with discovered mines as a control group is necessary to assess the effect of mineral prices on conflict.

In conclusion, this thesis aims to analyse the effect of conflict on the mobilisation of domestic resources in Africa. Empirically, it demonstrates overall that conflicts have a negative effect on domestic taxation. More specifically, it shows that instability reduces the effect of migrant transfers on tax revenues (chapter 2); empirically proves a negative relationship between incidents of neighbourhood terrorism and customs performance (chapter 3); and shows a positive effect of mineral price variation on conflict at the local level, although this effect is attenuated when the cells of discovered mines are used as a control group (chapter 4). The thesis thus highlights the importance of political stability for the effective mobilisation of economic resources in Africa.

Chapter 2. Remittances and Taxation in times of crisis: Does political instability condition the effect of remittances on domestic tax revenues?[1]

[1] Paper presented to the 94th International Atlantic Economic Conference, March 2022, New York.

2.1. Introduction

The World Bank estimated that migrant remittances to low and middle-income countries reached approximately 551 billion US dollars in 2019, with 105 billion specifically directed to Africa (World Bank, 2020). Therefore, based on the definition of World Bank, Migrant remittances encompass the total of worker's remittances, compensation of employees, and migrants' transfers. Remittances have been found to have various macroeconomic effects, including their impact on tax mobilization. Studies, such as Gnagnon et al. (2020*)* suggested that migrant remittances inflows can expand the fiscal space in developing countries. Additionally, Ebeke (2011) demonstrates that remittances contribute to increased VAT revenues. In sum, remittances positively impact domestic taxes revenues (direct and indirect taxes).

Migrant remittances impact domestic taxes through two channels. First, the increase in remittances leads to a rise in household consumption (Ebeke, 2014). The additional resources received contribute to higher spending on items such as food, clothing, and healthcare (Castaldo et al, 2012). This, in turn, positively affects indirect taxes collected by the state. Secondly, as remittances grow, households have more capacity to invest in productive activities, enhancing firms' productivity (Munir et al., 2011). This improvement in productivity subsequently results in higher direct tax revenues, such as income taxes, for the government.

The role of remittances is of particular significance, considering that domestic tax mobilization remains a challenge for developing countries, especially those affected by political instability. Besley et al. (2009) argue that fiscal policies are influenced by the stability of institutions. Political stability could develop a favorable environment to boost both consumption and investment of households. Thus, political stability may affect positively the impact of remittances on domestic revenues. In contrast, a war situation or political instability could decrease the effect of migrant remittances on domestic taxes revenues. This hypothesis is the focus of this paper.

To test it, we investigate how political stability in Africa conditions the marginal effect of migrant remittances on both direct and indirect taxes. Our analysis involves 40 African countries from 2000 to 2019 with panel fixed effects and instrumental variable strategies.

To make sure that our results are robust, we perform two additional tests. Firstly, we enhance our model by introducing an additional instrument. Secondly, we use an alternative estimator, the two-stage system of generalized method of moments (Blundell & Bond, 1998), to verify the stability of our baseline results.

The results of our study confirm that the impact of remittances on domestic tax revenues is contingent on the level of political stability: remittances increase both direct tax and indirect taxes revenues in countries that exhibit sufficient stability. By contrast, the effect is statistically insignificant in unstable countries.

The main contribution of this paper is to provide evidence that the impact of remittances both on direct and indirect tax revenues is conditional on political stability. This finding extends the existing literature, which had previously examined the effect of remittances on tax revenues without considering the role of political stability (e.g., Asatryan et al., 2017; Ebeke et al., 2012). By demonstrating that political stability is a necessary condition for remittances to positively influence domestic tax revenues, this research adds a new dimension to our understanding of the relationship between remittances and fiscal policies.

Furthermore, in an empirical goal, the paper introduces a novel instrument to address the issue of endogeneity between remittances and political stability. Asatryan et al. (2017) used the world-wide price of oil and the distance to oil-producing countries as instruments to tackle the endogeneity between tax revenues and remittances. This instrument can be subject to discussion. The reason for this is that most tax revenues of African countries are heavily dependent on revenues from natural resources, raising concerns about the validity of the instrument's exclusion restriction. As natural resources revenues are likely to influence both remittances and tax revenues, this instrument may not fully capture the independent effect of remittances on tax revenues. In light of this concern, our study proposes a novel instrument: using the average inflows of international remittances in neighboring countries. There are waves of transfers between countries. By focusing on remittance flows in neighboring countries, the instrument is less likely to be affected by common factors that influence both remittances and tax revenues in African countries. We attest that international migrant remittances received by neighbors represent a good predicator of the variance of domestic migrant remittances. Also, we provide a theoretical rationale supporting the exclusion restriction, arguing that the instrument is solely connected to

domestic taxes through migrant remittances. Overall, the introduction of this alternative instrument is a methodological improvement enhancing the credibility and robustness of the paper's findings.

Lastly, in a public policy goal, our findings provide valuable insights for policymakers to formulate effective responses during crisis periods for the taxation of migrant remittances. Indeed, during times of crisis, governments must mobilize tax revenues to finance war efforts, such as defense spending. Thus, our results suggest that African states should consider domestic taxes from migrant remittances less during a crisis in the goal of tax collection.

The remainder of the paper is organized as follows. Section 2.2 reviews the literature on the relationship between remittances, domestic tax revenues, and political stability, and formulates hypotheses on the conditional effect of political stability on migrant remittances. Section 2.3 outlines the empirical strategy and methodology. Section 2.4 presents our findings, and Section 2.5 provides robustness checks. Finally, Section 2.6 concludes.

2.2. How Political Stability Conditions the Effect of Remittances on Domestic Tax revenues

In this section, we review the existing literature to argue that remittances likely increase both direct and indirect domestic tax revenues, and that political stability likely conditions this relationship.

2.2.1 The effect of Remittances on Domestic taxes Revenues

Domestic tax revenues consist of direct and indirect tax revenues. The use of both direct and indirect taxation is a fundamental aspect of tax design aimed at combining efficiency and fairness (Atkinson, 1977). According to Buchanan et al. (1980) definition, direct taxes are those "imposed on the person who is expected to be the ultimate bearer of the payment burden". Similarly, Martinez-Vazquez et al. (2011) argue that direct taxes should be tailored to the individual characteristics of the taxpayer. Therefore, direct taxes are primarily levies collected from individuals who ultimately bear the burden (Bullock, 1898).

As highlighted by Bullock (1898), direct taxes are immediately linked to the ability to bear the

public burden. Thus, individuals, income, or property are considered immediate manifestations of wealth.

In contrast, indirect taxes, as defined by Buchanan (2014), are differentiated sales taxes with varying rates for different goods and services. These taxes are collected from taxpayers through an intermediary responsible for collecting the tax (Bullock, 1898; Ebeke et al, 2016). Indirect taxes are based on a presumption of secondary manifestation, with excise duties and value-added tax (VAT) being primary examples. Indirect taxes represent levies on consumption covered by the prices of products.

Migrant remittances can influence both direct and indirect tax revenues in a recipient country through two primary channels: household consumption and households' investments.
First, remittances received by households are spent for consumption needs (food, clothing, housing, education, healthcare). Thus, when migrant remittances increase and lead to higher levels of household consumption in the recipient country, they increase sales and, in turn, the collection of consumption taxes such as excise taxes and Value Added Tax (VAT) (Ebeke, 2011).

In line with this contention, several studies have focused on the usage patterns of international remittances in developing countries (Bang et al,2016; Ahlburg, 1996; Adams et al, 208). Savage et al. (2007) conducted a broad literature review and argued that a significant portion of remittances is directed towards essential needs, such as food, clothing, and healthcare expenses. This indicates that remittances often play a crucial role in meeting immediate household consumption needs. Similarly, Castalado et al. (2012) conducted a study in Ghana, focusing on 2000 households at the district and state level in 2005-2006. The study used semi-structured interviews as a research method and found that remittances are primarily utilized for satisfying consumer needs. This finding reinforces the idea that remittances contribute to supporting household consumption in recipient countries.

Furthermore, Bangake et al. (2022) analyzed the impact of remittances on tax revenues, including sales tax revenues, income tax, and resources tax, in 83 developing countries from 1990 to 2019. The researchers employed both the threshold regression method and System-GMM for their analysis. The study concluded that the effect of remittances on sales tax revenues is more pronounced than their effects on income tax revenues and resources tax. This suggests that

remittances may have a more significant impact on consumption-related taxes, such as sales tax, due to their role in supporting household consumption.

Ebeke (2014) investigates the relationship between remittances inflows and tax revenues using the system generalized method of moments (GMM) estimator in a broad sample of countries from 1980 to 2005. He observes that remittances have a positive effect on the tax revenue ratio in the presence of Value Added Tax (VAT). The tax base increases due to the growth of household consumption that occurs in the presence of VAT and excise taxes. This finding suggests that remittances contribute to boosting tax revenues by stimulating household consumption, which, in turn, leads to an expansion of the tax base.

Remittances may also increase incomes for both individuals (from employment or business profits) and businesses hence direct taxes through income tax revenues (Wahba,1991, Combes et al, 2011). This, in turn, can lead to higher taxable incomes.

Moreover, remittances impact direct tax revenues by increasing households' savings and investment. When households receive remittances, this additional income serves as a source of savings that can be directed toward investments in small businesses or the growth of private savings. Consequently, the government stands to increase its tax collection through direct taxes, thanks to the additional income generated by migrant remittances.

Several studies have examined this relationship, shedding light on the positive effects of remittances on private savings and subsequent investment, which can lead to increased tax revenues. Baldé (2011) investigates the impact of remittances on savings and investment in Sub-Saharan countries over the period 1980–2004, using both Ordinary Least Squares (OLS) and instrumental variables strategies. The findings indicate that a one percent increase in remittances leads to a 0.65 percent increase in households' private savings in the region. This suggests that remittances serve as an additional source of income for households, motivating them to save more for the future. Also, Munir et al. (2011) investigate the impact of remittances on private savings in Pakistan with the ARDL Bounds Testing Approach of co-integration with annual time series data for 1973-2007. The paper reports that remittances positively impact private savings in Pakistan both in the long run and the short run. The increase in private savings generated by remittances encourages households to invest. In particular, they allow poor households to invest

in entrepreneurship and small businesses (Kakhkharov, 2019). Those investments raise the performance of those small businesses', resulting in higher incomes that increase the tax base of income taxes and result in higher tax revenues.

In summary, migrant remittances can impact indirect taxes through consumption and direct taxes through income in the recipient country. These two channels highlight how remittances have the potential to affect both direct and indirect tax revenues, contributing to the fiscal dynamics of the recipient country.

2.2.2 The moderating role of Political Stability

In countries with low political stability, economic downturns, social unrest, shadow economy and tax fraud may negatively impact migrant remittances that affect domestic taxes revenues through both consumption and investment channels. In that respect, based on a survey of the literature, Oluwafemi et al. (2014) argue that political instability dampens the effect of remittances on tax revenues in Nigeria. Indeed, due to conflict, the Central Bank of Nigeria observed from 2007 to 2010 a higher share of remittances inflow received through informal channels that decreased tax mobilization by the state (Oluwafemi et al., 2014*);* Englama, 2007). Moreover, the insurgency of Boko Haram negatively affected investment generated from remittances inflow.

Low political stability encourages the development of informal channels to transfer the flow of remittances (Wahba, 1991) and may negatively impact the banking industry by reducing formal banking transactions. This situation may encourage migrants to use unofficial channels of remittances to provide financial support to their families and communities (Freund et al, 2008). Thus, the increase of informal remittances flows in unstable countries would contribute to developing the informal sector and the black market, which decreases domestic taxes.

Conversely, in a politically stable environment, if international remittances are substantial and consistently flowing into the country, they can have a positive impact on tax revenues through an extended tax base, indirect and direct taxes such as value-added taxes (VAT), and income taxes. In stable environments, remittances received may be more likely invested in income-generating activities, starting businesses, or purchasing assets. This may contribute to the collection of direct taxes such as income taxes.

In addition, political stability enables governments to develop and implement policies that support the effect of remittance inflows on taxes (Agbhegha, 2006; Bohn, 2002*)*. A stable state may develop financial services and a banking sector that decrease the risk of disruption of formal channels. Therefore, the development of official channels due to stability, would boost taxes mobilization by capturing remittance-related tax revenues (El-Sakka, et al. 1999*)*.

As a result, we can hypothesize that while the effect of remittances both on direct and indirect tax revenues is on average positive, its magnitude is larger in more stable countries, hence the following hypothesis:
Hypothesis 1: The marginal effect of remittances on direct tax revenues is positive and larger in politically more stable countries.
Hypothesis 2: The marginal effect of remittances on indirect tax revenues is positive and larger in politically more stable countries.

In the remainder of the paper, we empirically test whether political stability conditions the marginal effect of remittances on direct and indirect domestic taxes in Africa.

2.3. Method and Data

In this section, we first present our empirical strategy. Second, we describe the measurement variables for migrant remittances, direct and indirect tax revenues, and political stability. Lastly, we present our control variables.

2.3.2 Empirical Strategy

To test whether migrant remittances have a significant impact on indirect and direct taxes and whether their impact is conditioned by political stability, this article adopts the empirical approach of Asatryan et al. (2017) specified as:

$$\ln DOMTAX_{it} = \alpha + \beta_1 \ln REMIT_{it-1} + \beta_2 STA_{it-1} + \beta_3 (\ln REMIT_{it-1} \times STA_{it-1}) + \mu_i + \lambda_t + \varepsilon_{it} \quad (2\text{-}1)$$

Where $\ln DOMTAX_{it}$ represents the dependent variables (Indirect taxes or Direct taxes) in logarithm at time "t" in country "i"; $REMIT_{it-1}$ represents the lagged value of international

remittances received in percent of GDP of country "i" at time "t-1". STA_{it}Ğ1 is the lagged of Political Stability /Absence of Violence in a country i at time t-1. The term η_i is the country-specific effect, λ_t is the individual year fixed effects; ε_{it} is the unobserved random error term. The vector X represents the set of control variables and σ' is the associated vector of parameters. Note the signs of the coefficient of the interaction term, evaluate if the political stability enhances or distorts the marginal effect of remittances on domestic taxes revenues.

$$\frac{\partial \ln DOMTAX}{\partial \ln REMIT_{it}\check{G}1} = ß_1 + ß_3 STA_{it-1} \quad (2\text{-}2)$$

The key parameters of interest are $ß_1 1$ and $ß_3$.

According to Hypothesis 1, we expect $ß_1 1>0$ and $ß_3>0$. Specifically, migrant remittances increase domestic taxes, the effect is larger the more stable the country is.

Data on international remittances inflows come from the World Bank databank, which measures Personal remittances per capita, received and compensation of employees. We use remittances in percentage of GDP in the model, noted "Remittances (%GDP)". Data on Domestic taxes extracted from the International Centre for Tax and Development (ICTD) and UNU-WIDER datasets. We use both Indirect taxes and Direct Taxes as government domestic taxes revenues. Indirect tax measures total taxes on goods and services, which include sales taxes, and excise taxes (% GDP) noted as "Indirect Taxes". Direct tax measures total taxes on income, profits, and capital gains, containing taxes on natural resource firms (% GDP) noted, "Direct Taxes".

The database on political stability is extracted from the World Bank databank. It measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.

In the estimation process, we may face an endogeneity issue. Indeed, about the relationship between domestic taxes and migrant remittances, the government can implement fiscal policies on consumption to capture more remittances inflows from migrants. Thus, when fiscal space increases, the government may raise social spending and therefore may reduce migrants' incentives to send remittances (Gnagnon and al. 2020). Inversely, remittances bear on domestic

taxes revenues through indirect and direct taxes.

To resolve the endogeneity bias between domestic taxes revenues and migrant remittances, we use the two-stage least square estimator. To do so, we need an exogenous variation of taxes revenues but that correlates with remittances.

According to Angrist et al. (2009*)*, to find a suitable instrument, we must analyze the economic mechanism and institutions of the variable of interest. There is evidence that geography is a determinant of remittance inflows (Valdivia et al, 2010; De Sousa et al,2010). For instance, MacDonald, et al. (2018) report a regional spillover of remittances in Sub Saharan. Moreover, Lopez et al. (2010) have demonstrated that remittances have spatial heterogeneity at the regional level. We use as instrument a variable that measures remittances received by neighboring countries. We build the instrument as follows:

$$\text{REMITSpillover}_{jt} = C\mathcal{O} \times \text{REMIT}_{it}, \tag{2-3}$$

with $\text{REMITSpillover}_{jt}$ is the personal remittances received in percent of GDP of country *"i"* at time *t*; $C\mathcal{O}$ is the spatial weight matrix and REMIT is the value of personal remittances received in percent of GDP of country "ȷ" at time t by country and per year *with* $\jmath \neq i$ per year.

The weight matrix is a binary $N \times N$ matrix coding neighboring countries, defined as countries whose capital is less than 1000 kms away from the capital city of country *i*. We set the threshold at 1000 kms because it is the minimal distance for which the spatial correlation becomes significant with the global Moran's I[2] test (see Annex B Table 2-A3).

The elements of the matrix are therefore defined as follows:

$$C\mathcal{O}ij = \begin{cases} 1 & if\ d_{ij} < 1000 \\ 0, & otherwise \end{cases} \qquad \text{With } d_{ij} = \frac{d_{ij}}{\sum_{ij}^{N} d_{ij}} \tag{2-4}$$

with $d_{ij} < 1000$ is the indicator function that takes the value 1 if the bilateral distance between

[2] The Global Moran's I test is a spatial autocorrelation test based on both locations and feature values. The purpose of the test is to assess the degree of spatial correlation between on adjacent location. The statistic material calculates both Moran's I value, z-score and p-value to present the significance of the index. If P-value is statistically significant, and z-score is positive, we may reject the null hypothesis: spatial distribution is not a random process. Otherwise, we cannot reject the hypothesis if P-value is statistically no significant and z-score is negative: the spatial distribution is a random process.

the capitals of country *i* and *j* is less than the threshold distance(1000kms) and 0 otherwise[3] . C_{ij} quantifies the spatial connection between the capital cities of countries i and j, and d is the distance between the capitals of countries. This measure assigns greater weight to countries that are closer to the domestic country, indicating that geographical proximity facilitates the impact of international migrant remittances received between neighboring countries. Observations that are closer show a higher spatial connection than distant observations. As a matter of fact, the remittances received by a country's neighboring countries likely influence the domestic economy due to regional spillover effects. For example, when neighboring countries receive higher remittances, this can lead to increased cross-border trade, investment opportunities, or other economic exchanges that impact the domestic country. Accordingly, the matrix, which is row-standardized, ensures that closer neighbors exert a greater influence, effectively capturing how the remittances received by neighboring countries contribute to the economic environment of the domestic country.

To assess the validity of the instrument, we first plot in Graph 2-1 migrant remittances on the y axis versus neighbor's migrant remittances defined by Equation (2-3) on the x axis.

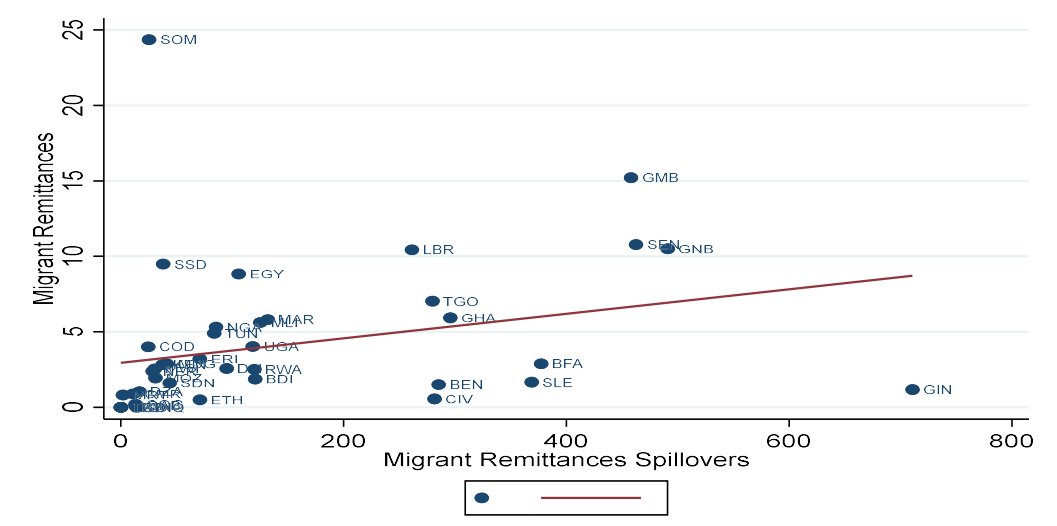


Figure 2-1: The graph plots the scatter plots of the migrant remittances and neighboring remittances

Source: Author's calculations.

Figure 2-1 attests to a positive link between migrant remittances and migrant remittances spillovers. This suggests that international remittances received by neighboring countries can

[3] d_{ij} is Euclidean distance.

serve as a robust predictor of migrant remittances in our sample.

Second, we run a least squares regression:

$$lnREMIT_{\mathrm{it}} = \beta ln(\mathrm{REMITSpillover_{jt}}) + \varepsilon_{\mathrm{lt}} \quad (2\text{-}5)$$

Where $REMIT_{\mathrm{it}}$ is the value of personal remittances received in percent of GDP of country i at time t is migrant remittances amount by country and per year, $REMIT\ \mathrm{Spillover}_{\mathrm{j}t}$ is the personal remittances of neighboring countries "j" at time t. It noted Remittances Spillover in table 2.A1.

Results from table 2.A1[4] support the relevance of the instrument. It shows a significant relationship between migrant remittances and the remittances received by neighboring countries. Additionally, the adjusted R-squared ranges from 0.37 to 0.84, indicating that remittance spillover is a good predictor of the variance of migrant remittances. Moreover, the F-statistics ranges from 112 to 411, well above the threshold of 10, suggesting that the instrument is strong enough. The positive correlation indicates that changes in remittances received by neighboring countries are associated with corresponding changes in migrant remittances within our sample.

Third, concerning the exclusion criterion, the chosen instrument is plausibly uncorrelated with domestic taxes, except through its influence on migrant remittances. This rationale is supported by the fact that domestic tax revenues in country "i" cannot directly capture the international remittances received by neighboring countries. Fiscal policies, including tax rates, are independently adopted by each country's parliament or national authority. As a result, the fiscal policies and tax rates in country "i" are distinct from those in country "j." Consequently, the migrant remittances in country "i" are influenced by the flow of remittances received by neighboring countries, which, in turn, have an impact on both direct and indirect taxes in country "i".

Furthermore, to address endogeneity in our model, we use domestic taxes collected in time "t" by the migrant remittances in time "t-1". Previous studies such as Anderson et al., 1981 and Todd et al.,2003, who have demonstrated that incorporating lagged variables can help alleviate

[4] See Annex.

endogeneity concerns, support this approach. By employing lagged variables, we can better capture the temporal nature of the relationship between remittances and tax revenues. This allows for a more robust analysis, as it accounts for potential time lags in the effects of remittances on tax revenues.

In summary, the choice of instrument and the use of lagged variables represent important methodological considerations in addressing endogeneity and strengthening the validity of our findings. However, despite this theoretical support of our instrument, we cannot exclude with certainty all violations of the exclusion criteria.

To enhance the effectiveness of our instrument, we add the interaction between neighboring migrant remittances and political stability as a second instrument. This addition is essential because the variable of interest is dependent on political stability. By employing this methodology, the paper aims to provide a more accurate and reliable assessment of the relationship between remittances, political stability, and tax revenues in the context of African countries (Balli et al., 2013). This approach allows us to better capture how variations in political stability interact with remittance flows from neighboring countries, thereby refining our understanding of their impact on domestic tax revenues.

2.3.2 Control Variables

We use as a control variable, trade openness ("Trade") which is the sum of exports and imports of goods and services (% GDP). According to previous studies, trade openness can negatively influence tax revenues. Indeed, some authors such as Cagé and al. (2018) showed that trade openness in developing countries causes the falling of tax revenues due to reduction of the tax base. Furthermore, the relationship between trade and remittances is positive. Trade openness boosts the consumption of foreign goods. Indeed, trade stimulates households' demand for migrant remittances (Miao et al., 2021; Yang, 2008).

Moreover, we included the real official exchange rate (US$ per LCU) (from the World Bank data) noted, ″Exchange rate". The exchange rate plays an ambiguous role a priori on tax collection. A depreciation of the currency increases imports and international trade tax. On the contrary, the currency's appreciation leads to a decrease of domestic taxes revenues such as excise taxes (Fishlow, 2014). Regarding the relationship between exchange rate and remittances, lopez et al.

(2007, 2008) have shown that increasing migrant remittances appreciates the exchange rate. Indeed, the link between the exchange rate and migrant remittances is explained through both external and internal equilibrium of economy by respectively the development of international capital and the raising of domestic capital and labor (Lopez et al., 2007).

In addition, we employ the corruption index "Corruption" (from the World Bank database) to proxy institutional quality, which assesses transparency, accountability, and corruption in the public sector including tax administration. Previous studies have consistently shown that higher levels of corruption can decrease tax revenues collected by the state due to fraud and inefficiencies.

About the relationship between remittances and corruption, scholars such as Gnagno et al. (2020), Ehrhart (2011), and Bird et al. (2008) have found a positive link between higher institutional quality, an expanded tax base, and increased remittance inflows, all of which are associated with reduced levels of corruption. For example, Abdith et al. (2012) observe that increased remittance inflows can decrease institutional quality by lowering control over corruption, government effectiveness, and the rule of law. However, contrasting perspectives exist. Some studies suggest that remittances can enhance access to public services, thereby reducing opportunities for corrupt activities (Berdiev et al., 2013). In summary, the relationship between remittances and corruption is ambiguous.

To control for the impact of inflation, we add an inflation index measured by the consumer price index (annual %) from the World Bank database, *"*Inflation". The link between inflation and tax revenues is unclear. Indeed, inflation can increase taxes and decrease public debt by appreciating the real exchange rate. On the contrary, inflation can generate a Tanzi effect. The Tanzi effect is an economic situation where the inflation rate reached thresholds that involve the deterioration of tax collection volume (Tanzi, 1980). In addition to the relationship between inflation and tax, there is a connection between inflation and remittances. The devaluation of domestic currency implies raising remittance demand by households in developing countries (Barua, (2007)). Also, Narayan et al. (2011) argue that in developing countries, remittances generate inflation in the long run. They documented that remittances involve both consumption expenditure and domestic currency demand. These two channels stimulate inflation due to remittances.

Similarly, we control for the value added of Agriculture (% of GDP) from the World Bank data, "Agriculture". The harder to tax the farming sector triggered by the dispersion of farmers and the shadow economy reduces the number of taxpayers in Africa (Leuthold, 1991*).* Consequently, we expect that the size of the pastoral sector reduces taxation. Furthermore, there is a reverse causality between remittances and the share of agriculture. Remittance inflows increase the income of households and agriculture productivity through the investment in agriculture by households. However, the increase in agriculture productivity increases the living standard of households and lowers the demands of remittance inflows (Kapri and al., 2020).

Finally, we add gross domestic product per capita on purchasing power parity from the World Bank data, (constant 2010 US$) *("*GDP*")*. We included GDP per capita as a proxy of the level of development, also it is a proxy of the potential tax base (Diakite et al., 2019). Likewise, the impact of remittances on economic growth has been discussed in the literature (Das et al,2011; Ebeke et al, 2013). For example, Das et al. (2011) report a negative relationship between GDP and remittance inflows in developing countries. However, some researchers support the positive impact of remittances on growth (e.g., Pradhan et al. 2008; Loxley and Sackey, 2008). Remittances may impact GDP per capita by affecting households' consumption, aggregate demand and investment in received countries *(*Das et al., 2011).

2.4. Data Overview and Estimation Results

2.4.2 Data Overview

We build an unbalanced panel data for 40 African countries from 2000 to 2019. The countries included in the sample are listed in Annex 2. Table 2-1 provides descriptive statistics, showing that the average remittance inflow in Africa is US$3.218 billion. The data reveal that the amount of indirect taxes collected is higher than direct taxes in our sample. Specifically, the mean value of indirect taxes as a percentage of GDP is 9.3%, compared to 4.9% for direct taxes.

Moreover, the dataset includes some small island nations and microeconomies, as their domestic tax revenues are heavily reliant on foreign income sources, such as international migrant remittances (Ebeke, 2014). These external revenues are vital for sustaining their economies, which

makes these countries particularly relevant to the analysis. Their inclusion provides valuable insights into the impact of remittances on domestic resource mobilization in contexts where external income sources significantly support economic stability.

Table 2-1: Summary Statistics

Variable	Mean	Std.Dev.	Min	Max
Migrant Remittances	3.218	5.125	0	53.826
Political Stability	-.58	.90	-3.3	1.28
Direct Taxes	.049	.029	.002	.171
Indirect Taxes	.093	.042	.004	.486
Corruption	-.646	.606	-1.869	1.217
Inflation	9.595	29.73	-9.798	513.907
Trade	73.114	39.703	16.141	347.997
Exchange Rate	66.642	12.134	42.39	90.34
GDP per Capita	2434.003	3110.623	187.517	20532.98
Agriculture	21.293	14.205	.893	79.042

Source: Author's calculations.

The table 2-2 presents the matrix of correlation. The data show a positive correlation between migrant remittances and domestic tax revenues (direct and indirect). Also, table 2-2 shows a positive correlation between political stability and migrant remittances.

Table 2-2: Matrix of Correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Migrant Remittances	1.000									
(2) Direct Taxes	-0.214*	1.000								
(3)Indirect Taxes	-0.101*	0.689*	1.000							
(4) Political Stability	0.080*	0.118*	0.157*	1.000						
(5) Inflation	-0.061	-0.073*	-0.139*	-0.213*	1.000					
(6) Agriculture	0.347*	-0.368*	-0.276*	-0.161*	0.010	1.000				
(7) trade	0.106*	0.259*	0.164*	0.083*	-0.009	-0.207*	1.000			
(8) Exchange Rate	0.087*	-0.193*	-0.179*	0.039	0.091*	0.379*	-0.121*	1.000		
(9) Gdp per capita	-0.271*	0.231*	0.180*	0.230*	-0.058	-0.521*	0.334*	-0.422*	1.000	
(10) Corruption	0.046	0.187*	0.224*	0.404*	-0.177*	-0.063*	-0.088*	0.046	-0.229*	1.000

* shows significance at the .05 level

Source: Author's calculations.

2.4.2 Estimation Results

Table 2-3 presents the outcome of the estimation for our baseline model. As regards control variables[5], our findings indicate that international trade has a positive effect on both indirect and direct tax revenues. On the other hand, inflation and exchange rate fluctuations are observed to decrease indirect taxes. Also, our outcomes attest that remittances improve both direct and indirect taxes revenues. These findings are consistent with those of several authors, such as Ebeke (2014), who have also confirmed that remittances contribute to an increase in government tax income, primarily through income-tax revenues and indirect taxes.

The results reported in column (1) of table 2-3 show that a one percent increase in remittances in stable countries leads to a 0.013 percent increase in direct taxes revenues. Thus, remittances are a statistically significant and positive predictor of direct taxes, but this effect is conditional on political stability. Specifically, the interaction term between remittances and political stability is positive, implying that the absolute value of the marginal effect of remittances increases as a country becomes more stable. When political stability is equal or greater than its mean value, the effect become positive and statistically significant. Figure 2-2 plots the estimated marginal effect of remittances on direct taxes. It shows that the marginal effect of migrant remittances at mean and maximum of political stability is positive and statistically significant. It confirms that it increases with political stability and is statistically insignificant below a certain threshold.

Similarly, the results for indirect taxes in column (2) of table 2-3, show that political stability raises remittances impact. A one percent increase of both remittances and political stability leads to a 0.0025 percent increase in indirect taxes revenues.

In Figure 2-3, which plots the marginal effect of remittances, attests that the marginal effect of migrant remittances at minimum and maximum of political stability is statistically significant. It suggests that political stability has a positive and significant impact on the marginal effect of remittances on indirect taxes below a certain threshold. Our analysis demonstrates that stable institutions are directly linked to the relationship between indirect tax revenues and migrant remittances.

As a result, political stability significantly enhances the absorption of remittances through both direct and indirect tax revenues. Our study confirms a positive link between remittances and domestic taxes in Africa. Importantly, we extend this understanding by revealing that this

[5] See Table 2.1.A

relationship depends on political stability and could be negligible in politically unstable nations.

Table 2-3: Impact of migrant remittances on domestic taxes in countries conditional on political Stability

	First Stage Estimations: dependent variable = Migrant Remittances	
Remittances Spillovers	0.0047***	
	(0.0004)	
Fisher Test	120.7***	
	2LS	2LS
Second Stage Estimations: dependent variable =	DIRECT TAXES	INDIRECT TAXES
Lag.Remittances(%GDP) (Ln)	0.0038***	0.0014
	(0.0011)	(0.0016)
Lag.Political Stability	-0.0015	-0.0006
	(0.0011)	(0.0014)
Lag.Political Stability × Lag.Remittances (%GDP) (Ln)	0.0013*	0.0025*
	(0.0008)	(0.0014)
Observations	701	701
R2	0.84	0.86
Sargan Test	0.09	0.051
Country Fixed	YES	YES
Year Fixed	YES	YES
Control Variable	YES	YES
Constant	YES	YES
Marginal Effect of Migrant Remittances		
Minimun of Political Stability	-0.0005	-0.0009*
	(0.002)	(0.004)
Mean of Political Stability	0.0030***	0.0035
	(0.008)	(0.013)
Maximun of Political Stability	0.0054**	0.0063*
	(0.001)	(0.003)

Notes: Constant and control variables included but not reported. See annex Table 1A to check the complete table. We applied the robust command to adjust for heteroscedasticity and intra-country correlation.*** 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 ($p<0.1$).

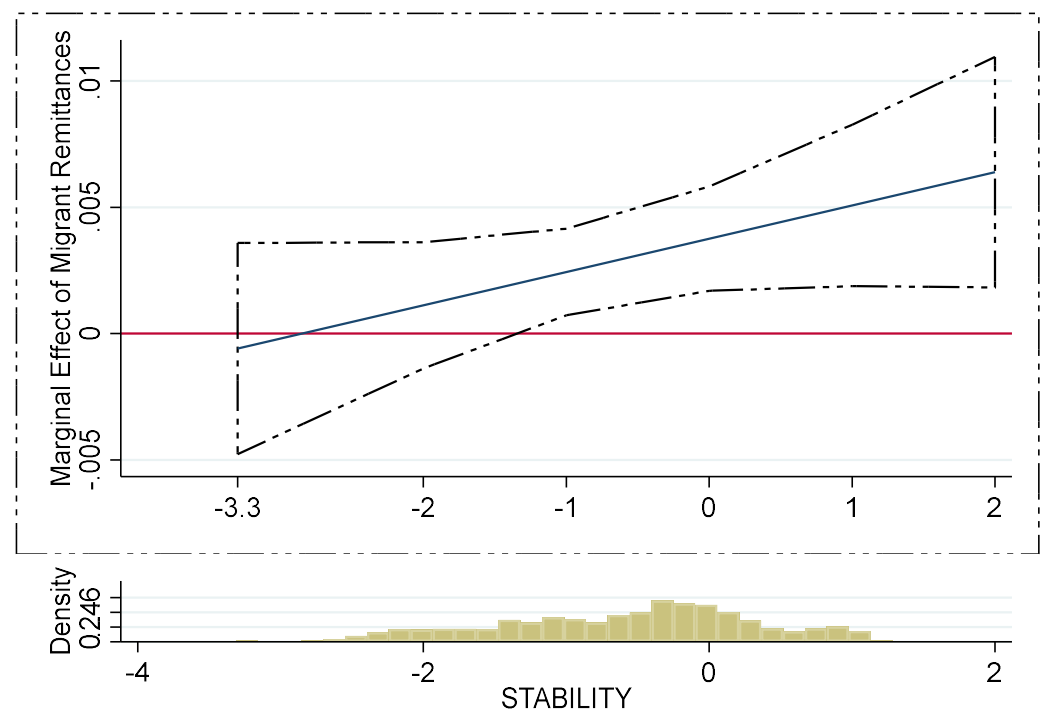


Figure 2-2: Marginal effect of Migrant Remittances on direct taxes as a function of political stability. Results are based on the estimates shown in column (1) of Table 2.3

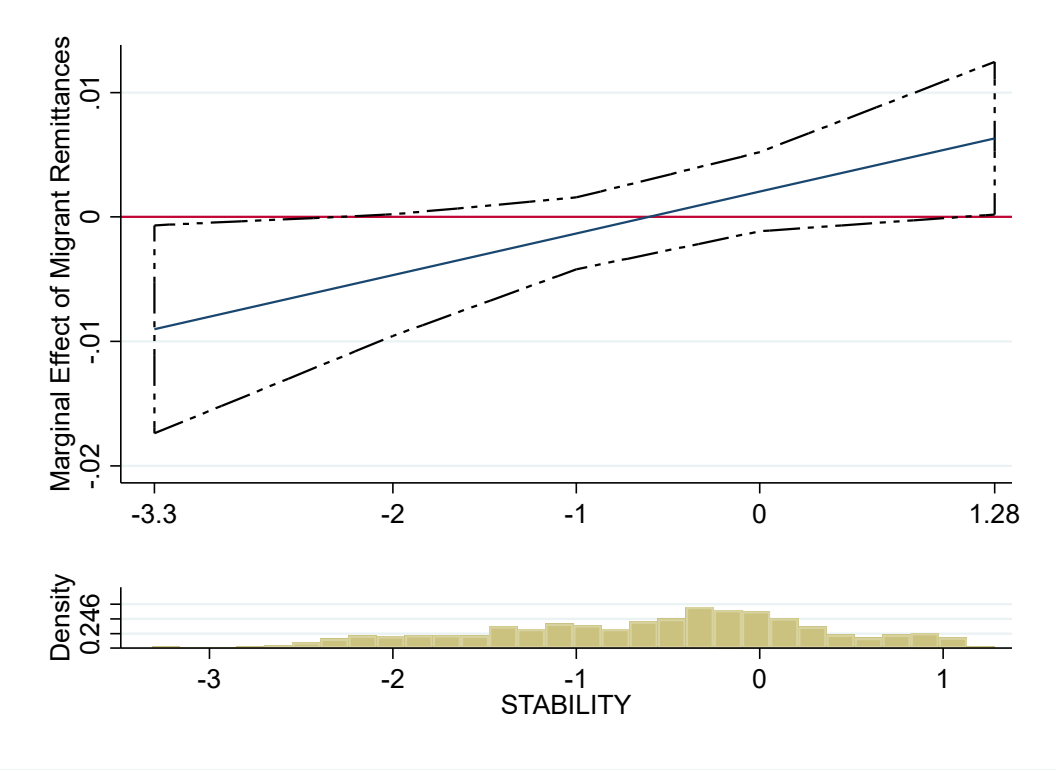


Figure 2-3: Marginal effect of Migrant Remittances on indirect taxes as a function of political stability. Results are based on the estimates shown in column (2) of Table 2.3

2.5. Robustness Check

In the robustness section, we perform two tests. In the first robustness exercise, we introduce both an instrument and a control variable into our model. Secondly, we utilize the GMM estimator (Blundell & Bond, 1998) as an alternative estimator to assess our main findings.

2.5.1 Addition of an instrument and control variable

There may be a reverse causality bias between direct and indirect taxes and political stability. Indeed, better tax mobilization can improve public spending on social expenditures. The improvement of public goods may reduce grievances and increase state stability. However, on the contrary, the presence of violence could lead the government to raise taxes to react to violence (Besley, 2008). Therefore, as a second robustness check, we add an instrument to further address the potential endogeneity issue between domestic taxes and political stability. We use as instrument the political stability of neighboring countries.

Several authors have studied the contagion effect or spillover impact of institution quality in Africa. For example, Starr et al. (1983) attested to a dynamic statement of the border and the spatial diffusion of struggle in Africa. Moreover, according to De Maio, (2010) the common of kind groups such as ethnic groups across the frontier clash can spread violence. Consequently, based on previous theoretical results, we use the political stability of neighboring countries as an instrument.

We present our instrument (the political stability spillover) as follows:

$$\text{STABSpillover}_{jt} = \text{Ↄ} \times \text{STA}_{it} \quad (2.6)$$

With $\text{STABSpillover}_{jt}$ is the political stability/absence of violence of country j at time t per year; Ↄ is the spatial weight matrix and STA_{it} is the political stability/absence of violence of country i at time t with $j \neq i$.

We use a spatial matrix[6] distance as weight matrix. The weight matrix is a binary $N \times N$ matrix coding neighboring countries. We apply a radius of 1000 kms from the capital of the city of country "i". The global Moran's I test attests that 1000 kms is the minimal distance for which the spatial correlation becomes significant (see Annex Table A4).

To evaluate our instrument, we first plot[7] political stability (y-axis) against political stability of neighboring countries (x-axis). The graph shows a positive correlation, indicating that political stability in neighboring countries is positively linked to political stability in country i.
Second, we apply the least square ordinary regression to investigate the relationship between political stability in a local country and the political stability of neighboring countries. The equation is as follows:

$$STAB_{it} = \beta(\text{STABSpillover}_{jt}) + \varepsilon_{lt} \quad (2.7)$$

Where $STAB_{it}$ is the measure of political stability in a country "i" at time "t", STA_{it} is the political stability/absence of violence in a country "i" at time "t". $\text{STABSpillover}_{lt}$ is the political stability /absence of violence of country "ȷ " at time "t".

Results in Table 2-A2[8] shows a significant link between neighboring political stability and political stability. The fisher test shows a goodness of fit (F-Test=44.2 and 106) and R-squared Ajusted (0.84 and 0.11).

Regarding the exclusion criterion, we argue that the political stability of neighboring countries is not directly linked to domestic taxes, except through the political stability of a specific identified country. In essence, each state independently adopts its domestic fiscal policies through its national assembly. Therefore, the low stability of country "j" cannot directly influence the parliament in country "i" to modify its fiscal policy. Instead, the impact on country "i" occurs when the political stability in country "i" is negatively affected by the level of stability in neighboring countries. In such a scenario, the government and parliament in country "i" may decide to raise taxes to finance the security sector in response to the instability caused by its

[6] To build the matrix, we use the same equation used to build the matrix of remittances received of neighboring countries in the section II.
[7] See Graph 2-2
[8] See Table 2.A2 in the appendix.

neighboring countries.

To conclude our robustness test, we include population growth as a control variable to mitigate omitted variable bias. Demographic factors such as population growth play a crucial role in determining state tax efforts (Bird et al., 2008). Additionally, states experiencing higher population growth often witness increased economic activity. This economic expansion enhances migrant remittances, leading to an increase in the flow of remittances sent back to the home country (El-Sakka et al, 1999). This underscores the interconnectedness between demographic trends and economic outcomes in the context of migrant remittances.

Our findings in table 2-4 confirm our baseline results. Figure 2-4 and 2-5 attest that the marginal effect of migrant remittances on domestic taxes revenues (direct and indirect taxes) is positive in stable states but not in unstable ones.

Table 2-4: Impact of migrant remittances on domestic taxes in countries affected by Political Stability

	First Stage Estimations: dependent variable = Migrant Remittances	
Remittances Spillovers	0.0047***	
	(0.0004)	
	2SLS	2SLS
Second Stage Estimations: dependent variable =	DIRECT TAXES	INDIRECT TAXES
Lag.Remittances to Gdp (Ln)	0.0036***	0.0017
	(0.0011)	(0.0017)
Lag.Political Stability	-0.0016	-0.0005
	(0.0011)	(0.0014)
Lag.Political Stability × Lag.Remittances to Gdp (Ln)	0.0013*	0.0026*
	(0.0008)	(0.0014)
Observations	701	7601
R2	0.86	0.84
Sargan Test	0,084	0,0513
Country Fixed	YES	YES
Year Fixed	YES	YES
Control Variable	YES	YES
Constant	YES	YES
Marginal Effect of Migrant Remittances		
Minimun of Political Stability	-0.0005	-.0009*
	(0.002)	(0.004)
Mean of Political Stability	0.0029***	0.0003
	(0.009)	(0.0013)
Maximun of Political Stability	0.004***	0.0063*
	(0.001)	(0.0031)

Notes: Constant and control variables included but not reported. See annex Table 1A to check the complete table. Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation .*** 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 ($p<0.1$).

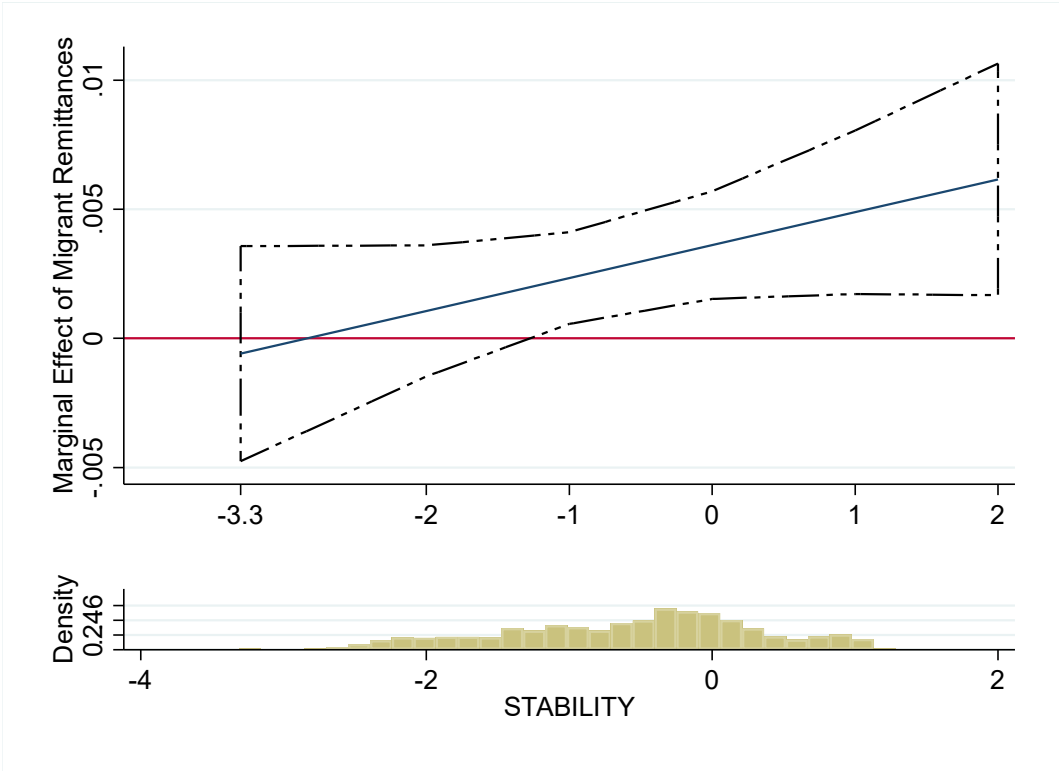


Figure 2-4: Marginal plot of Migrant Remittances on direct taxes as a function of state stability (measured in percentage points). Results are based on the estimates shown in column (1) of Table 2.4

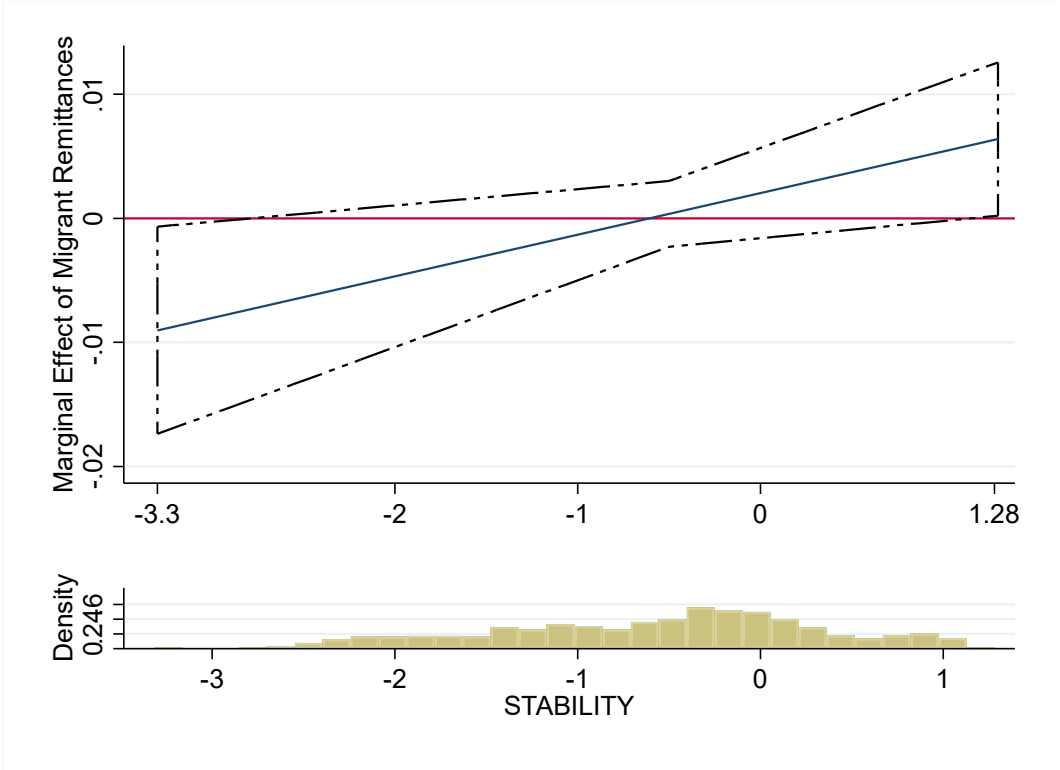


Figure 2-5: Marginal plot of Migrant Remittances on indirect taxes as a function of state stability

(measured in percentage points). Results are based on the estimates shown in column (2) of Table 2.4

2.5.2 Generalized Method of Moments

To further address the potential endogeneity bias in the relationship between domestic taxes, migrant remittances, and political stability, we now employ the Generalized Method of Moments (GMM) estimator developed by Blundell and Bond (1998) as an additional test.

The GMM estimator offers several advantages in our analysis. Firstly, it allows us to resolve endogeneity with internal instruments. Additionally, the GMM estimator solves the issue of heteroskedasticity (Baum et al., 2003*)*. By correcting for this issue, we can obtain more accurate and efficient parameter estimates.

In summary, the utilization of the GMM estimator in this section allows us to address endogeneity and heteroskedasticity in an alternative way, enhancing the robustness and reliability of our basic findings regarding the relationship between domestic taxes, migrant remittances, and political stability.

We present our equation as follows:

$$\ln DOMTAX_{it} = \alpha + \boldsymbol{\theta}_1 \ln DOMTAX_{it-1} + \beta_1 \ln REMIT_{it} + \beta_2 STA_{it} + \beta_3 (\ln REMIT_{it} \times STA_{it}) + \mu_i + \lambda_t + \varepsilon_{it} \quad (2.8)$$

Where $lnDOMTAX_{it-1}$ represents the dependent variables (Indirect taxes or Direct taxes) in logarithm at time "t" in country "i"; $REMIT_{it}$ represents the international remittances received in percent of GDP of country "i" at time "t-1". STA_{it-1} is the Political Stability /Absence of Violence in a country i at time t. The term η_i is the country-specific effect, λ_t is the individual year fixed effects; ε_{it} is the unobserved random error term.

The vector X represents the set of control variables and σ' is the associated vector of parameters. Overall, these outcomes, Table 2-5, and the marginal effect plots (Figure 2-6 and 2-7), support our main finding. They indicate that political stability enhances the positive effect of migrant remittances on both direct and indirect tax revenues. In essence, as political stability increases, the impact of migrant remittances on domestic taxes—both direct and indirect—becomes more significant.

Table 2-5: Impact of migrant remittances on domestic taxes in countries with political Stability with GMM estimator

	First Stage Estimations: dependent variable = Migrant Remittances	
Remittances Spillovers	0.0047***	
	(0.0004)	
	2SLS	2SLS
Second Stage Estimations: dependent variable =	DIRECT TAXES	INDIRECT TAXES
Lag.Direct Taxes	0.5974***	
	(0.0399)	
Lag.Indirect Taxes		0.5388***
		(0.1598)
Lag.Remittances to Gdp (Ln)	0.0066***	0.0031
	(0.0016)	(0.0041)
Lag.Political Stability	-0.0072***	0.0081
	(0.0014)	(0.0055)
Lag.Political Stability × Lag.Remittances to Gdp (Ln)	0.0034**	0.0139**
	(0.0015)	(0.0065)
Observations	727	727
AR2	0.1711	0.5866
Hansen Test	0.7923	0.8301
Constant	YES	YES
Control Variable	YES	YES
Marginal Effect of Migrant Remittances		
Minimun of Political Stability	-0.0018**	-0.0028
	(0.0008)	(0.0018)
Mean of Political Stability	0.0012**	0.0008
	(0.0005)	(0.0000)
Maximun of Political Stability	0.0031***	0.0032*
	(0.001)	(0. 0015)

Notes: Constant and control variables included but not reported. See annex Table 1A to check the complete table. Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation .*** 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 ($p<0.1$).

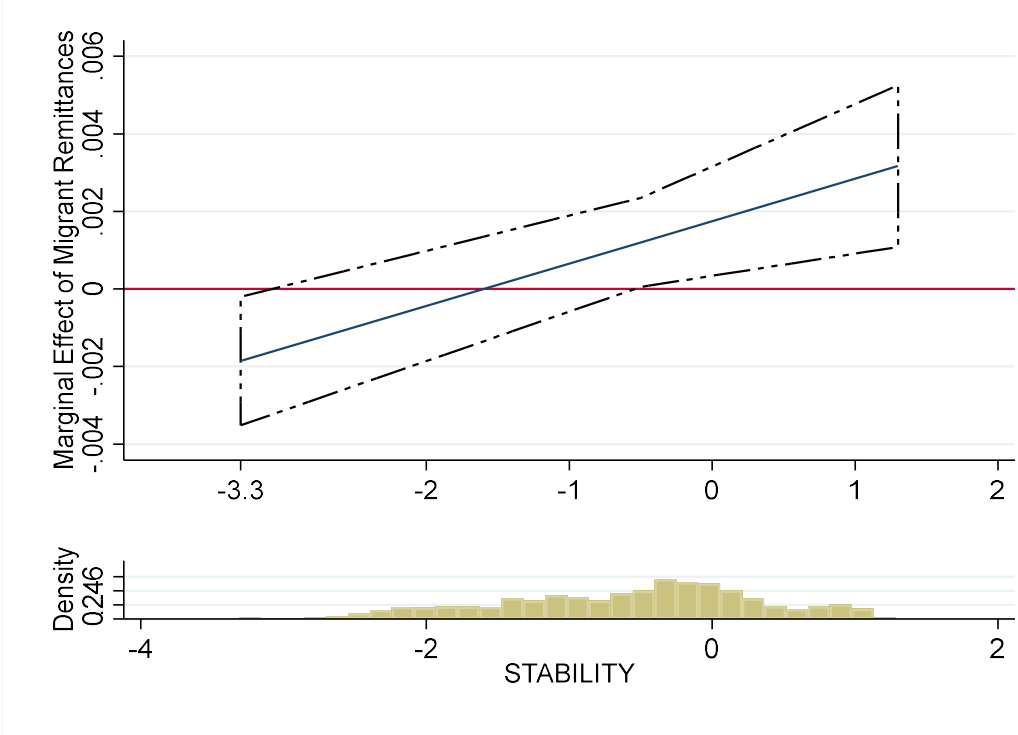


Figure 2-6: Marginal plot of Migrant Remittances on indirect taxes as a function of state stability (measured in percentage points). Results are based on the estimates shown in column (2) of Table 2.5

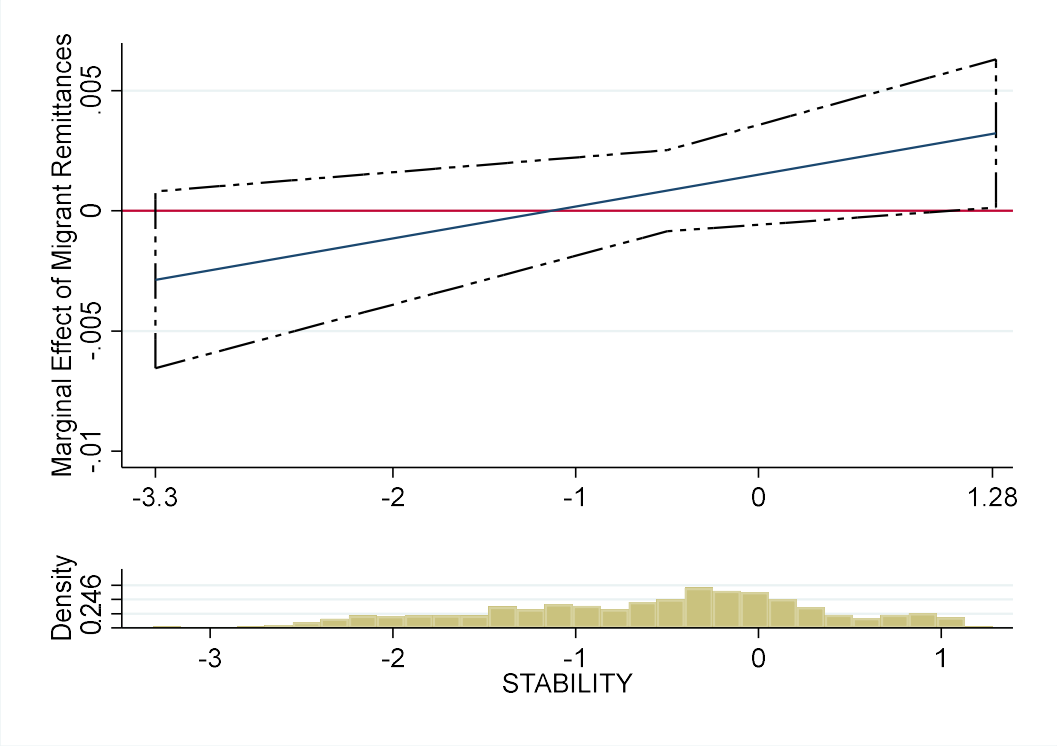


Figure 2-7: Marginal plot of Migrant Remittances on indirect taxes as a function of state stability (measured in percentage points). Results are based on the estimates shown in column (2) of Table 2.5

2.6. Conclusion

In this paper, we conducted an empirical study on the relationship between migrant remittances, political stability, and domestic taxes across 40 African countries from 2000 to 2019. Utilizing the two stage least squares estimator, we have confirmed that migrant remittances have a positive marginal impact on domestic taxes revenues (direct taxes and indirect taxes) in political stable countries but not politically unstable ones. These results are robust across our analyses.

Our study has brought to light the crucial roles played by remittances and political stability in shaping fiscal policies in African countries. It underscores the significance of institutions in influencing fiscal decision-making processes throughout the continent.

This study highlights the importance of considering both remittances and political stability in crafting effective fiscal policies that cater to the unique economic landscape of African nations. Therefore, African countries must encourage international migrant remittances. Moreover, by demonstrating that neighboring countries have a significant impact on the effect of migrant remittances received on domestic taxes in a country, we assert that states should promote regional

measures to better capture more domestic taxes from migrant remittances.

Nonetheless, this study only investigates the influence of formal migrant remittances on domestic tax revenues. Given the significant presence of the informal sector or shadow economy in Africa, it is imperative to expand our analysis to the effects of informal migrant remittances and their relationship with institutional factors such as political stability on tax revenues. Thus, in future research, we must consider these dynamics comprehensively and evaluate their consequences in the context of mobilizing tax revenues.

Annex:

Table 2.1.A: Impact of migrant remittances on domestic taxes in countries with political Stability with control variables and constant

	First Stage Estimations: dependent variable = Migrant Remittances	
Remittances Spillovers	0.0047***	
	(0.0004)	
Constant	0.5598***	
	(0.0043)	
Fisher Test	120.7***	
	2LS	2LS
Second Stage Estimations: dependent variable =	DIRECT TAXES	INDIRECT TAXES
Lag.Remittances (%GDP) (Ln)	0.0038***	0.0014
	(0.0011)	(0.0016)
Lag.Political Stability	-0.0015	-0.0006
	(0.0011)	(0.0014)
Lag.Political Stability × Lag.Remittances (%GDP) (Ln)	0.0013*	0.0025*
	(0.0008)	(0.0014)
GDP per capita	0.0000	-0.0000
	(0.0000)	(0.0000)
Corruption	0.0023	-0.0007
	(0.0018)	(0.0027)
Agriculture	-0.0001	-0.0000
	(0.0001)	(0.0001)
Exchange Rate	-0.0000	-0.0007***
	(0.0002)	(0.0003)
Inflation	-0.0000**	-0.0001***
	(0.0000)	(0.0000)
Trade	0.0001***	0.0001***
	(0.0000)	(0.0000)
Constant	0.0396***	0.1343***
	(0.0143)	(0.0209)
Observations	701	701
R2	0.84	0.86
Country Fixed	YES	YES
Year Fixed	YES	YES

Notes: Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation .*** 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 2.2.A: Impact of migrant remittances on domestic taxes in countries affected by Political Stability with control variables and constant

	First Stage Estimations: dependent variable = Migrant Remittances	
	2SLS	2SLS
Second Stage Estimations: dependent variable =	DIRECT TAXES	INDIRECT TAXES
Lag.Remittances to Gdp (Ln)	0.0036***	0.0017
	(0.0011)	(0.0017)
Lag.Political Stability	-0.0016	-0.0005
	(0.0011)	(0.0014)
Lag.Political Stability × Lag.Remittances to Gdp (Ln)	0.0013*	0.0026*
	(0.0008)	(0.0014)
Gdp per capita	0.0000	-0.0000*
	(0.0000)	(0.0000)
Corruption	0.0021	-0.0004
	(0.0018)	(0.0028)
Agriculture	-0.0001	0.0000
	(0.0001)	(0.0001)
Exchange Rate	-0.0015	0.0026
	(0.0021)	(0.0028)
Inflation	-0.0000**	-0.0001***
	(0.0000)	(0.0000)
Trade	0.0001***	0.0001***
	(0.0000)	(0.0000)
Population	0.0014	-0.0033
	(0.0021)	(0.0029)
Constant	0.0394***	0.1346***
	(0.0143)	(0.0209)
Observations	701	701
R2	0.86	0.84
Country Fixed	YES	YES
Year Fixed	YES	YES

Notes: Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation.*** 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 2.3.A: Impact of migrant remittances on domestic taxes in countries with political Stability with GMM estimator with control variables and constant

Variable	(1) Indirect Taxes	(2) Direct Taxes
Lag.Indirect Taxes	0.5388***	
	(0.1598)	
Lag.Direct Taxes		0.5974***
		(0.0399)
Remittances to Gdp (Ln)	0.0031	0.0066***
	(0.0041)	(0.0016)
Political Stability	0.0081	-0.0072***
	(0.0055)	(0.0014)
Political Stability × Remittances to Gdp (Ln)	0.0139**	0.0034**
	(0.0065)	(0.0015)
GDP	-0.0000	0.0000
	(0.0000)	(0.0000)
Agriculture	-0.0003	-0.0003***
	(0.0006)	(0.0001)
Trade	0.0001	0.0000
	(0.0001)	(0.0000)
Exchange Rate	-0.0032*	-0.0002
	(0.0017)	(0.0003)
Corruption	-0.0115	0.0018
	(0.0082)	(0.0024)
Constant	0.2791**	0.0289
	(0.1180)	(0.0183)
Observations	719	719
AR(2) p-value	0.5866	0.1711
Hansen p-value	0.8301	0.7923

Notes: Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation .*** 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 2.A1: Effect of migrant remittances of neighboring countries on Migrant Remittances

	Ln (Migrant Remittances)	Ln (Migrant Remittances)
Ln(Remittances Spillover)	6.2464***	0.2762***
	(0.2255)	(0.0127)
Constant	1.0837***	-0.1509***
	(0.0852)	(0.0556)
Observations	800	800
F-Test value	112***	411***
Adjusted R-squared	0.90	0.36
R-squared	0.89	0.37
Year Fixed	Yes	No
Country Fixed	Yes	No

*** indicates statistical significance at the 1% (p<0.01), ** indicates statistical significance at the 5% (p<0.05), * indicates statistical significance at the 10% (p<0.1).

Table 2.A2: Effect of Political Stability spillovers on Political Stability

	Political Stability (Ln)	Political Stability (Ln)
Political Stability Spillovers	-1***	.008***
	(0.0641)	(0.007)
Constant	-24.06***	-0.323***
	(0.8038)	(0.0584)
Nbs. Of observation	800	800
F-Test value	44.2***	106***
R-squared	0.84	0.11
R-squared Ajusted	0.84	0.11
Countries fixed effect	Yes	No
Year fixed effect	Yes	No

*** indicates statistical significance at the 1% (p<0.01), ** indicates statistical significance at the 5% (p<0.05), * indicates statistical significance at the 10% (p<0.1).

Table 2.A3: Moran's I Statistic test of Migrant remittances with a distance of 1000 Kms

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
Remittances	0.256	-0.001	0.007	37.444	0.000

Table 2.A4: Moran's I Statistic test of Political Stability with a distance of 1000 Kms

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
Stability	0.27	-0.001	0.006	43.79	0.000

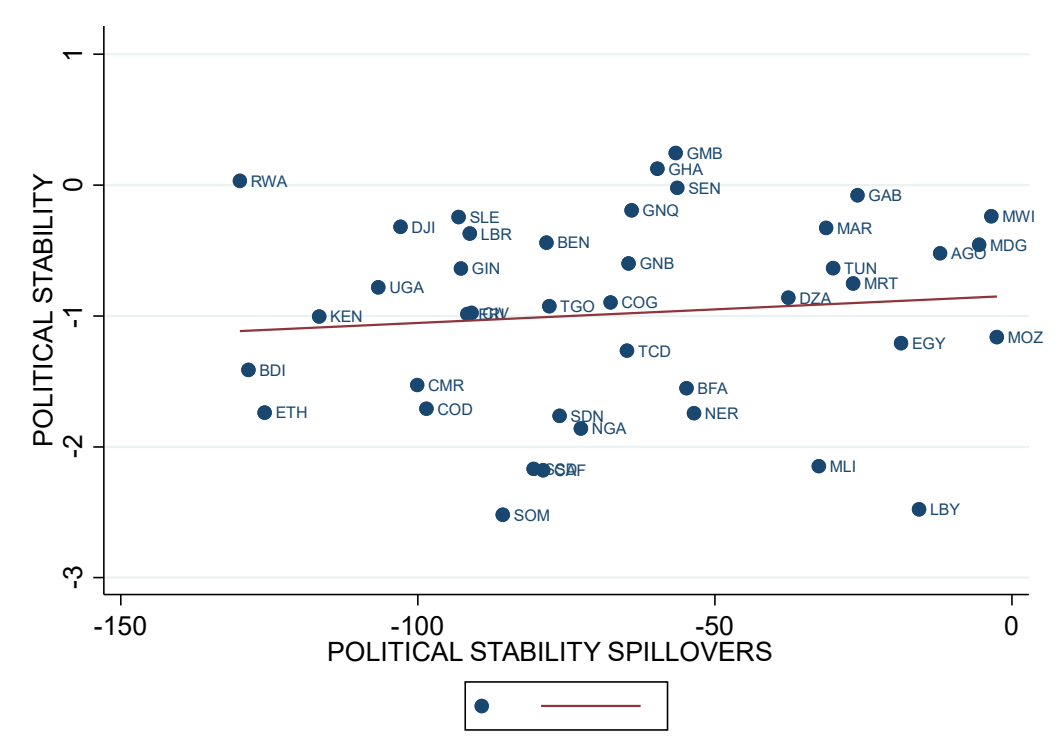


Figure 2-8: The graph plots the scatter plots of the political stability and political stability spillovers.

Table 2. B2: Variables and Sources

Migrant Remittances	World Development Indicator, World Bank
Indirect Taxes Revenues	International Centre for Tax and Development (ICTD) and UNU-WIDER
Direct Taxes Revenues	International Centre for Tax and Development (ICTD) and UNU-WIDER
Political Stability	World Development Indicator, World Bank
Trade Openness	World Development Indicator, World Bank
Gdp per Capita	World Development Indicator, World Bank
Exhange Rate	World Development Indicator, World Bank
Corruption	World Development Indicator, World Bank
Inflation Rate	World Development Indicator, World Bank
Population Growth	World Development Indicator, World Bank

Table 2.B3: List of 40 Countries in the sample

Angola, Botswana, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo Republic, Ivory Coast, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Egypt Republic, Eswatini, Gabon, Gambia, Guinea Republic, Kenyan, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Senegal, Sudan, Seychelles, Rwanda, Serra Leona, Somalia, Sao Tome and Principe, South Soudan, Togo, Tunisia, Uganda.

Chapter 3. Terrorism, Neighborhood effects in Africa Gold Exports Fraud[9]

[9] This chapter was written with Bertrand Laporte, CNRS IRD CERDI, Université de Clermont-Ferrand. Paper presented at the 17th Picard2 (Partnerships in Customs Academic Research and Development) Forum of the World Customs Organization, November 2022, Brussels.

3.1. Introduction

Several African countries grapple with the scourge of terrorism. As a result, terrorist activities exert a significant influence on both public administration and international trade (Abadie et al., 2003; Frey, 2004; Blomberg et al., 2004; Ndumbe et al., 2005; Elnahass et al., 2022; Shoup, 2011; Bueger, 2013; Estrada et al, 2015).

The United Nations has acknowledged the connection between trade and terrorism, as stated in United Nations Security Council Resolution 2195 (Gurulé, 2017)). The financing of activities by jihadist groups relies on their control of trade routes (Shelley, 2020). This control is facilitated by weak state governance at borders due to both the ineffective performance of customs administration and inadequate security (Meriman, 2000; Shelley, 2020; Reno, 1998; Elgin, 2014). For instance, due to insecurity, in the Lake Chad region, the jihadist group Boko Haram controls the trade route between Chad and Nigeria (Hoinathy, 2021). Across Africa, extremist groups have destabilized border administrations, leading to an increase in smuggling activities (Titeca et al., 2011).

To facilitate the evacuation of smuggled goods, terrorist groups resort to spreading violence across borders (Cantens, 2019; Golub, 2015). As a result, at borders, geographical space plays a crucial role as a determinant of conflict contagion, especially in the spread of terrorism. The study of the link between conflict and geography has a long history, dating back to the 19th century (Siverson & Starr, 1990). Pioneers in this field, such as Mahan (1918), Mackinder (1919), and Spykman (1944), Murdoch and Sandler (2002), established a theoretical framework that highlighted how the geography of belligerent states, including factors such as mountains, climate, and natural resources, conditioned international conflicts, including the First and Second World Wars.

Some scholars such as Starr (1978, 1987) renewed the analysis of the link between geography and conflict by introducing the concepts of "Opportunity" and "Willingness". He demonstrated theoretically overview a spatial diffusion of conflict. De Groot (2010) explored the effect of neighboring conflict on income per capita growth from 1960 to 2000 using ordinary least squares estimation. The findings reveal that conflict in neighboring countries has a positive spillover effect on non-contiguous states but a negative impact on contiguous states in Africa.

Additionally, studies by Carmignani et al. (2017, 2016), Buhaug et al, 2008, Gibler et al. (2013) and Gleditsch (2007) have confirmed that the diffusion and outbreak of civil wars are influenced by the spatial dimension, particularly the proximity of neighboring countries. Carmignani et al. (2016) analyzed whether the spillover of conflict in Sub-Saharan African countries is more significant compared to other regions in Africa over the period from 1960 to 2010, using a maximum likelihood estimator. The results first confirm a spillover effect of conflict in Africa and further indicate that in Sub-Saharan African countries, the presence of conflict in neighboring countries increases the likelihood of war onset by 1% compared to the broader African sample.

Regarding the link between geography and mineral resources in countries affected by war, several studies have provided evidence of the connection between minerals extracted from war zones and their geographical spread through border trafficking, particularly concerning diamonds and ores (e.g., Le Billon, 2014; Cantens and Raballand, 2021, 2017). These studies highlight that exports from war-torn countries are often smuggled into neighboring nations and then illicitly exported under the guise of legality. Countries such as Côte d'Ivoire, the Democratic Republic of Congo, Sierra Leone, and Uganda, which border conflict-affected states, have been implicated in the trade of these conflict diamonds and gold (Raeymaekers, 2010). Some of these countries have faced sanctions and have been excluded from the Kimberley Process, an international certification scheme aimed at preventing the trade of conflict diamonds.

Particularly, terrorist groups utilize geography both to expand their shadow activities and to combat legitimate governments. Indeed, by exploiting the porosity of borders, terrorist groups can find suitable locations to train, hide, and plan their attacks, as well as develop illicit activities (Cantens, 2016). For example, in the Sahel area, the borders between Burkina Faso and Togo have been frequently attacked, with the aim of both controlling trade routes and gaining access to the sea (Ian, 2020). Consequently, in 2018, an estimated 20 tons of gold were illicitly transported from Burkina Faso to Togo (Solozza, 2018).

At the local level, artisanal and small-scale gold mining plays a critical role in financing terrorism in resource-rich African countries (Aragona et al., 2015). In eastern Democratic Republic of Congo (DRC), for instance, 90% of artisanal gold is illegally exported, with only 1% passing through legal channels (Tchomba, 2024). These mining regions are often prime targets for terrorist

groups, given the lack of government oversight and the entrenchment of these groups within the informal economy. Unlike minerals such as copper or cobalt, which require advanced technology and infrastructure for extraction, gold can be mined using basic tools, making it easily accessible and readily integrated into illicit markets. This accessibility renders artisanal gold mining a lucrative source of income for terrorist groups, enabling them to fund their operations and expand illegal mineral trafficking. The simplicity of gold extraction and its subsequent smuggling into the shadow economy by these groups facilitates a continuous flow of financial resources, further compounding the challenges faced by customs enforcement.

Therefore, in this context, our study aims to analyze the impact of terrorism in neighboring countries on gold customs fraud in Africa. We hypothesize that the destabilization of neighboring borders by terrorist armed groups promotes an increase in domestic gold customs fraud in Africa.

Our research topic is crucial because the role of customs administration holds particular significance in fragile states, especially in the ongoing challenge of domestic tax mobilization to finance war efforts. In Africa, customs taxes play a vital role as a significant source of revenue for governments, more so than in any other region (Ghosh et al., 2004; Cantens et al., 2017). Customs administrations have a key mission in controlling and managing border trade activities and tax collection, which in turn contributes to the stability of the state, especially during times of conflict. However, the presence of smugglers and terrorist groups controlling trade routes and resorting to violence directly impacts customs operations, undermining the effectiveness of customs administrations (Cantens et al., 2017; Van Liempt et al., 2018; Nitsch, 2011; Van Dunem, 2009). Thus, investigating the link between gold customs fraud and terrorism spreading is important for enhancing resource collection to address warfare effectively.

To assess the impact of terrorism in neighboring countries on customs fraud, our analysis concentrates on gold minerals for several reasons. First, within the context of a conflict economy, the issue of gold smuggling extends beyond financing terrorist activities; it also poses a significant threat to the legitimate revenue sources of affected states (Gold, 2004; Grynberg et al., 2020; Jensen, 2004; Munshi, 2021). For instance, between 2017 and 2018, an astonishing $15.1 billion worth of smuggled gold from Africa was reported to have entered the United Arab Emirates (Lewis et al., 2019). The substantial volume of gold smuggled from African countries presents a considerable challenge for customs administrations in these states, as it not only funds terrorist

activities but also significantly diminishes legitimate revenue sources (Munshi, 2021).

Secondly, in conflict literature, the smuggling of gold minerals has been documented as a means to finance the war economy (Titeca et al., 2011). According to a UN panel on the DRC, the allure of controlling Congo's resources through violent means remains potent, as an ounce of refined gold is valued at more than $400, while a used Kalashnikov rifle can be purchased for less than $40. This vast disparity in value creates strong incentives for armed groups to seek control over valuable resources such as gold minerals. Therefore, focusing on gold customs fraud in our study contributes to the conflict literature.

Our analysis encompasses 50 African countries spanning from 2000 to 2019. In our study, the variable of interest is neighboring terrorism, measured by the spatial lag of the number of deaths during terrorism incidents. The dependent variable is measured by Customs fraud on gold. The variable is estimated through the analysis of gold mirror data for 50 African countries spanning the period from 2000 to 2019, using COMTRADE data. The mirror data analysis, initially introduced by Bhagwati, 1964 to estimate customs fraud in Turkey, has since been widely employed in numerous academic works and more recently by customs administrations in several African countries for customs risk management (Cantens, 2015; Geourjon et al., 2023).

Using both least square estimator and two-stage least squares estimator (TSLS), we evaluate the impact of terrorism in neighboring countries on domestic gold customs fraud in Africa. The findings reveal that an increase in deaths resulting from terrorism incidences from neighboring countries, significantly amplifies domestic gold customs fraud in Africa. Therefore, we empirically establish that a one percent rise in terrorism-related deaths in neighboring countries correlates with a 3.65 percent surge in domestic gold customs fraud (TSLS estimator). Our results support that terrorism activities from neighboring countries diminish the customs efficiency of nations, potentially undermining state revenues, particularly in terms of taxes collected at border customs checkpoints.

To further validate the robustness of our primary findings, we implement the two-stage system of generalized methods of moments (Blundell & Blond, 1998) in our empirical strategy and several sample dependence tests. This approach helps strengthen the reliability of our results and reinforces the positive link between neighboring terrorism and gold customs fraud in Africa.

The study makes several significant contributions. First, from an empirical standpoint, this paper holds significance as it is the first study to extensively examine the gold missing trade data of 50 African countries. Previous research on customs fraud (eg, Cantens, 2019; Cantens et al., 2017) has not delved into the specific context of extractive minerals, such as gold, which serves as a crucial source of tax revenue in many African nations.

Secondly, in terms of contributing to the literature, the performance of customs administrations, especially in terrorism situations, is underexplored. While some studies have addressed corruption and administration management, including works by Chalfin (2008), Raballand (2009), Cantens (2010, 2013), and Chalandard et al. (2020), few have delved into the specific challenges faced by customs in conflict zones. Among the pioneers in this area are Cantens and Raballand (2017; 2021), whose research focuses on the governance of trade in border regions during and after conflicts. They delve into the practices and strategies adopted by customs officers operating in insecure border areas, shedding light on the challenges faced by customs administrations in such contexts. Therefore, our study represents a pioneering empirical investigation into the relation:nship between customs fraud and neighborhood terrorism in Africa.

Moreover, our paper adds to the ongoing debate on the role of war in state-building. Scholars like Tilly (1985) argue that war can serve as a catalyst for state-building, as it prompts the implementation of necessary reforms to enhance tax collection and finance wartime efforts. However, contrasting views presented by authors such as Reno (1998), Thies et al. (2004), and Taylor et al. (2008) suggest that war can instead destabilize already fragile states. By focusing on the relationship between terrorism and customs administration performance in tackling fraud, our research challenges the validity of Tilly's theory in the context of customs operations in conflict zones.

Lastly, our research has valuable implications for public policy literature, as we offer discussions on the management of customs administration and state security in conflict-affected countries. We argue that border economies represent a critical issue in ensuring domestic state security. Therefore, enhancing surveillance at borders by customs administration will not only improve tax administration but also help in addressing terrorism financing.

The remainder of the paper is structured as follows. Section 3.2 presents our measure of gold customs fraud, terrorism and neighborhood effect, and the empirical approach. Section 3.3 discusses the results, and Section 3.4 presents a robustness check. Concluding remarks and policy discussions are given in Section 3.5.

3.2. Methodology and variables

To estimate the effect of terrorism on gold customs fraud from 2000 to 2019, we use a panel of 50 African countries. We include this panel countries for two main reasons. First, it allows us to measure the regional effect of terrorism activities, capturing the spread of these activities across both gold-rich and gold-poor countries. Second, it helps to avoid sampling bias. Focusing on only a single country or a small group of countries would not provide a comprehensive understanding necessary for policy recommendations regarding the impact of terrorism contagion on gold customs fraud.

We employ a spatially lagged explanatory variables model:

$$\ln CUTOMSFRAUD_{it} = \alpha + \beta 2\ \ln TER.NEIGH_{jt} + \beta 3\ DEATHS_{it} + \theta\ Z_{it} + \mu_i + \lambda_t + \varepsilon_{lt} \quad (3\text{-}1)$$

$\ln CUTOMSFRAUD_{it}$ is the logarithm measure of the missing gold export (as defined in eq.3.2) by year (t) for country (i). $\ln TER.NEIGH_{it}$ is the logarithm of the neighboring terrorism (spatial lag) for country "j " at time "t". $DEATHS_{it}$ is the number of deaths from terrorist attacks by year (t) for country (i). β_2 captures spatial neighborhood effects on gold customs fraud. Z_{it} is the matrix of control variables. μ_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.

Discrepancies in trade data may be due to factors other than fraud, such as valuation differences (CIF-FOB), exchange rate conversion problems, unintentional misclassification, and others (Geourjon et al., 2023). However, like Chalendard (2017), we reasonably assume that export misreporting is unrelated to the error term.

- **Gold customs fraud**

Illicit trade is traceable by the trade statistics (Bhagwati, 1964; Buehn et al., 2012, Aziz et al.,2014). Our measure of gold custom fraud is based on mirror data analysis. Since Bhagwati (1964) for Turkey, many authors have used mirror analysis to detect customs fraud that may be a consequence of smugglers' actions: Carrere & Grigoriou (2015) for global trade, Raballand et al. (2013) for Cameroon, Cariolle et al. (2019*)* for Gabon, for the most recent ones.

Mirror data analysis has even received renewed attention since some developing country administrations use it in their customs risk analysis and management (Geourjon et al., 2023; Carleton et al., 2016). "Mirror data analysis (or mirror data) refers to the comparison between the import (or export) data of a country X and the data for imports to (or exports from) country X by one or more countries" (Cantens, 2015).

Missing exports value is thus captured by the difference between partner imports value (mirror exports value) and exports value as reported by the country. Because imports are measured CIF and exports FOB, we correct mirror exports by 15% to have an indicator based on FOB-FOB comparison, as is common in the literature (Chalendard, 2017; Chalendard et al., 2020). Building on Chalandard and al. (2019) or Ndikumana and Boyce (2018), the missing gold exports value is the following:

$$DX_t^{\mathrm{i}} = \sum_{\mathrm{j}=1,\mathrm{i}=1}^{\mathrm{Ji}} \left(M_{ji,\,\mathrm{t}} - \beta X_{ij,\mathrm{t}}\right) \tag{3-2}$$

DX_t^{i} represents the missing gold exports value in a given year t by a country i, while j represents the rest of the world. We can note two cases of declaration differences, namely the overestimation or underestimation of gold declarations between the exporting country i and the importing country j.

If country i declares gold exports lower than those declared by country j, it is a situation of underestimation of the exported gold declaration. Conversely, when the exporting country i declares a higher value than that declared by the importing country j, it is a situation of overestimation of the gold declaration (Geourjon et al., 2023).

A positive DXti is generally more directly associated with customs fraud, as it indicates that the exporting country is under-declaring its exports, a common practice to avoid customs controls (Cantens, 2015). However, a negative sign can also be related to fraud, but it is often caused by administrative disparities and declarative errors.

β is the CIF-FOB correction factor. CIF (Cost, Insurance, and Freight) and FOB (Free on Board) are international shipping agreements used in the transportation of goods between a buyer and a seller. CIF includes the cost of goods, insurance, and freight, while FOB only includes the cost of goods and transportation to the port of shipment. The correction factor β adjusts for these differences to ensure accurate comparisons.

The missing data extracted from the COMTRADE database, and we use disaggregated Harmonized System 6 (HS) gold commodities.

Mirror discrepancies reflect a number of situations in international trade (UNECA, 2013). They can be a sign of mis-valuation of exported production, particularly by multinational companies exporting the ore, or a sign of smuggling, i.e. exports not registered at customs, which are more the result of the practices of small-scale miners. These two phenomena are intertwined in the measurement of the mirror gap. In the case of mis-valuation (fraud on value), there is a customs clearance on export in the producing country and a customs clearance on import in the recipient (partner) country, but the value differs, resulting in a mirror difference that can be positive or negative depending on the company's aggressive tax optimization strategy (World Customs Organization, 2018). In the case of smuggling, there is no export clearance in the producing country. The customs clearance on imports into the destination country may reflect two main situations. The import declaration may be made even though there has been no export clearance in the producing country, because there is no systematic exchange of data between the customs clearance systems of the different countries in the world. In this case, there is a mirror discrepancy reflecting the fraud. There may also have been a customs clearance on export from a neighboring country if the ore was fraudulently transited to that country and then officially exported from that neighboring country. If there is no mis-valuation, then this fraud does not create a mirror discrepancy. However, this fraud is detectable if the neighboring exporting country does not produce the ore or if its production level is insufficient. But international trade data alone is not enough to detect this fraud.

The analysis of mirror discrepancies should therefore be considered as an indicator of fraud and not as a precise measure of fraud, especially as other factors linked to the methods of collecting and processing information may be at the origin of discrepancies that are not attributable to fraud (Geourjon et al., 2023).

- **Terrorism and its neighborhood effect**

We use terrorism neighboring as an interest variable for several compelling reasons. First and foremost, from an econometric perspective, incorporating this variable helps mitigate the bias stemming from unobserved factors, particularly those related to spatial considerations. As astutely pointed out by Tolber (2004), "Everything interacts with everything, but two nearby objects are more likely to do so than two distant objects." This fundamental concept highlights the significance of geographic proximity between countries and the permeability of borders when it comes to elucidating the profound impact of terrorism on customs fraud.

Furthermore, delving into the economic dimension, as described in the introduction section, both terrorist groups and smugglers exploit porosity at borders to facilitate illicit activities. This leads to the establishment of networks by terrorist groups that operate across borders. Through the sharing of terrorist activities between countries, extremist groups generate a ripple effect that extends to neighboring regions.

Thus, we attest a spatial correlation of civil deaths during terrorism incidence with a global Moran's I test. The Global Moran's I test is 0.045 and statistically significant at the 1% level. We reject the null hypothesis of zero spatial autocorrelation in the variable terror incident (see Annex 1, Table 3.B1).

Terrorism in neighboring countries is quantified by generating a spatially lagged variable, which accounts for the number of deaths caused by terrorist incidents in each country. We assess terrorist activity by counting civilian fatalities during terrorist acts, using data from the Global Terrorism Database (GTD). This measure is commonly employed to analyze the macroeconomic impact of terrorism, as it provides a consistent metric of the severity of attacks. The dataset, produced by

the Institute for Economics and Peace (IEP), uses the number of fatalities from terrorist events as a standard indicator of terrorism activity (Frey et al., 2003). For each country in the sample, we track the number of deaths from terrorist incidents on an annual basis.

The spatial lag of terrorism incidents is calculated using an average of neighboring values. Our spatial contagion variable thus relies on the interaction between the variable measuring the number of deaths from terrorist attacks and the spatial weight matrix (see Anselin, 1988). It is defined as follows:

$$TER.NEIGH_{jt} = Ↄ \times Deaths_{it}, \quad (3\text{-}3)$$

With $TER.NEIGH_{jt}$= neighboring terrorism, Ↄ= spatial weight matrix, and Deaths= number of deaths from terrorist attacks in country i.

The weight matrix is a binary N×N matrix representing neighboring countries, defined as countries whose capital city is less than 1000 km away from the capital city of country i. We set the threshold at 1000 km because it is the minimum distance for which the spatial correlation becomes significant with the global Moran's I[10] test (see Annex 1, Table B1).
The weight matrix is a function of the following equation:

$$Ↄij = \begin{cases} 1 & if\ d_{ij} < 1000 \\ 0, & otherwise \end{cases} \qquad \text{With } d_{ij} = \frac{d_{ij}}{\sum_{ij}^{N} d_{ij}} \quad (3\text{-}4)$$

$Ↄij$ quantifies the spatial connection between the capital cities of i and j, and d is the distance threshold between the capitals of countries "i" and "j". The neighborhood includes all countries

[10] The Global Moran's I test is a spatial autocorrelation test based on both locations and feature values. The goal of the test is to assess the degree of spatial correlation between on adjacent location. The statistic material calculates both Moran's I value, z-score and p-value to present the significance of the index. If P-value is statistically significant, and z-score is positive, we may reject the null hypothesis: spatial distribution is not a random process. Otherwise, we cannot reject the hypothesis if P-value is statistically insignificant and z-score is negative: the spatial distribution is a random process.

that fall within a 1000 km radius of country i. Then, with $d_{ij} < 1000$ is the indicator function that takes the value 1 if a bilateral distance between the capitals of country *i* and *j* is less than the threshold distance (1000kms) and 0 otherwise. Consequently, the weight is higher for countries that are closer to the domestic country, reflecting that geographical proximity facilitates illicit trade such as smuggling activities of terrorist groups. Observations that are closer show a higher spatial connection than distant observations. The matrix is Row standardized.

Regarding the minimum distance of 1,000 kilometers used to construct the neighborhood effect, this assumption is well supported by the fact that the distance between Madagascar or the Comoros and the African coast is significantly less than 400 kilometers, particularly when considering countries like Mozambique. This close proximity makes these regions strategically important for activities like smuggling, given the ease of maritime transport and the potential for cross-border illicit trade.

In our empirical approach, we will initially employ the fixed effects estimator (FE) to analyze the data. To determine whether to use fixed or random effects, we will conduct the Hausman test, which will help us choose the appropriate estimator.

Additionally, we employ a two-stage least squares estimator (TSLS) to mitigate potential issues of reverse causality between discrepancies in the gold trade and the proliferation of terrorism. As previously discussed, terrorism-related violence contributes to porous borders and weak customs management (Cantens, 2019). The violence and criminal activities imposed by jihadist groups at borders can escalate smuggling and degrade customs performance (Cantens et al., 2017). For instance, Cantens (2019) highlighted that smugglers collaborate with terrorist groups to destabilize borders in the Sahel region.

Conversely, customs performance can also influence terrorist activities. Inadequate customs administration and weak border control can foster informal trade, facilitated by corrupt officials at the border. Poor customs performance may increase the circulation of illicit goods, providing financial support for terrorist groups and allowing them to strengthen their activities.

Therefore, by using the TSLS estimator, we aim to consider these complex interactions and better understand the relationship between missing gold trade and terrorism spillover in the context of

weak customs administration and border control.

To deal with the issue of endogeneity, we instrument both neighboring terrorism and local terrorism. This approach is crucial because it enables us to incorporate the local nuances of terrorism, including specific political, social, or economic dynamics unique to specific country. These factors could exert a significant influence on customs performance independently of attacks from neighboring countries. We employ the lagged annual mean temperature of neighboring countries to instrument the neighboring terrorism and the lagged of the perception of voice and accountability to instrument the domestic terrorism.

Firstly, we use the lagged annual mean temperature of neighboring countries as an instrumental variable. This choice of instrument is justified by its relevance in the context of African social conflict and anti-governance violence, as highlighted in the literature (Hendrix et al., 2012). Previous studies, such as Burke et al. (2009), have demonstrated that warming increases the risk of war in Africa. Moreover, a substantial body of research has argued that climate disturbance contributes to social violence and conflict in the region (Brown et al., 2007; Goldthau, 2020; Raleigh et al., 2012; Hsiang et al., 2014; Alagidede, et al., 2016; Hendrix et al., 2012; Regan et al.,2022; Price et al.,2016). The instrument's transmission channel is based on the idea that a rise in neighboring countries' temperatures increases terrorism incidences in country “i”, leading to gold fraud activities in that country.

The relationship between domestic terrorism and voice and accountability has been the subject of various academic investigations. Kaufmann et al. (2010) have established that the presence of mechanisms for voice and accountability, specifically through the replacement of political leaders, is negatively associated with the onset of conflicts. Their findings suggest that the ability to hold leaders accountable and replace them in a democratic process reduces the likelihood of conflict escalation.

Similarly, Asongu et al. (2017), utilizing the Generalized Method of Moments (GMM) in a study of 53 African countries between 1998 and 2012, demonstrated that improvements in voice and accountability significantly decrease domestic terrorism in Africa. The underlying premise of this instrument is that enhanced voice and accountability reduce the marginalization of populations, thereby addressing root causes of terrorism. Indeed, when citizens have a channel to express grievances and hold leadership accountable, the incentives for engaging in terrorism diminish.

Using lagged variables in instrumental variable strategies helps reduce biases arising from reverse causality problems (Anderson & Hsiao, 1981). By implementing this approach, we aim to mitigate any spurious relationships between a neighboring temperature and gold missing trade, ensuring more reliable estimates of the impact of gold trade on terrorism in Africa, while considering the potential influence of climate-related factors on social conflict and violence.

We first explore the relationship between neighboring terrorism and the lagged annual mean temperature of neighboring countries using a scatter plot (see Figure 3-1). The scatter plot reveals a positive correlation, with the neighboring mean annual temperature plotted on the x-axis and neighboring terrorism levels on the y-axis. Additionally, the scatter plot in Figure 3-4 illustrates a negative correlation between the perception of voice and accountability and domestic terrorism, where higher levels of voice and accountability are associated with lower levels of domestic terrorism.

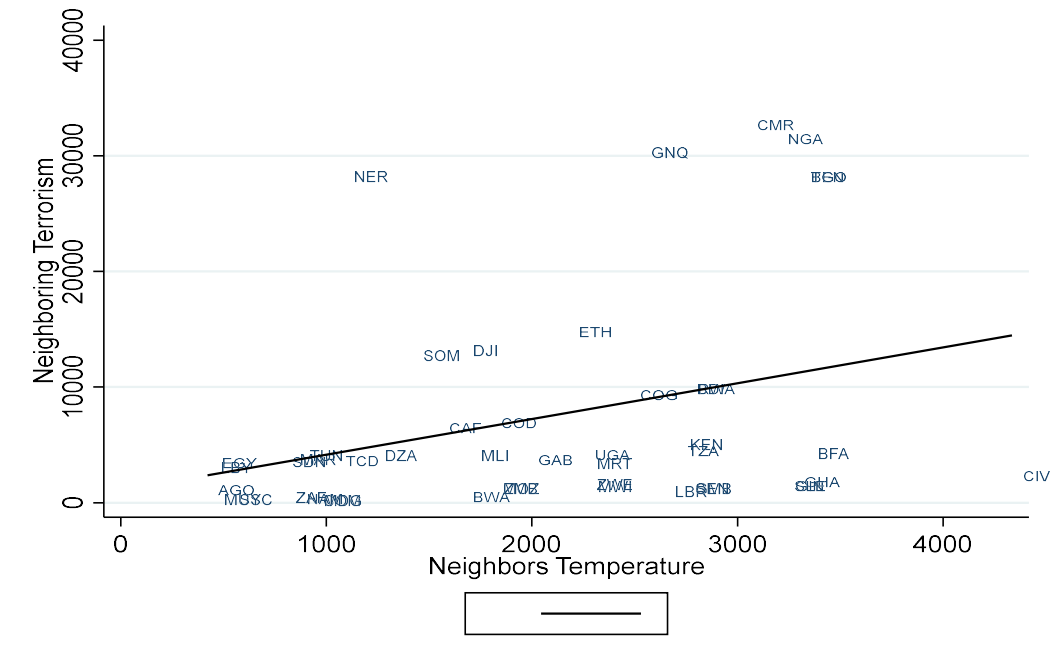


Figure 3-1: Plot of Neighboring Terrorism and Neighboring Temperature (Lagged)

Source: Author's calculations.

Second, we run present the least squares estimation as follows:

$$\text{TER. NEIGH}_{jt} = \beta.\text{TEMPERATURE. NEIGH}_{jt}\ \check{G}_1 + \theta Z_{lt} + \mu_l + \lambda_t + \varepsilon_{lt} \quad (3\text{-}5)$$

$$DEATHS_{lt} = \beta.VOICE_{lt}\ \check{G}_1 + \theta Z_{lt} + \mu_l + \lambda_t + \varepsilon_{lt} \quad (3\text{-}6)$$

In equation (3-5) and (3-6), TER. NEIGH_{jt} is the spatial lag of terrorism incidences by year (t) for country (j). DEATHS is the number of deaths from terrorist attacks by year (t) for country (i). $\text{TEMPERATURE. NEIGH}_{jt}\ \check{G}_1$[11] is the lag in one period of the annual mean temperature of neighboring countries. $VOICE_{lt}\ \check{G}_1$ measures the lag in one period of the perception of voice and accountability of citizens by year "t" in country "i". Z_{lt} is the set of control variables. Also, we add years and countries fixed effect respectively by λ_t and μ_l ; ε_{lt} is the error term.

Results in Annex 1, specifically Table 3.B2 and Table 3.B3, support the validity of the instruments. They illustrate a significant and positive relationship between neighboring terrorism and the lagged annual mean temperature of neighboring countries and a negative link between domestic terrorism and the perception of voice and accountability. Additionally, the F-statistics outcomes range in 8825 (Table 3.B2) and 10 (Table 3.B3), suggesting the instrument's strength.

About the exclusion criteria for our two instruments are well-founded, ensuring that the instrument (lagged neighborhood temperature and the perception of voice and accountability) exclusively relates to gold trade irregularities through terrorism incidents in neighboring countries and local terrorism incidences. Firstly, concerning the neighborhood temperature, while there is concern about potential spillover effects from country "j" temperature affecting the economic sectors in country "i", this concern is not substantiated in the African context due to both limited economic interdependencies and low intra-African trade. As highlighted by Olney (2022), economic activities within Africa, including trade or manufacturing connections, represent only 12 percent of the total, in sharp contrast to the European continent, where this figure is approximately 47 percent. This significant contrast underscores the fact that neighboring African countries often have fewer economic connections. Thus, the relatively weak neighboring effects resulting from

[11] $\text{TEMPERATURE. NEIGH}_{jt}\ \check{G}_1 = C\mathcal{O} \times \text{TEMPERATURE}_{jt}\ \check{G}_1$, with $\text{TEMPERATURE}_{jt}\ \check{G}_1$ is the annual temperature in lagged one period, $C\mathcal{O}ij$ is the weight matrix. We use the same methodology used to build the neighborhood terrorism effect variable. Also, we keep 1000 Kms as the threshold distance. The calculation of the annual mean temperature is based on the sum of daily or monthly temperatures, aggregated by country and by year.

the temperature of country "i" on the diverse economic sectors of country "j" can be attributed to the relatively low volume of economic connections between African nations. To address potential omitted variable bias, we include the trade variable (sum of exports and imports) in our control variables. Additionally, it's important to note that trade policies and fiscal policy reforms, including customs management, are independently determined by each national authority. This independence results in distinct trade and tax policies in country "i" compared to those in country "j".

Secondly, regarding the perception of voice and accountability, there does not appear to be a direct link with domestic gold customs fraud, except through the intermediary role of terrorism. Indeed, terrorism often thrives in environments where voice and accountability are weak, as marginalized groups may resort to illicit activities, including gold smuggling, to fund their operations or as a response to perceived injustices. In this sense, domestic terrorism can serve as a conduit that connects weak governance, particularly in terms of accountability and transparency, to customs fraud in the gold sector.

To conclude, employing the lagged neighboring temperature and lagged of perception of the voice and accountability enhances the robustness of our analysis, addressing endogeneity bias by accounting for potential time lags (t-1) in the impact of neighboring temperature on customs fraud. This approach ensures a more comprehensive understanding of the temporal dynamics involved, contributing to the accuracy and reliability of our findings.
Despite this theoretical support of our instrument, we cannot exclude with certainty all violations of the exclusion criteria.

In the final step of our empirical methodology, we include control variables in the model to mitigate omitted variable bias.

- **Institutions and tariff**

Mishra et al (2008) propose simple models of interactions between importing firms and customs officials to explain customs evasion and their interaction with the institutional framework. These models assume an increasing marginal cost of evasion with the fraction of goods evaded and the quality of enforcement. The tariff is presented as the primary driver of fraud, but the intensity of

fraud would depend on the institutional context. Our problem is different from articles in the literature that have focused on import fraud to avoid/reduce the payment of duties and taxes at customs, including Bhagwati (1964) for Turkey, Fisman & Wei (2004) for China-Hong Kong bilateral trade, Kumar et al. (2008) for India, Worku et al. (2016) for Africa, Levin and Widell (2014) for Kenya and Tanzania, Rijkers et al. (2015) for Tunisia. Indeed, multilateral rules of international trade usually ban tariffs on exports. Also, we do not use tariffs as a control variable.

Considering the quality of institutions to explain customs fraud is not straightforward because of the high degree of colinearity between institutional variables, making it challenging to identify the influence of each of them. Three institutional dimensions seem particularly relevant to address customs fraud: rule of law, government effectiveness, and control of corruption. We use the WDI indicators (Kaufman et al., 2008). "Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence." The rule of law determines whether potential sanctions pose a credible threat if illegal practices are discovered. "Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." Control of Corruption "captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the State by elites and private interests".

The effectiveness of government and the control of corruption determine the level of ethics of public servants, especially customs officers, in their control activities. The country's score on these three aggregate indicators is in units of standard normal distribution, i.e., ranging from -2.5 to 2.5. Nevertheless, a large body of literature shows strong links between institutional quality and per capita income due to a two-way causality. For example, Islam et al. (2019) attested a negative relationship between GDP per capita and corruption among officials and between GDP per capita and illicit trade. De Wulf et al. (2005) show that GDP per capita positively affects the efficiency of the customs administration. We will, therefore, use GDP per capita, noted “GDP per Capita”, from World Bank dataset, as an overall indicator of the different institutional dimensions and then introduce each dimension separately.

The link between institution and conflict has been exhaustive in the literature. Most scholars have

attested that conflict decrease the quality of institution in developing context (Nordhaus et al, 2002; Collier and Hoeffler, 2004).

- **Trade facilitation**

Since the 1980s, most countries have adopted trade liberalization policies to facilitate trade worldwide. This process has been conducted under the aegis of the WTO through the Trade Facilitation Agreement. The customs of developing countries, at the heart of this process, have implemented modernization programs with the help of the WCO (revised Kyoto Convention) and the Bretton Woods institutions. They aim to establish transparent and simple rules and procedures, foster good citizenship among customs users, and develop effective control and audit mechanisms (Keen et al., 2003). These reforms aim to improve the relationship between economic operators and customs officers and thus reduce customs fraud. These trade liberalization and customs reforms usually reduce customs fraud, depending on the reforms implemented in each country. No global indicator measures a country's degree of commitment to the trade liberalization process. The OECD publishes a Trade Facilitation Indicator (TFI) based on 16 sub-indicators and 97 variables. It aims to measure the level of implementation of the WTO Trade Facilitation Agreement. It measures a country's deviation from "best practices". It remains imperfect, given the importance of missing data (Geourjon et al., 2012), and it only covers the aspects of facilitation retained in the WTO agreement (Ireland, 2010). We, therefore, choose to introduce a broader indicator: the rate of openness, measured as the sum of exports and imports of goods and services as a share of gross domestic product (GDP) (World Development Indicators, World Bank). Trade openness is closely linked to trade liberalization (Cagé et al., 2018; Mattoo, 2009) and may reduce the incentives for customs fraud. Michael (2012) attested that trade facilitation helps reduce corruption in customs agencies.

About the relationship between trade and terrorism activities, Shelley (2020) theoretically established a link between illicit trade, smuggling, and terrorism. Similarly, Nitsch et al. (2003) used a gravity model to demonstrate that terrorism incidents reduced the volume of bilateral trade flows from 1960 to 1993. Globally, in countries affected by war, trade significantly impacts the economy through goods markets, growth, and household consumption.
The trade database is extracted from World Bank dataset. We noted “Trade”.

- **Natural resource**

The literature on resource curse has received considerable theoretical and empirical attention over the years. This resource curse, which associates natural resources with a loss of collective well-being, can be explained by two effects, one economic, the Dutch disease (Sachs et al., 1995), and the other more institutional, the deterioration of the quality of institutions and social cohesion (Ross, 2001, 2015). In addition, the mining scale, whether artisanal or industrial, also influences the mechanisms at play in the curse of natural resources. Studies show that mining benefits populations living near artisanal mines more than those near industrial mines. Artisanal, labor-intensive mining provides additional income in poor agricultural areas of developing countries. Thus, some mining is carried out informally. While the link between customs fraud and mining rents has not been demonstrated due to a lack of studies, the link between rents and the development of the informal sector has been documented, both by numerous press articles and by several recent academic articles, notably Blanton et al. (2021), Kpognon (2022) and Mantz et al. (2018). Since part of the activity is informal, we can hypothesize that part of the mining production is disposed of and exported fraudulently.

During war, the abundance of natural resources often fuels conflicts between the government and rebel groups. Gold, in particular, is frequently extracted by terrorist groups to finance their activities (Berman et al., 2017). Bhattacharyya and Mamo (2021) also demonstrated a positive link between intra-state wars and local-level mineral discoveries.
Therefore, we introduce the total rent as a control variable (noted “Rent”), measured as the difference between the value of production for a stock of minerals at world prices and their total production costs (from WDI, World Bank dataset).

3.3. Data Overview and Estimation results

3.3.1 Data Overview

Firstly, Table 3.1 provides descriptive statistics for the variables included in the analysis. The table indicates that there are 966 and 964 observations for gold export missing and neighboring terrorism, respectively.

Regarding gold customs fraud, the average (mean) value is -$114 million, with a minimum value of -$24.3 billion and a maximum value of $11.1 billion. This range highlights a significant variability in the data, reflecting substantial fluctuations in gold customs fraud within the sample. The data on deaths during terrorist incidents ranges from 0 to 7781, where 0 indicates no deaths and 7781 represents the highest number of deaths recorded in a terrorist attack between 2000 and 2019. On average, the number of deaths in larger countries in the sample is 85.1. In the dataset, we include small island nations and countries like Madagascar, as they represent regions particularly affected by smuggling activities. These countries are included because of their strategic geographic locations and the prevalence of illicit trade routes. For example, gold smuggling routes between Madagascar and the Comoros in 2022 highlight the significance of these regions in illicit trade activities. These smuggling leaks underscore the vulnerability of small island nations to illegal trafficking due to their strategic locations and often limited enforcement capabilities.

Table 3-0-1: Summary Statistics

	Obs	Mean	Min	Max
Gold Customs Fraud(=Gold export missing)	966	-114 Millon	-24.3 billion	11.1 billion
Terrorism Neighboring	964	6891.393	186.36	32663.71
Death	964	85.122	0	7781
Rents	943	1.194	0	24.834
GDP per Capita	964	2449.041	258.629	16989.96
Trade	879	70.842	1.219	347.997
Neighboring Temperature	944	895000	0	2800000

Source: Author's calculations.

Secondly, Table 3-2 present the matrix of correlations. We present a primary relationship between terrorism neighboring and gold customs fraud. We attest to a positive correlation (0.17) between terrorism neighboring and gold customs fraud. The correlation supports our intuition: terrorism is an enhancer for gold customs fraud. Also, table 3-2 shows a positive correlation of gold customs fraud with both Rents (0.2017) and domestic deaths from terrorism activities (0.1802).

Table 3-0-2: Matrix of Correlations

Variable	Gold Customs Fraud	Terrorism Neighboring	Death	Gdp per Capita	Rent	Tarrif	Trade
Gold Customs Fraud	1.0000						
Terrorism.Neighboring	0.1726*	1.0000					
	(0.0004)						
Death	0.1802*	0.4440*	1.0000				
	(0.0002)	(0.0000)					
Gdp per Capita	0.0050	-0.0067	-0.0272	1.0000			
	(0.9191)	(0.8348)	(0.3984)				
Rents	0.2017*	-0.0568	-0.0342	-0.1483*	1.0000		
	(0.0000)	(0.0812)	(0.2945)	(0.0000)			
TARRIF	-0.2164*	0.0335	0.0815*	-0.5150*	0.0543	1.0000	
	(0.0001)	(0.3394)	(0.0199)	(0.0000)	(0.1213)		
TRADE	-0.0354	-0.1040*	0.0973*	0.5121*	0.0396	0.1208*	1.0000
	(0.4970)	(0.0020)	(0.0039)	(0.0000)	(0.2408)	(0.0007)	

Source: Author's calculations.

Thirdly, Figure 3.2 presents the evolution of the global gold price and customs fraud related to gold in Africa. We observe a rising trend in both indicators over time.

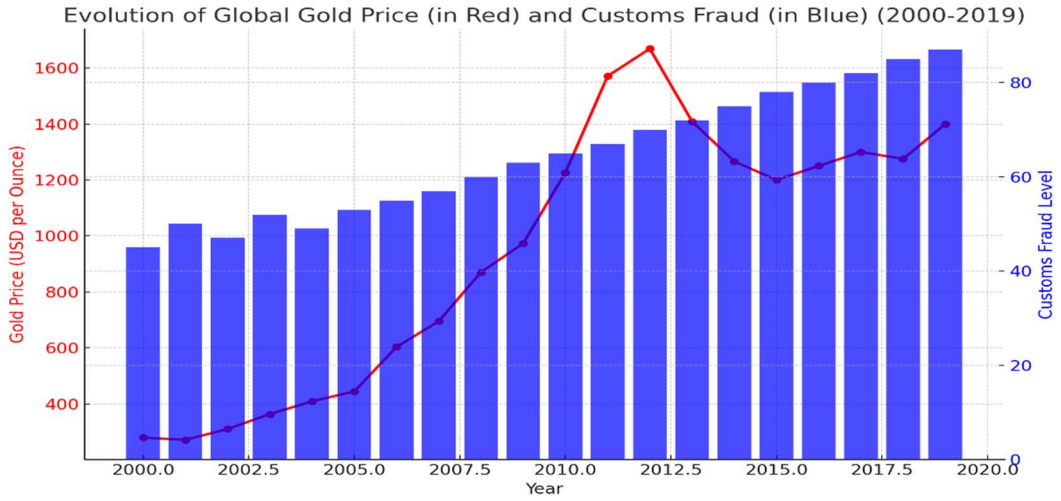


Figure 3-2: Plot of the Evolution of Global Gold Price and Gold Customs Fraud[12]

Source: Author's calculations.

[12] We extract the global gold price from World Bank's world commodity price dataset.The Gold customs fraud is measured by the gold mirror discrepancies.

Finaly, Figure 3.3 illustrates a key stylized fact: the prevalence of gold customs fraud in peacetime (blue) compared to periods marked by terrorist activity (red). The data reveal that, on average, during episodes of terrorism, the gold customs fraud, is significantly higher than during times of peace. This observation aligns with our hypothesis: smugglers exploit periods of instability to amplify trade mis-invoicing and illicit cross-border flows, taking advantage of weakened governance structures and reduced regulatory oversight (World Customs Organization, 2018). Terrorism exacerbates these vulnerabilities, facilitating the underreporting of exports and the avoidance of taxes or customs duties, which are critical revenue sources for governments already strained by security challenges.

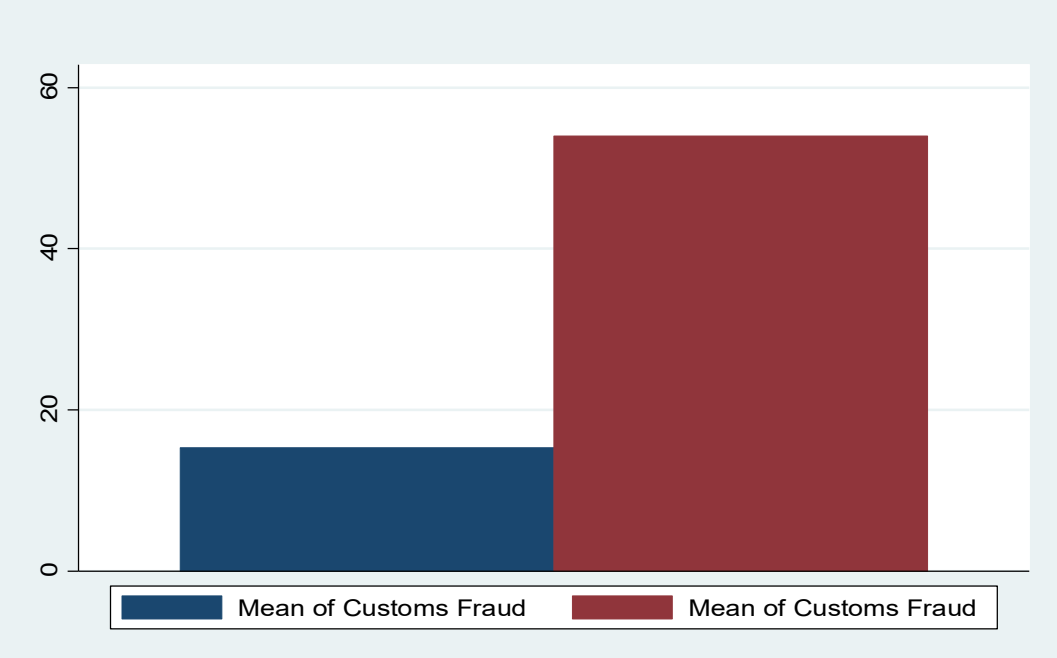


Figure 3-3: Gold customs fraud in times of peace (Blue) vs. the gold customs fraud according to exposure to terrorism (Red)

Source: Author's calculations.

3.3.2 Estimations Results

Table 3-3 reports baseline results. They indicate a positive relationship between neighboring terrorism and gold customs fraud. Specifically, the coefficient is statistically significant and positive in the fixed effects (FE) model, as shown in column (1) Table 3-3. A one percent increase in deaths during terrorism incidents in neighboring countries leads to a 4.45 percent increase in gold customs fraud.

Additionally, to address potential endogeneity issues, we employ the two-stage least squares (TSLS) estimator with the neighboring annual temperature and the perception of voice and accountability as an instrument. In the second stage of the TSLS results, we find that a one percent increase in deaths caused by neighboring terrorism increases gold customs fraud by 5.93 percent (Table 3-3, column 2).

These findings substantiate the hypothesis proposed by Cantens et al. (2019) that terrorist activities can result in a decrease in customs efficiency at borders, consequently undermining state consolidation. Terrorist groups exploit porous borders to facilitate the illicit trade of gold across state boundaries. The collusion between terrorist groups and criminal networks engaged in such illicit activities significantly undermines the effectiveness of customs operations and exacerbates instances of customs fraud.

Our results show that the effect of terrorism in neighboring countries is more significant than that of domestic terrorism, and several factors justify this finding. First, terrorist groups in neighboring countries exert a destabilizing influence across multiple borders, not only through cross-border attacks but also by facilitating the smuggling of goods, which amplifies customs fraud associated with neighboring terrorism. Additionally, border areas are often less controlled by authorities compared to the interior of the country, making it more difficult to monitor terrorist activities, especially when they spread across multiple borders. This leads to a more pronounced impact of neighboring terrorism than domestic terrorism, due to the porous nature of borders and the transnational criminal networks that facilitate the movement of resources and violent actors across several countries. Regarding the control variables, we prove that the presence of substantial rent-seeking activities contributes to an increase in customs fraud. However, GDP per capita and trade decrease gold customs fraud.

Our results challenge Tilly's theory, which posits that conflict can have a positive impact on tax mobilization by the state. Overall, our study sheds light on the complex interactions between terrorism, customs administration, and gold trade in Africa, emphasizing the need for improved security measures and governance to address the challenges posed by illicit trade activities in the region.

Table 3-3: Impact of Neighboring Terrorism on Gold Customs Fraud

	(1)	(2)
	Fixed effect	TSLS
		First Stage Estimations:
Neighboring Temperature (Lag)		0.222***
		0.1378
Voice		0.081***
		0.0025
Terrorism Neighboring (Ln)	4.552**	5.931***
	(1.391)	(2.8510)
Deaths	0.0008***	0.0009***
	(0.0002)	(0.0002)
GDP per capita	-0.0002*	-0.0002**
	(0.0001)	(0.0001)
Rent	0.088*	0.1094**
	(0.0422)	(0.0420)
Trade	-0.0116**	-0.0136***
	(0.0055)	(0.0060)
Constant	-24.25*	-33.84**
	(9.721)	(19.92)
Observations	879	798
R^2	0.46	0.45
Country fixed effect	YES	YES
Year fixed effect	YES	YES
Instruments:		
Lagged of Neighboring temperature and Voice Accountability		

Notes: Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation.*** 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 ($p<0.1$).

3.4. Robustness check

To test the robustness of our results, we first apply an alternative estimator, specifically the Generalized Method of Moments (GMM) estimator, as proposed by Blundell and Bond (1998), to account for potential endogeneity and unobserved heterogeneity. Secondly, we perform multiple tests for sample dependence to ensure that the results are consistent across different sub-samples and not driven by specific groups or unobserved common factors within the data. These steps confirm our findings.

3.4.1 Generalized Methods Moments

The use of the two-step system of Generalized Methods Moments (GMM) estimator, as proposed by Blundell and Blond (1998), proves to be advantageous in addressing the endogeneity issue between terrorism and gold customs fraud. This estimator is particularly well-suited for large cross-sectional datasets, making it a valuable tool for analyzing a wide range of countries in our study.

One of the key benefits of the GMM estimator is its ability to handle endogeneity problems and address omitted variable bias simultaneously. Endogeneity arises when there is a mutual relationship between the dependent and independent variables, which can lead to biased estimates if not properly addressed. With the GMM estimator, we can control for endogeneity by utilizing lagged variables as instruments, allowing us to obtain more reliable estimates of the impact of neighboring terrorism on gold customs fraud.

In our case, we have identified the lagged neighboring temperature as a relevant instrument to capture the effect of neighboring terrorism on gold customs fraud. By incorporating this instrument into our GMM estimator, we can isolate the causal relationship between terrorism and gold customs fraud while accounting for potential confounding factors. Overall, the use of the two-step GMM estimator with an appropriate instrument helps strengthen the internal validity of our findings, providing more robust evidence on the relationship between terrorism and gold customs fraud in Africa.

We present the equation with the two-step system Generalized Methods Moments specified as:

$$LnCUSTOMFRAUD_{it} = \alpha + \boldsymbol{\theta}_1 LnCUSTOMSFRAUD_{it-1} + \beta_1 .Ln\ TER.NEIGH_{jt} + \beta_2\ DEATHS_{it} + \theta\ Z_{it} + \varepsilon_{it} \quad (3\text{-}7)$$

$LnCUSTOMFRAUD_{it-1}$ represents the lagged in one period of customs fraud in logarithm; $Ln\ TER.NEIGH_{jt}$ is the neighboring terrorism in a country (i) by year (t) in logarithm. $DEATHS_{it}$ measures the number of deaths due to terrorism activities in a country (i) by year (t). Z_{it} is the set of control variables. ε_{it} is the error term. Moreover, we included political stability as a control variable to avoid omitted variable bias. Political stability is a key governance indicator that can influence both customs performance and the prevalence of terrorism. In unstable political environments, weakened institutions, corruption, and lack of rule of law may exacerbate customs inefficiencies, making it easier for illicit activities, such as gold smuggling, to thrive. At the same time, political instability can fuel domestic terrorism by creating conditions of unrest, dissatisfaction, and limited government control, which terrorist organizations often exploit to expand their operations.

The results presented in Table 3-4 provide further support for our initial findings, demonstrating that neighboring terrorism has a significant impact on African gold customs fraud. Specifically, we observe that a 1% increase in terrorism incidence in neighboring countries leads to a 4.74% increase in missing gold exports.

Table 3-4: Impact of neighboring terrorism on gold customs fraud in Africa with GMM estimator

	GMM estimator
Customs Fraud (Ln).Lag	0.6268***
	(0.1494)
Terrorism Neighboring (Ln)	4.7496***
	(1.7454)
Deaths	0.0049**
	(0.0022)
GDP per Capita	0.0032***
	(0.0006)
Trade	-0.0714**
	(0.0277)
Rent	0.2018
	(0.2324)
Stability	-2.7197
	(1.5499)
Constant	-37.0134**
	(14.2889)
Observations	876
AR2	.2839
Number of Instruments	23
Number of Groups	45
Hansen Test	0.1689

Notes: Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation .*** 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 ($p<0.1$).

3.4.2 Sample Dependence Test

In the final part of our robustness check, we evaluate the stability of our estimation by implementing both the jackknife (column 1) and bootstrap tests (column 2). These tests are particularly important in the case of a large sample, as they provide robust measures of the variability of the estimates. The jackknife method systematically re-estimates the model by leaving out one observation at a time, allowing us to assess the sensitivity of the results to any

single data point. Similarly, the bootstrap method, by resampling with replacement, offers a reliable way to gauge the distribution of the estimates and generate more accurate standard errors. Additionally, we perform a robustness test consisting in removing the top 1% and the bottom 1% of values (column 3) for our dependent variable, such as gold customs fraud. This trimming of extreme values helps to ensure that our results are not driven by potential outliers

We use a similar estimation model as our baseline and employ the two-stage least squares (TSLS) estimator, with Lagged Neighboring Temperature and Voice and Accountability as instruments. The table 3-5 demonstrates the stability of the coefficients across the different estimation methods—jackknife (column 1), bootstrap (column 2), and the model excluding the top and bottom 1% of values (column 3). The coefficients for terrorism in neighboring countries and rents remain relatively stable in both magnitude and significance across all methods, indicating that these variables have a robust impact on customs fraud, regardless of the estimation technique used.

Table 3-5: Impact of neighboring terrorism on gold customs fraud in Africa

Variable	(1) Jackknife	(2) Bootstrap	(3) Top-bottom
Terrorism Neighboring (Ln)	0.202*	0.202***	2.110**
	(0.1142)	(0.0602)	(10.2920)
Death (ln)	0.0654*	0.0654*	-0.0270
	(0.0826)	(0.0551)	(0.0725)
GDP (ln)	0.0986	0.0986	-1.6943**
	(0.2034)	(0.0927)	(0.6862)
TRADE (ln)	-0.4796	-0.4796**	0.1404
	(0.3803)	(0.2052)	(0.2909)
Rent (ln)	0.5558*	0.5558***	0.5685***
	(0.2929)	(0.1225)	(0.1972)
Constant	12.9243***	12.9243***	131.1731*
	(1.8831)	(1.0194)	(70.0101)
Observations	859	859	842
R^2	0.19	0.18	0.43
Country Fixed Effects	YES	YES	YES
Year Fixed Effects	YES	YES	YES

Variable	(1) Jackknife	(2) Bootstrap	(3) Top-bottom
Instruments:			
Lagged of Neighboring temperature and Perception of the Voice Accountability			

Notes: Clusters are defined at the regional level to correct for errors, accounting for potential dependence between observations within each region. We applied the robust command to adjust for heteroscedasticity and intra-country correlation .*** 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 ($p<0.1$).

3.5 Conclusion and Policy Recommandations

Customs administration serves as a crucial instrument for states to mobilize domestic taxes. However, this tool is compromised due to the proliferation of terrorist activities. Therefore, the goal of the study is to examine empirically the effect of neighboring terrorism on domestic gold customs fraud in a panel of 50 Africa countries from 2000 to 2019. We employ fixed effects and two-stage least squares as estimators to investigate this relationship. The robustness of our findings is reinforced by both the two-step/system of generalized method of moments and several sample dependence tests.

Our findings reveal that neighboring terrorism significantly increases domestic gold customs fraud in Africa. We prove that insecurity caused by extremist groups fosters gold illicit trade across porous borders, severely disrupting customs performance. Our results are robustly attested.

In terms of public policy recommendations, as outlined in this paper, states affected by terrorism must urgently implement mirror analysis of goods in customs administration to track fraud. This database generated from mirror analysis of each product will enhance both the detection and surveillance of goods entering the country from neighboring states.

Moreover, through the use of spatial econometrics tools, our study demonstrated the existence of spatial contagion of terrorism. Our results suggest that national security measures alone cannot effectively combat customs fraud and smuggling. Cooperation between customs administrations, ministries of defense, and neighboring countries therefore represents a crucial challenge to efficiently combat terrorism group financing.

Thus, it is imperative to encourage and support joint customs surveillance initiatives, enabling cooperation between neighboring states and expanding the scope of collaboration to non-military administration, such as tax and customs administration. This will contribute to dismantling organized fraud networks and the alliance between smugglers and terrorist groups across borders.

Annex:

Table 3.B1: Moran's I Statistic test of Terrorism incidences with a distance of 1000 Kms.

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
Stability	0.045	-0.001	0.005	8.953	0.000
Spatial Randomization					

Table 3.B2: Effects of neighboring temperature on neighboring terrorism with fixed effect (First stage of two squares estimator).

Log. Neighboring Temperature (Lag)	0. 9299 ***
	(0.0638)
Constant	1.1311***
	(0.4756)
Nbs. of observations	944
R^2	0.18
F-Test value	8825
Adjusted R-squared	0.99
Country + Year fixed effect	YES
Instrument:	
Lagged of Neighboring temperature	

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table 3.B3: Effects of Voice accountability on local terrorism (Least square estimator)

Log. Neighboring Temperature (Lag)	-0.081 ***
	(0.025)
Constant	57.1***
	(15.89)
Nbs. of observations	898
R^2	0.09
F-Test value	10
Adjusted R-squared	0.09
Country + Year fixed effect	YES
Instrument: Lagged of Voice Accountability	

Notes: robust standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

Table *3*.B4: Variables and Sources

Gold Customs Fraud (=Gold export missing)	UN Comtrade Database
Death	Global Terrorism Index
Rents	World Development Indicator, World Bank
Trade Openness	World Development Indicator, World Bank
Gdp per Capita	World Development Indicator, World Bank
Annual Temperature (Mean)	World Development Indicator, World Bank
Perception of Voice and Accountability	World Development Indicator, World Bank
Political Stability	World Development Indicator, World Bank

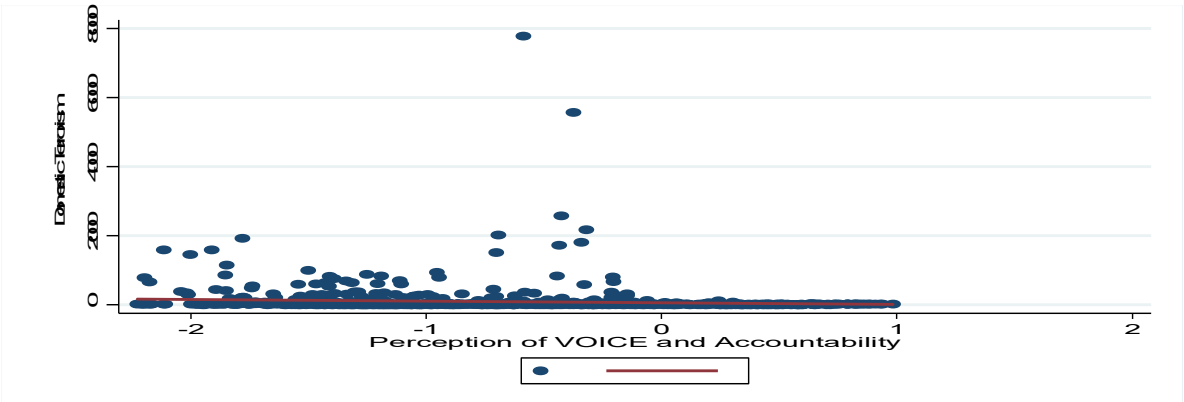


Figure 3-4: Plot of domestic Terrorism and the perception of Voice and Accountability

Table 3.B5: List of countries

Algeria, Angola, Botswana, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Ivory Coast, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Egypt, Gabon, Gambia, Guinea, Ghana, Kenyan, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, Seychelles, Rwanda, Serra Leona, Somalia, South Africa, South Soudan, Eswatini, Togo, Tunisia, Uganda, United Republic of Tanzania, Zambia, Zimbabwe.

Chapter 4. The effects of Mineral Price Variation on Conflict in Africa[13]

[13] The chapter have written with Yoann Morin, CESAER UMR1041, INRAE, Université Bourgogne Franche-Comté, CERDI UMR 6587 CNRS – UCA

4.1. Introduction

From Ukraine to Mali, the resurgence of war currently poses one of the most pressing contemporary challenges, threatening stability in different regions. However, even if war has upsurged recently in Europe, Africa is permanently a battlefield of armed conflict (Davis, 2019). Several scholars have investigated the causes of war in Africa (e.g., Collier and Hoeffler, 2004, 1998; Le Billon, 2012; Ross, (2003); Humphreys, 2005; Besley, 2014; Elbadawi et al (2002), Fearon (2005), Berman et al, 2017, Robinson et al, 2006). The most popular theory on war causes in developing countries especially in Africa, is the “Natural Resources curse”.

The dominant notion of the natural resources curse and war in Africa is that natural resource wealth in Africa causes clashes. Therefore, various studies attested that natural resources are used by rebel groups to finance warfare (e.g., Collier et al., 2004; Berman et al., 2017). The most popular empirical study about natural resources and conflict is “Greed and Grievance in civil war" by Collier, Hoeffler, and Söderbom (2004). Utilizing a novel dataset covering wars from 1960 to 1990, those authors construct an econometric model with a least squares ordinary estimator to predict the onset of war. Collier, Hoeffler, and Söderbom (2004) observed that the extraction of natural resources reduces the cost of joining a rebel group. The greater the abundance of existing natural resources, the more armed groups are incentivized to exploit them as spoils of war (Tullock, 1980). Moreover, Cotet and Tsui (2013) have investigated the effect of oil wealth per capita on the onset of civil war with a least squares ordinary estimator from 1930 to 2003. They reported that oil discoveries generate armed conflict when controlling for country-fixed effects.

Despite numerous studies suggesting a positive link between natural resources and armed conflict (e.g., Collier et al., 2004; Berman et al., 2017; Tullock, 1980), the impact of natural resources on war remains ambiguous. Some scholars have argued that previous studies about the link between natural resources and conflict may be biased due to omitted variables or endogeneity issues. Fearon and Laitin (2003) posited that the onset of civil war in resource-rich countries is conditioned by weak institutions. In their study involving a sample of 161 countries with a Poisson regression analysis, they found that civil war results from institutional conditions such as high levels of corruption, as well as financially, organizationally, and politically weak central governments that foster insurgency. Countries with stronger institutions are better equipped to manage counterinsurgency efforts in resource-rich countries.

Several scholars have also presented evidence suggesting no significant link between war and natural resources, depending on various factors such as the nature of conflict, mineral resources, or local conditions of the country or area. Lujala et al. (2005) conducted a comprehensive multivariate analysis to evaluate the relationship between diamond deposits, production, and incidents of 13 anti-colonial armed conflicts spanning from 1945 to 1999. The empirical results indicated that while diamonds increase the risk of civil conflict, especially ethnic wars, they do not impact other types of conflicts such as political instability. Bhattacharyya and Mamo (2021) leveraged a quasi-natural experiment to explore the connection between intra-state war and mineral discoveries at the grid level (0.5×0.5) between 1950 and 2008. Their findings demonstrated a no significant relationship between mineral discoveries and conflict in Africa, even after controlling for grid-cell and year fixed effects, past discoveries, and property rights institutions.

The study of Berman et al. (2017) analyzed the impact of mineral prices on armed conflict at the local level in Africa. They attest a positive relationship between conflict and mineral price variation in Africa, specifically through mining activities at the grid level. Utilizing a least squares ordinary estimator and geo-referenced data of 14 minerals with conflict events from 1997 to 2010, their findings indicate that an increase in mineral prices and mining activities leads to, on average, 25 percent of the average violence level in Africa. However, the study's strategy can be subject to discussion.

Indeed, the authors used all regions in the sample to evaluate the local impact of mineral prices on armed conflict, without considering the particularities of each country at the local level. Yet, as noted by Bhattacharyya and Mamo (2021), natural resources are not evenly distributed at the local level, emphasizing the importance of considering local variations in the relationship between natural resources and conflict. Some countries or regions boast abundant resources. For instance, the Eastern region of the Democratic Republic of Congo stands out as a prime example of what is often referred to as a "geographic scandal", due to its abundant resources. Thus are areas with abundant mining resources and some areas endowed with less resources.

Consequently, using all areas at the local level to investigate the link between mineral prices and conflict may introduce estimation bias. This bias can stem from heterogeneity in the distribution of resources at the local level (Groves et al, 2005). Indeed, some areas may have an abundance of active mines, while others may have fewer active mines and consequently a lower risk of armed conflict. This heterogeneity bias can lead to skewed results and conclusions in the study by Berman et al. (2017).

Therefore, the goal of this paper is to analyze the impact of mineral prices on armed conflict at the grid level in Africa, incorporating cells where mines have been discovered but not yet exploited as a control group. In our study, we use cells representing geographic grids subdivided into areas measuring 0.5 × 0.5 degrees in latitude and longitude.

By using cells discovered but not exploited mines as the control group, we significantly reduce the risk of heterogeneity bias. Mines discovered yet never exploited exhibit comparable characteristics to active mines, such as geographical and socio-economic conditions, except for variations in mineral prices, as discovered mines are not being exploited and thus are not dependent on price fluctuations. Thus, the control group is shielded from the direct impact of mining activity on resource prices. This approach allows for a more precise isolation of the effect of price variations on active mines in Africa, by excluding confounding factors related to mining itself.

Hence, employing cell where mines discovered but not exploited mines in our study to assess the impact of minerals price on war may potentially alter the conclusions drawn by Berman et al. (2017) and contribute to a better understanding of the causes of war in Africa.

Mineral prices serve as an explanatory variable of conflict in Africa for several reasons. Firstly, as rebel groups exploit mineral resources, higher mineral prices boost their financial funding. Consequently, as mineral prices rise, so do the financial capabilities of rebel groups. Escalating global mineral prices also increase the costs associated with joining rebel groups (Collier, Hoeffler, and Söderbom, 2004). The financial opportunities derived from illicit mineral trade enable rebel groups to finance their operations, recruit combatants, and procure weapons, thereby escalating conflict dynamics. Consequently, escalating mineral prices heighten the risk of conflict development.

Moreover, due to the economic dependence of African states on natural resources, prolonged shocks in mineral prices severely curtail the state's financial capacity, impairing its ability to fund war efforts and counterinsurgency movements.

Our study relies on the Armed Conflict Location Events Data dataset (ACLED), a georeferenced event dataset providing information on location, actors, and types of conflict events such as battles, violence against civilians, explosions/remote incidents, protests, and riots. We merge this armed conflict dataset with the World Bank's world commodity price dataset, encompassing mineral prices from 1997 to 2019. Additionally, we extract data on mine discoveries from the MinEx mineral deposits

dataset.

The units of analysis in our study are cells measuring 0.5 × 0.5 degrees of latitude and longitude. To account for potential variations, we incorporate country × year fixed effects and cells fixed effects, controlling for unobserved cross-sectional and temporal heterogeneity. This integrated approach allows us to explore the complex interactions between armed conflict events, mineral prices, and mine discoveries across diverse geographic locations and over an extended period.

In our empirical method, firstly, we estimate the impact of mineral prices on conflict with no control group, using the least square estimator and country-year fixed effects at the grid level. We follow a strategy similar to Berman et al. (2017) and use the same explanatory variables as in their study such as mineral prices. Using mineral prices as explanatory variable helps to mitigate endogeneity bias, as prices are determined by the international market and are therefore exogenous to the conflict. The discovery of mines in particular cells is not expected to have a substantial effect on the overall pricing of minerals in the global market. Additionally, we empirically attest to the lack of significant effect of discovered mines on conflict. This approach helps to ensure that our findings are not influenced by potential endogeneity issues.

In a second step of the empirical strategy, we investigate the impact of mineral prices on conflict by employing cells where mines have been discovered but not yet exploited as control group and utilizing the least squares estimator with fixed effect.

Our findings provide substantial evidence supporting the following conclusions: when using areas with no cells where mines have been discovered as the control group, mineral prices significantly increase conflict in Africa. Specifically, doubling mineral prices leads to a 7.5% to 3.8% increase in the probability of armed conflict at the local level in Africa. We confirm Berman et al.'s (2017) findings: the rise in mineral prices leads to an increase in armed conflict when areas with no mine discoveries are used as the control group. However, we assert that the impact of mineral prices on conflict is significantly diminished by using our control group, reducing the probability of conflict by 20% to 40%. Our findings align with the hypothesis proposed by Bhattacharyya and Mamo (2021), suggesting that mine discoveries act as inhibitors, reducing the risk of clashes at the local level in Africa.

Our paper contributes significantly to the existing literature for several reasons. Firstly, our main contribution lies in the innovative methodological approach of employing cells where mines have

been discovered as a control group at the grid level to analyze the impact of mineral prices on conflict. This methodology represents a pioneering effort in empirical conflict literature and offers a novel perspective on the relationship between mineral prices and armed conflict proliferation in Africa. Indeed, by attesting to a positive link between mineral price and conflict in Africa without a control group or with a control group, we align with the theory of the natural resource curse, which suggests that countries rich in resources may offer attractive opportunities for rebellion activities due to rent-seeking incentives.

The application of our new methodology in this paper offers a nuanced perspective on the theory. By employing cells where mines have been discovered as a control group, we can better isolate and reduce the impact of mineral prices on conflict. This approach provides a more accurate and refined analysis of the relationship between mineral prices and conflict in Africa.

Moreover, in terms of public policy, the paper underscores the local impact of the global prices on the stability of African states. Sudden spikes or declines in mineral prices can be indicative of the security landscape in countries affected by conflict. Therefore, by comprehending the local effects of the mining industry, policymakers can formulate proactive strategies to mitigate conflict risks, enhance state stability, and promote sustainable development in the region.

The remainder of the paper is organized as follows. Section 4.2 presents the data and section 4.3 presents the characteristics of the suggested control group in relation to the treated group and to all other areas. In section 4.4 we present the empirical strategy and section 4.5 reports and discusses our results. Finally, section 4.6 concludes.

4.2. Data

In line with Berman et al. (2017) and Bhattacharyya and Mamo (2021), we assign each observation (mine, conflict, etc.) to cells of 0.5° × 0.5° (approximately 55km × 55km at the equator). Rather than constructing our own grid of cells, we adopt the one proposed by Tollefsen, Strand, and Buhaug (2012). Given that the history of conflicts and other factors specific to each cell may influence conflict outcomes (Besley and Reynal-Querol, 2014), we incorporate cell fixed effects into our econometric specification[14].

[14] Refer to Annex, Map 4-2 for a map of Africa illustrating country and cell borders

To build our conflict data, we extract geocoded datasets of war from the Armed Conflict Location and Event Dataset (ACLED, Raleigh, Kishi, and Linke, 2023). Observations in the ACLED dataset are "Event Types". The Event Types considered in our study are: Battles, Violence against civilians, Explosions and Remote violence, Protests, and Riots. All events are sourced from press accounts, whether regional, international, or historical archives. Our initial conflict measure is a binary variable coded as 1 if any type of conflict occurred and 0 otherwise. We also examine the impact of mining on each specific type of conflict. The database provides geographical coordinates for each event, and we retain events with the most precise geo-referencing to avoid misallocating conflicts in the cells. Map 4-3, contains a graphic illustrating the locations of conflicts over our sample period.

We employ the MinEx Consulting mineral deposits dataset, which provides the geographic locations of mineral discoveries and mines. The dataset encompasses mines with varying deposit sizes, categorized as minor, moderate, major, and Giant. Our analysis focuses on 14 minerals with available price data: bauxite, coal, copper, diamonds, gold, iron, lead, nickel, phosphate, platinum, potash, silver, tin, and zinc. Within each cell, we retain the mineral deposit with the highest reported total value in the MinEx Consulting database. If the sole mine in a cell features a mineral without price data, we exclude the cell from our database. A graph illustrating the evolution of the number of active mines can be found in Figure 4-5.

Our primary source for mineral prices is the World Bank's World Commodity Price dataset, which provides data on real prices in constant 2005 US dollars. This dataset covers all the minerals used in this study, apart from diamonds. Obtaining reliable price data for diamonds is challenging, as there is no comprehensive dataset with historical prices for rough diamonds. Therefore, we rely on the Rapaport Diamond Index (RDI), which represents the average prices listed on Rapaport for different diamond qualities (D-H, IF-VS2, RapSpec, and A3+).

The index measures prices in dollars per kilogram, and the price variable for a given year is uniform across all observations with the same primary mineral. The RDI is available for various diamond sizes, and we calculate our price measure using the average price of 0.5-carat and 1-carat diamonds, with prices adjusted to constant 2005 US dollars. The evolution of the price of each mineral is depicted in Figure 4-6, and a table with summary statistics is presented in Table 4-5.

With the aim of conducting a statistical analysis of our datasets to compare the characteristics of different types of areas (those with discovered mines, active mines, or neither), we enhance the dataset by incorporating additional information at both the country and cell levels. These supplementary

variables are not utilized in the estimation process.

At the country level, we integrated the polity2 score, as proposed by Plümper and Neumayer (2010), to capture political regime. Numerous studies exploring the connection between political regimes and mining activities consistently highlight the pivotal role of political stability on natural resources management. For example, Jensen et al. (2004) employed both generalized least squares and fixed effects ordinary least squares methods to demonstrate a negative link between wealth and political stability in Africa. The inclusion of the polity2 score enhances our understanding of the relationship between political regimes, natural resources, and mining activities.

We incorporated the Bayesian Corruption indicator, a measure of the perception of corruption introduced by Standaert (2015). The relationship between corruption, conflict, and resource wealth has been explored by Arazki et al. (2013) over the period 1985 to 1997. Utilizing both least squares estimation and the system-GMM (Blundell and Bond, 1998), they empirically established a positive correlation between the level of corruption and resource rent, with a more pronounced effect in less democratic countries. In unstable countries, the level of corruption impacts the state's ability to effectively manage natural resources, including mining activities (Bhattacharyya et al, 2010).

We included indicators related to ethnic and religious polarization/fractionalization, following the method proposed by Montalvo and Reynal-Querol (2005). Previous studies (e.g., Collier et al., 2004; Costalli et al,2017) have suggested that armed conflicts are often motivated by ethnic diversity and religious fractionalization, particularly in countries rich in natural resources such as mining resources.

We incorporated GDP per Capita from the Penn World Table 10 (Feenstra, Inklaar, and Timmer, 2015) to capture the level of development at the country level. Mamo et al. (2019) found evidence a positive link between mining discoveries and GDP per Capita in Sub-Saharan African countries. Higher GDP per Capita levels stimulate economic activities, thereby enhancing the attractiveness of investments across various sectors, including the mining industry. This heightened economic activity and investment interest consequently encourage further research and exploration to uncover new mining opportunities.

We also added military spending data from the World Bank dataset. The abundance of natural resources encourages states to increase military spending to counter insurgency movements (Collier et al. 2001). In this regard, Conrad (2023) attested that in resource-rich developing countries, governments allocate a higher defense budget than other states to combat rebel movements. This variable has also been used in the studies by Berman et al. (2017).

At the cell level, our dataset includes variables that describe land use, health metrics (child malnutrition and infant mortality rate), and connectivity to nearby areas measured by travel time to the nearest major city. Land use emerges as a significant factor influencing mining activities, given that the use of chemical materials in mining negatively affects productivity and soil quality. Additionally, agricultural productivity is identified as a determinant of the living standards of the population at local level. Examining the relationship between health metrics and mining activities, a connection between mining activities and childhood health is supported by Swchartz et al. (2021), indicating that children born in mining areas are more likely to develop diseases compared to those born outside mining areas. Consequently, we anticipate a complex interplay between mining activities and health metrics.

The utilization of connectivity to nearby areas, measured by travel time to the nearest major city, allows us to capture local-level economic development. As discussed earlier, economic development is a determinant of both mining activities and conflict. All these data are sourced from the PRIO-GRID dataset (Tollefsen, Strand, and Buhaug, 2012).

Finally, we enriched our dataset by incorporating climate data, specifically average precipitation and temperature at the cell level, sourced from the ERA5-land dataset (Muñoz-Sabater et al., 2021). This addition is motivated by the substantial exploration of the relationship between climate change and mining activities in the literature (Ford et al., 2011). Moreover, the potential impact of climate change on mining productivity is significant (Odell et al., 2018). The inclusion of climate data enables us to delve deeper into the intricate connections between climate conditions and mining activities.

4.3. Areas with discovered mines as a control group

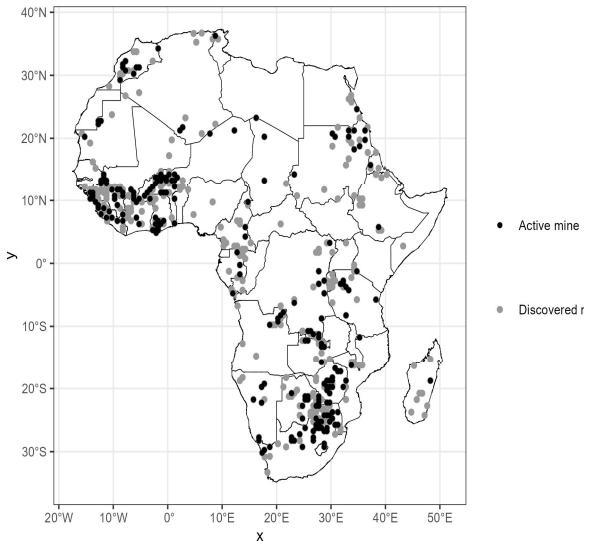
One of the main threats to the identification of the causal impact of mineral prices on conflict is the existence of time-varying confounders affecting conflicts and that are different between areas with mining deposits and areas with no mining deposit. For example, in areas with mining deposits, compared to areas with no mining deposit, better socioeconomic conditions can lead to increased employment opportunities and higher incomes for the local population, and thus reduce the probability of conflict. Therefore, in our study, we argue that time-varying confounders do exist and must be accounted for in the identification strategy to avoid bias and obtain more accurate and reliable results.

To control for time-varying confounders between areas with mining deposits and areas with no mining

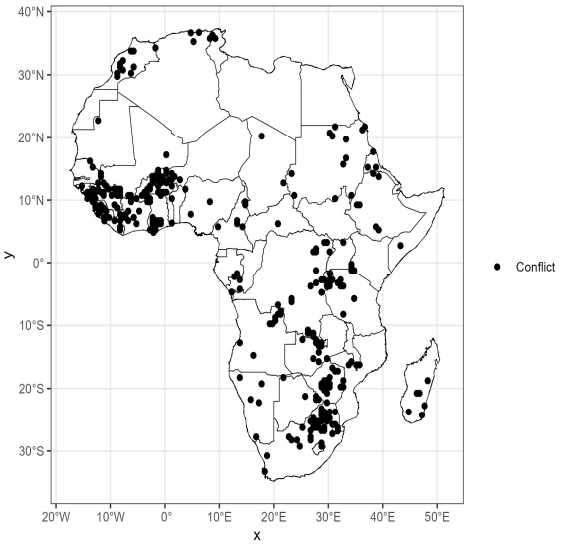
deposit, we use cells with mines discovered yet never exploited as a control group for areas with mine activity. Indeed, discovered and active mines share comparable geographic and geological features, thereby reducing the risk of sample bias (Bhattacharyya and Mamo, 2021). Also, discovered mines and active mines exhibit similar initial characteristics, encompassing environmental conditions and resource availability. Moreover, the 14 minerals selected for this study are highly valued by mining companies, which means they are generally not left unexploited for financial reasons. Moreover, they represent the minerals actively mined in Africa by mining companies that were chosen for the study. In the paper, mine discoveries are further differentiated by size into minor, moderate, major, and giant categories (Bell and Wolford, 2015).

As illustrated in Map 4-1-1, not every area has mining deposits, where a high spatial correlation is observed between areas with discovered mines (without active mine) and those with active mines, while some areas have none. Map 4-1-2 further illustrates that conflicts occurred in a significant proportion of areas with either discovered or active mines.

Map 4-1-1: Discovered and active mines



Map 4-1-2: Conflicts in areas with discovered mines



Furthermore, we can compare other observable characteristics of the areas based on the presence of discovered mineral deposits. Table 4-1 presents these characteristics at both the national and cell levels. At the national level, the treated and suggested control groups are more similar in terms of the polity score: they are overall less authoritarian than areas without discovered or active mines. Areas with active or discovered mines are also more religiously divided (religious polarization and religious fractionalization). As previous studies have shown, religiously divided areas are more likely to have conflicts (Berman et al., 2017; Fearon and Laitin, 2003). Therefore, using a control group that lacks similar characteristics in terms of religious

polarization and fractionalization may falsely attribute conflicts to mining activities.

Areas with mining deposits are situated in countries that, on the whole, have lower economic prosperity (lower GDP) and allocate a smaller proportion of their GDP to military spending. This economic situation may impact the government's ability to control regions with mining activities, potentially increasing the incentive for armed groups to take control of these areas.

Table 4-1: Comparing the characteristics of groups based on the type of mine

	Active mine (N=5037)		Discovered mine (N=5934)		No discovered nor active mine (N=228390)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Country-level variables						
Polity score (polity2)	2.756	5.035	1.544	4.985	0.747	4.743
Bayesian Corruption Indicator	55.322	9.044	56.985	9.543	58.056	8.378
Ethnic polarization	0.614	0.146	0.570	0.173	0.562	0.163
Ethnic fractionalization	0.645	0.192	0.646	0.229	0.635	0.239
Religious polarization	0.746	0.259	0.743	0.275	0.630	0.336
Religious fractionalization	0.429	0.165	0.440	0.181	0.369	0.211
Military spendings (% GDP)	1.902	1.568	2.083	1.905	2.406	2.088
GDP (million $)	143.325	214.955	121.095	193.276	168.313	238.545
Cell-level variables						
Coverage of agricultural areas	30.651	28.444	25.643	27.147	14.947	23.861
Coverage of aquatic vegetation	2.941	8.200	3.151	8.672	4.323	11.742
Coverage of forest areas	24.925	26.940	33.960	31.298	24.384	31.149
Coverage of herbaceous vegetation	14.178	23.888	10.367	22.616	10.961	23.681
Coverage of barren areas	12.496	30.837	11.436	28.962	34.227	44.906
Coverage of shrubland	12.317	17.376	13.672	17.547	7.172	13.593
Coverage of urban areas	0.663	3.942	0.125	0.704	0.085	0.692
Coverage of water areas	1.830	8.532	1.645	6.281	3.901	15.293
Proportion of mountainous terrain	0.203	0.308	0.234	0.312	0.136	0.257
Prevalence of child malnutrition (2000)	24.120	10.452	26.363	11.226	26.155	12.937
Infant mortality rate (2000)	895.273	357.451	955.159	342.510	909.530	439.710
Travel time to the nearest major city	399.927	409.832	443.310	418.762	725.966	738.764
Average precipitation (mm)	2.373	1.812	2.790	2.060	1.775	1.889
Average temperature (C)	23.364	4.204	23.875	3.414	24.152	3.508

Source: Authors' calculations.

Consequently, areas with mineral deposits are, on average, closer to major cities. Another noteworthy distinction among the three groups is the average precipitation, which is more comparable between our control group and the treated group than between the treated group and areas without mineral deposits. Harari and Ferrara (2018) demonstrate that climate can impact conflicts, underscoring the need to include areas in our control group with a climate similar to that of the treated group to avoid

erroneously attributing conflicts that may be explained by climate shocks affecting only one of the groups.

Table 4-2: Minerals per group

	Bauxite	Coal	Copper	Diamonds	Gold	Iron	Lead
Active Mine	161	46	436	615	2743	230	46
Discovered Mine	437	391	575	299	1955	1104	46
	Nickel	Phosphate	Platinum	Potash	Silver	Tin	Zinc
Active Mine	208	46	253	23	46	23	161
Discovered Mine	506	253	69	92	23	92	92

Source: Authors' calculations.

Table 4-2 reports how many times a mineral deposit is present in each group. Some minerals like gold and diamonds, platinum or copper have a higher proportion of discoveries actively mined. There is also a potential difference in the searching intensity of the different types of mineral deposits, but we cannot measure it to include it in our identification strategy.

The causes of the non-exploitation of discovered mines are diverse. First, despite the discovery of a mine, technical and geophysical challenges may arise (Bhattacharyya et al, 2021). If mineral deposits are deep, dispersed, or located in geologically unstable areas, extraction can become technically complex or economically unfeasible. Secondly, at the local level in Africa, social concerns play a significant role. In regions with existing small-scale or artisanal mining activities, local miners may resist large-scale operations due to fears of losing their livelihoods or facing environmental degradation.

Moreover, a weak rule of law in many African countries exacerbates legal disputes in the mining sector. Ownership corruption, and unclear regulations often result in prolonged legal battles between mining companies and governments, or among competing firms, leaving discovered mines inactive. Additionally, regulatory constraints, environmental protection laws, and opposition from local communities can also hinder the development of mining projects, even after significant mineral discoveries have been made.

Lastly, using cells with discovered yet never exploited as a control group may bias our estimates if mine discoveries also causes conflicts. The process of searching for mineral deposit may attract attention from potential armed groups and thus cause conflicts. We must estimate the effects of mines discoveries on conflicts.

In this subject, Bhattacharyya and Mamo (2021) suggested an identification strategy to estimate this effect. They study the effect of mine discoveries and their temporal lags on the probability of conflict.

They found no evidence of mine discoveries having an effect on conflict. We used a similar strategy to estimate the effect of mine discoveries on conflict in Table 4-6. Nevertheless, we also find that this strategy may have an issue identifying such an effect because mine discoveries are overall a rare event (Goodman-Bacon, 2021). As a consequence, we have a low number of observations that have both a conflict and a mine discovery.

Therefore, we choose to use another strategy to study the potential effect on mine discoveries on conflicts. To investigate the link between mine discoveries and conflicts, we estimate the linear probability model as followed:

$$C_{i,t} = \mu_i + \mu_{g,t} + \text{PastDiscov}_{i,t} + \varepsilon_{i,t} \quad (4\text{-}1)$$

where *ci,t* is a binary variable taking the value 1 if there is a conflict in period t in cell i. μi is a cell fixed effects and $\mu g,t$ is a country-year fixed effect. *PastDiscov* is a binary variable equal to 1 of a mine was ever discovered in this cell at time t or before.

Table 4-3: Discovered mines effects on conflict

	Full sample	GID never had active mine	GID with no active mine in the past
	(1)	(2)	(3)
Past discov.	−0.012 (0.018)	−0.020 (0.018)	−0.013 (0.021)
Num.Obs.	240 120	10 971	236 686

p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. Each regression includes time country-year fixed-effects and grid-cell fixed-effects, Standard errors are in parentheses and clustered by grid-cell.

The results are presented in Table 4-3, where we apply our model to different control groups. In Column (1), we estimate the model on all observations, while in Column (2), we restrict the analysis to cells that have never had an active mine. In Column (3), we further refine the scope by including only observations that had no active mines in the past in our sample—retaining data before a mine becomes active but excluding observations with active mines or mines that were operational before the start of our observation period. Our findings do not provide substantial evidence of mine discoveries significantly impacting conflict. The observed effect is negative and lacks statistical significance across all three control groups, aligning with the conclusions drawn by Bhattacharyya and Mamo (2021). The estimate consistently shows a negative trend in all columns but remains largely insignificant, with a standard error close to the value of the estimated effect. Consequently, areas with discovered but never active mines emerge as a viable control group for areas with active mines. This ensures that the effect of conflict is not falsely attributed to mining activities, especially when such

effects could be explained by events preceding the activation of the mine.

4.4. Empirical Strategy

To analyze the effect of minerals price on conflict, we estimate a linear probability model of the form:

$$C_{i,t} = \mu_i + \mu_{g,t} + P_{i,t} + \varepsilon_{i,t} \quad (4\text{-}2)$$

Where *i* corresponds to cell and t to time; $C_{i,t}$ represents violent events (Battles, Violence against civilians, Explosions and Remote violence, Protests, and Riots) at cell-year level; $P_{i,t}$ is the log of the main mineral price in cell *i* at time *t*. To do so, we use a similar definition of mine activity than in Berman et al. (2017). For the first definition, we only keep cells that have mines active in the whole period of our sample (noted as "keep" in results tables). The second definition considers that if a mine is active in a least one period, then it is always considered active (noted as "force" in results tables). In both cases, the effects of mine activity on conflict is absorbed by the individual fixed effect μ_i. $\mu_{g,t}$ a country-time fixed effect and $\varepsilon_{i,t}$ represents the error term to cell I and time t. We estimate equation 4-2 using two-way fixed effect estimates.

There may exist three main issues in identifying the causal effect of mineral prices on conflicts. Firstly, conflicts may lead to a change in the ownership of a territory, resulting in a shift in borders. Thus, we cannot use administrative borders as our spatial unit and instead rely on a grid consisting of 0.5 X 0.5 degrees cells. The second issue is unobserved time-varying confounders that may affect areas with mineral deposits differently than areas without mineral deposits. As described in section 4.3, using areas with discovered but never active mines as a control group helps having more similar characteristics between the treated and control group. Hence, they should also have more similar unobserved time-varying confounders. We present our results both using this control group and using all observations as the control group to study the difference between those two cases.

Moreover, about the endogeneity issue between mineral prices and conflict, we can assert a low risk of bias. Indeed, the fixation of international prices is determined by exogenous factors, such as global demand and supply dynamics. Relying on randomly determined international prices helps ensure the independence of variables between mineral prices and conflict, reducing the potential for correlation bias. Moreover, a single country does not possess the autonomy to independently influence the fluctuation of international prices. The intricate global market dynamics, driven by various actors and external forces, contribute to the exogeneity of mineral prices in the context of specific countries

experiencing conflict. Additionally, the discovery of mines in specific cells is unlikely to have a significant impact on mineral prices.

Lastly, the use of the Difference-in-Differences (DID) method with cell and period fixed effects can be subject to biases, as this method faces challenges in accurately identifying the Average Treatment Effect (ATE) when it varies across cells and periods, especially when the treatment adoption is staggered (Goodman-Bacon et al., 2021). Therefore, to validate the double difference approach, it is essential to conduct validation tests for the DiD estimator.

Therefore, we adopt Gardner's (2022) strategy by analyzing the impact of mine discovered on conflicts using the staggered DiD method. This approach aims to verify the parallel trends hypothesis, which posits that, before the discovery of mines, cells with and without mines should follow similar conflict trajectories. Validating this hypothesis is important to ensuring that the observed differences in conflicts after the treatment are genuinely due to mine discoveries, rather than to pre-existing differences.

To assess the impact of mine discoveries, we implement a parallel trends validation strategy by analyzing the effect of mines discoveries on conflict using three samples: cells that have never had active mines (3), those without active mines in the past (2), and the entire set of cells (1). This approach allows for the identification of whether cells with and without mines exhibited similar trends before the treatment. The non-significance of these tests is key to confirming the validity of the results and the reliability of the DiD estimator.

The following model examines the impact of mine discovered on the conflicts:

$$C_{i,t} = \mu_i + \mu_{g,t} + \text{PastDiscov}_{i,t} + \varepsilon_{i,t} \quad (4\text{-}3)$$

With $C_{i,t}$ is a binary variable taking the value 1 if there is a conflict in period t in cell i. μ_i is a cell fixed effects and $\mu_{g,t}$ is a country-year fixed effect. PastDiscov_i is a binary variable set to one if a mine was ever discovered in this cell at time t or before.

The results in Table 4-4 indicate no significant impact of discovered mines on conflicts across the full sample, cells that never had active mines, and cells with no active mines in the past. This suggests that the observed differences after the treatment are not due to pre-existing biases. The null R^2 values and stable criteria (AIC, BIC) further support this interpretation. Moreover, Figures 4-2, 4-3, and 4-4

confirm these findings: prior to the treatment (as indicated by the vertical dashed line), the coefficients are close to zero and the confidence intervals overlap with zero. This pattern suggests that the parallel trends hypothesis is upheld across all three samples (the full sample, cells without active mines, and cells without mines in the past).

The validation of the parallel trends hypothesis strengthens the credibility of using the Difference-in-Differences method to estimate the causal impact of mine discoveries on conflicts. It indicates that any observed differences after the treatment can be attributed to the effect of mine discoveries, rather than to systematic differences between treated and untreated cells that existed before the treatment.

Table 4-4: Effect of mines discovered on conflict

	(1) Full Sample	(2) GID Never Had Active Mine	(3) GID with No Active Mine in the Past
bin_past_discov = 1	0.020	0.022	0.021
	(0.015)	(0.017)	(0.016)
Number of Observations (Num. Obs.)	232,565	231,335	232,097
R^2	0.000	0.000	0.000
Adjusted R^2	0.000	0.000	0.000
AIC	-57,571.4	-58,235.9	-58,291.2
BIC	-57,561.1	-58,225.6	-58,280.8
RMSE	0.21	0.21	0.21
Standard Errors	Custom	Custom	Custom

Notes : + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

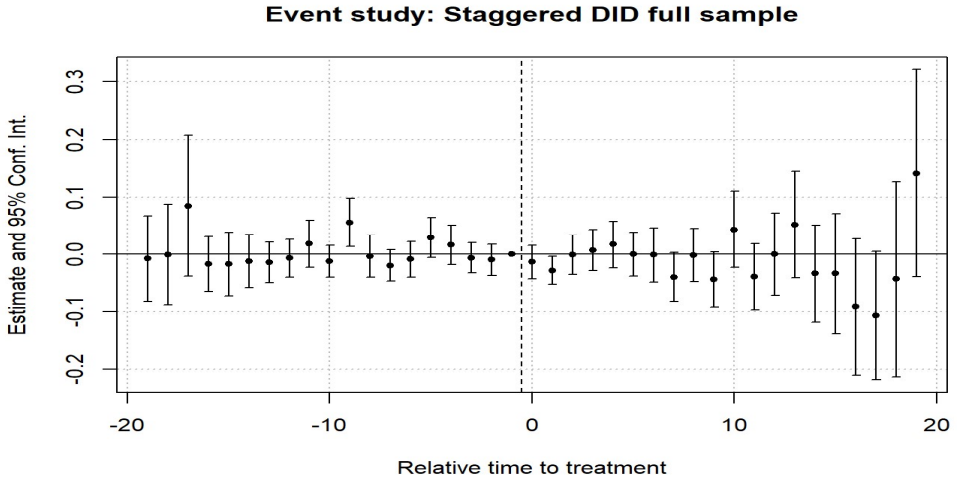


Figure 4-1: Impact of discovered mines on conflict with full sample (Staggered DiD, eq 4-3)

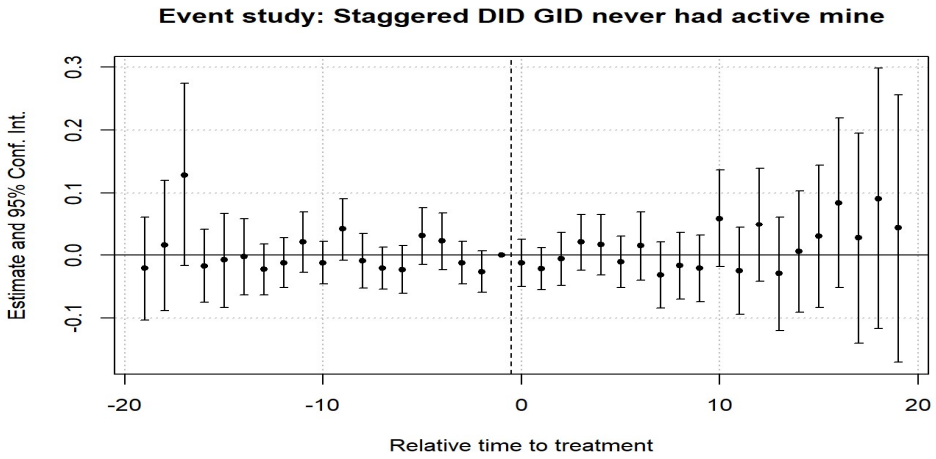


Figure 4-2: Impact of discovered mines on conflict with cells mine never active (Staggered DiD, eq 4-3)

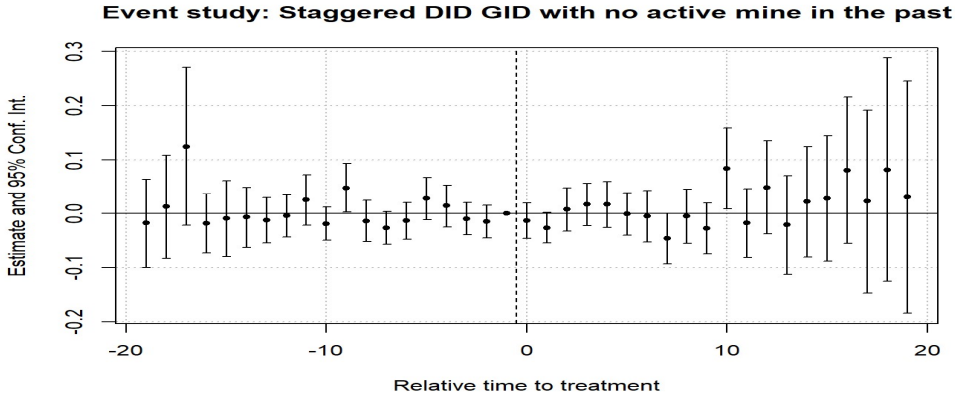


Figure 4-3: Impact of discovered mines on conflict with cells with no active mine in the past (Staggered DiD, eq 4-3)

4.5. Results

We estimate equation 4-2 and the results are presented in table 4-5.

We estimate the model for the two definitions of mine activity and using both the control group with areas having discovered but never active mines and all areas in Africa. When we use all observations on Africa as the control group, the effect of price variation on conflict is positive and highly significant. In the first column, we estimate that a doubling in mineral price raises conflicts by 7.5% when we keep only mines that are always active. The estimated effect is reduced to 3.8% when we define mines as always active is they are active at least once in the sample (column 3). The values are similar to those found in Berman et al. (2017), who found an effect of 7.2% for when keeping mine that area active during all the periods, and 4.5% in when coding mine active is active at least once.

When using the control group with cells where mines have been discovered but not yet exploited, the estimates of the effect of mineral price variations on conflicts are lowered. The standard errors are still close to the case with all observations in the control group, but because the estimate of the coefficient is lower, the significance is also lower. The estimated effect of mineral price variations on conflicts is reduced by 20% to 40% depending on the definition of mine activity used. Overall, we still find that mineral price variations affect conflicts: a doubling in mineral price raises conflicts by 2% to 5.9%. We also investigate the impact of fluctuations in mineral prices on the five types of conflicts outlined in our comprehensive conflict definition. The outcomes are detailed in Table 4. In the study by Berman et al. (2017), a positive association was identified between mineral price variations and violence against civilians, as well as riot and protest events (both events were combined into the same variable). Consistent with these findings, our results, when not employing the control group with discovered mines, reveal similar patterns.

Mineral price variations demonstrate a positive impact on riot, protest, and violence against civilian's events. However, when utilizing the suggested control group, this impact is attenuated but remains statistically significant. In aggregate, the effect is diminished by 30%. In sum, despite our findings showing that mineral price variations contribute to conflicts in Africa, the use of our control group reduces this effect.

Table 4-5: Impact of Minerals Price Variation on Armed Conflict in Africa

Mine act. Definition	Keep	Keep	Force	Force
Control group	All	Discov. mine	All	Discov. mine
	(1)	(2)	(3)	(4)
	Outcome: all conflicts			
log(Mineral price)	0.075***	0.059**	0.038***	0.020+
	(0.020)	(0.023)	(0.010)	(0.012)
	Outcome: battle event			
log(Mineral price)	0.006	0.002	0.002	0.000
	(0.007)	(0.008)	(0.004)	(0.006)
	Outcome: riot event			
log(Mineral price)	0.045**	0.032+	0.032***	0.018*
	(0.015)	(0.017)	(0.006)	(0.009)
	Outcome: civil event			
log(Mineral price)	0.040**	0.030*	0.013+	0.005
	(0.014)	(0.014)	(0.007)	(0.008)
	Outcome: explosion event			
log(Mineral price)	−0.003	−0.004	0.000	−0.001
	(0.004)	(0.004)	(0.002)	(0.003)
	Outcome: protest event			
log(Mineral price)	0.051**	0.038*	0.021*	0.004
	(0.017)	(0.018)	(0.008)	(0.009)
Obervations.	236 440	7291	240 120	10 971

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Each regression includes time country-year fixed-effects and grid-cell fixed-effects. Standard-errors are in parentheses and clustered by grid-cell. Clusters are defined at grid level to correct for errors, accounting for potential dependence between observations within each region.

4.6. Conclusion

The extensive debate surrounding the natural resource curse theory as a driver of conflict in Africa has been a focal point in conflict literature. In this topic, Berman et al. (2017) conducted an analysis examining the effect of mineral prices on war in Africa. The study attested a positive link between mineral prices and armed conflict in Africa. However, it may exist potential biases in their methodology, particularly regarding the presence of time-varying confounders that may affect conflicts differently between areas with mining deposits and those without.

Therefore, in this paper, our main contribution lies in introducing a novel empirical strategy for analyzing the impact of mineral prices on conflict in Africa spanning from 1997 to 2019. To explore the relationship between mineral prices and conflict, we utilize grid-level cells ($0.5° \times 0.5°$), employing cells with mines discovered but not yet exploited as the control group. We have used this approach because it offers cells with mines discovered but not yet exploited that exhibit similar characteristics (geographic, socio-economic conditions, etc.) to active mines, except for the variations in mineral prices. This innovative method aims to reevaluate the findings of Berman et al. (2017), who suggested a positive correlation between mineral prices and conflict in Africa.

Our study aligns with the conclusions drawn by Berman et al. (2017), indicating a positive association between mineral prices and armed conflict in Africa without the use of a control group. However, by utilizing cells where mines have been discovered but not yet exploited as our control group to analyze the impact of mineral prices on conflict, we uncovered a nuanced perspective. We attest that higher mineral prices contribute to conflict, but our results suggest that this effect diminishes by 20% to 40% when employing cells where mines have been discovered but not yet exploited as the control group.

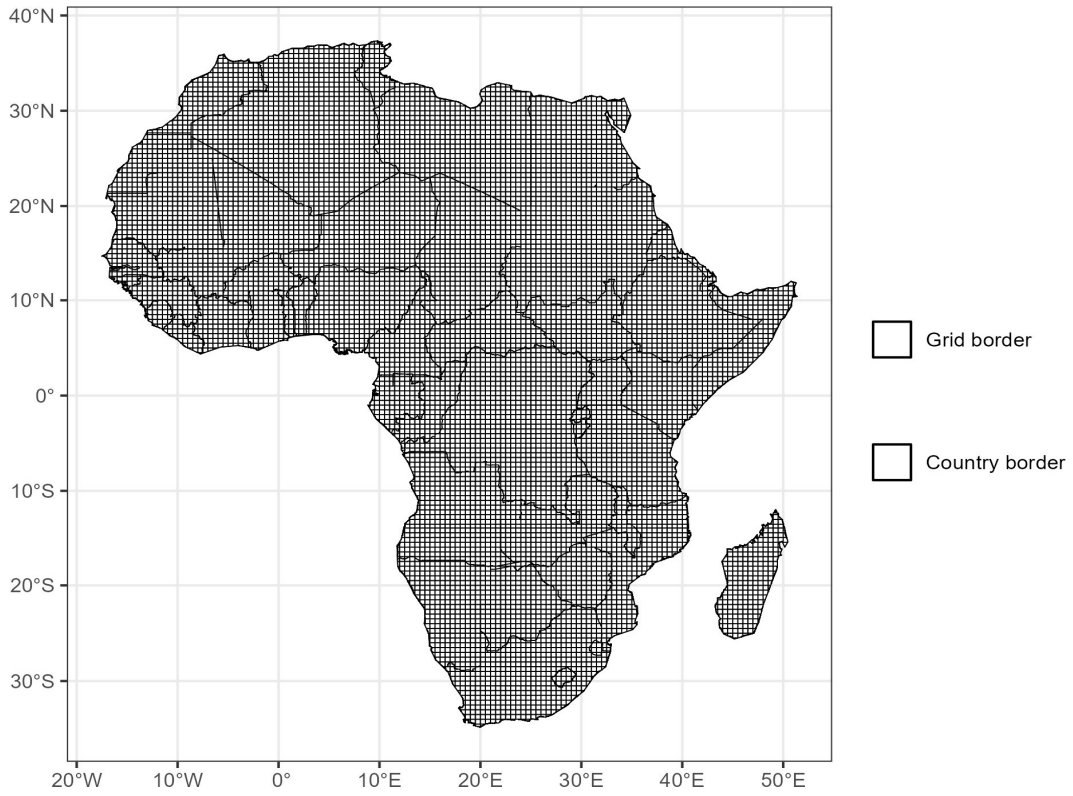
Furthermore, our analysis underscores that riot events are significantly more influenced by mineral prices than other forms of conflict, such as violence against civilians, protest events, explosions, or battles.

In a goal of public policy recommendation, first, we suggest that African countries, especially those affected by conflict, establish a geo-located database both of active mines and mines discovered but not yet exploited, as part of their strategies to counter insurgency. By focusing on these areas in addition to active mines, authorities can prevent tensions and deter insurgent or criminal groups from exploiting them for illegal purposes or funding.

Annex

Additional data description Grid and country borders

Map 4-2: Grid and country borders



Map 4-3: Conflicts map

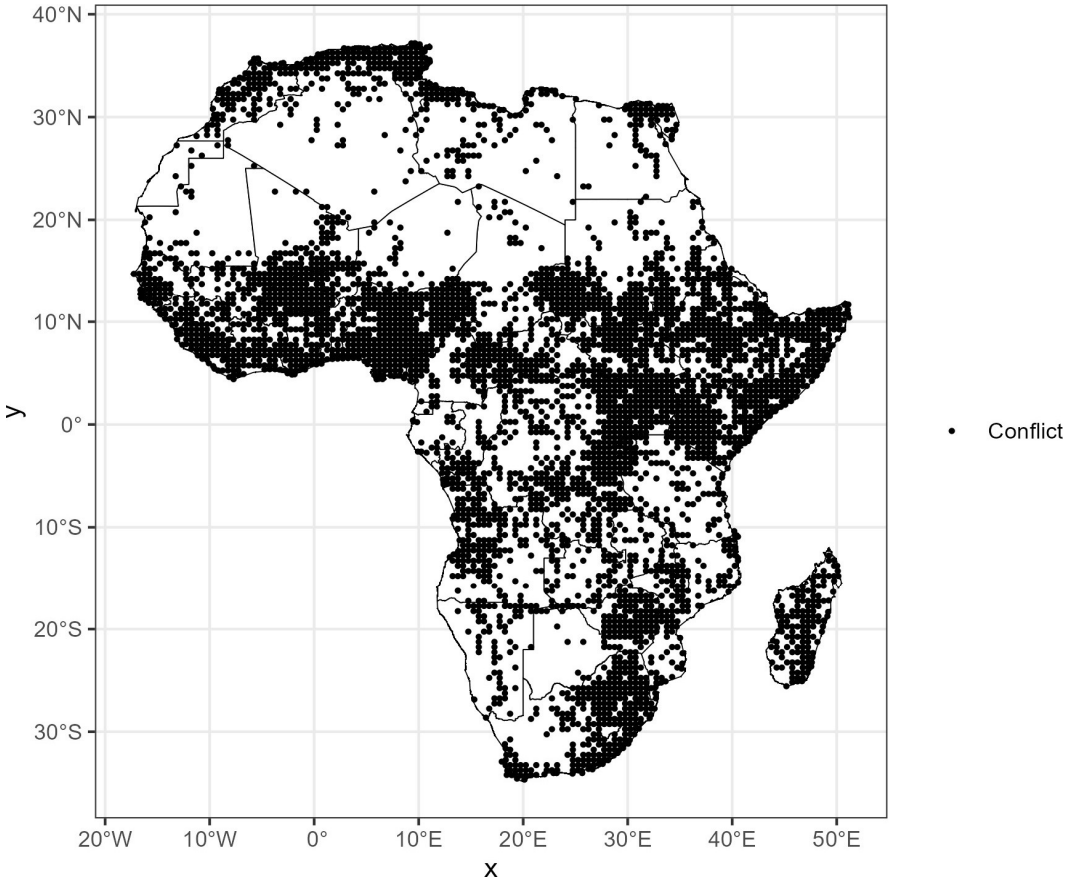


Figure 4-5: Evolution of the number of active mines

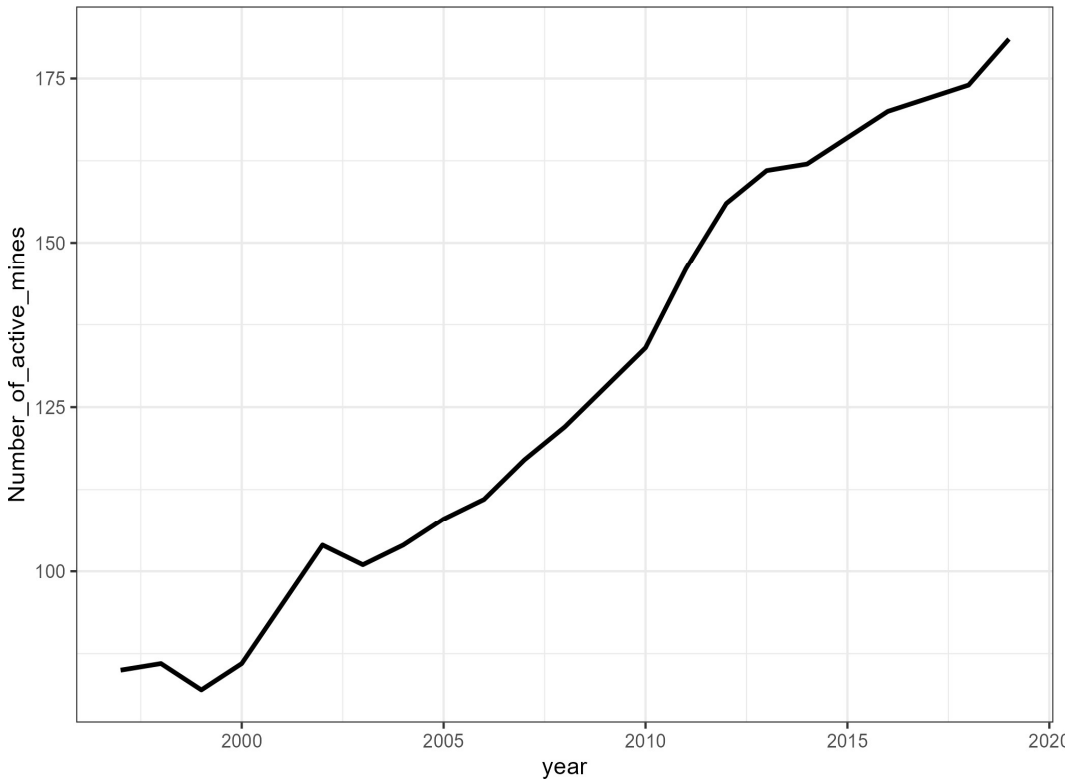


Figure 4-6: Mineral prices evolution ($/ton)

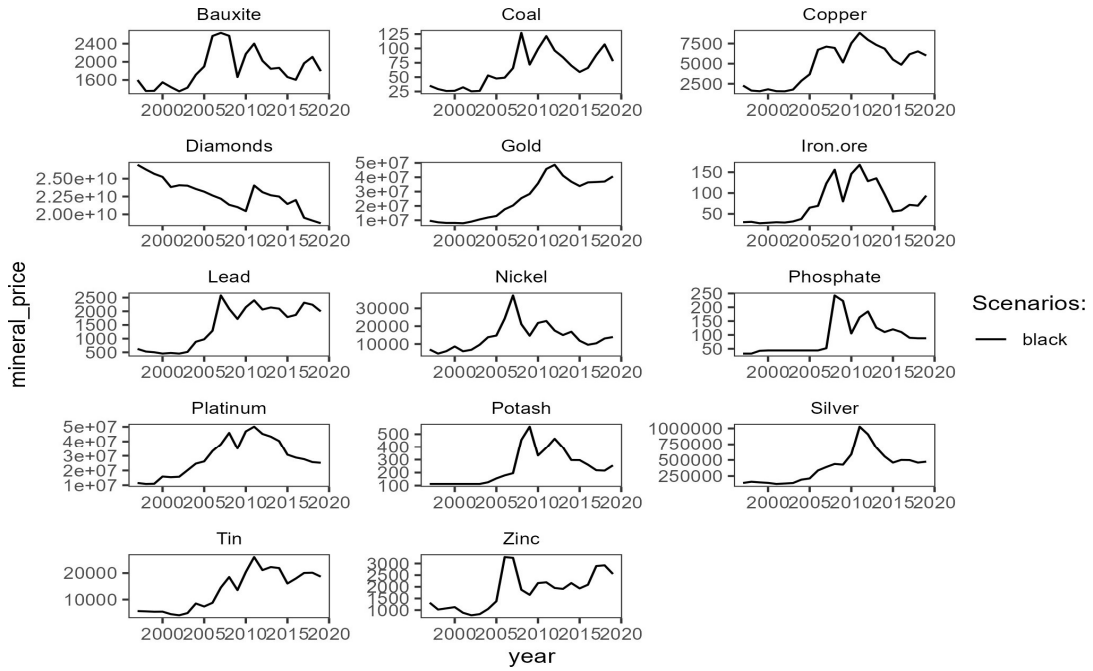


Table 4-5: Mineral prices summary table ($/ton)

	Mean	SD	Min	Max
Phosphate	92.18	61.67	32.50	242.74
Diamonds	22 770 031 520.97	2 179 424 149.47	18 754 974 350.28	26 946 022 071.58
Nickel	14 237.21	7573.11	4629.52	37 229.81
Copper	4884.08	2481.71	1559.48	8828.19
Zinc	1838.06	774.33	778.75	3275.29
Lead	1484.83	773.37	452.68	2579.99
Tin	13 538.93	7267.61	4060.50	26 053.68
Iron.ore	76.70	45.86	27.59	167.75
Gold	24 850 903.40	14 262 884.43	7 903 884.03	48 694 388.98
Coal	64.54	31.78	25.31	127.10
Platinum	29 036 717.97	12 464 561.49	10 858 179.08	50 151 557.32
Bauxite	1852.29	402.23	1349.92	2638.18
Potash	242.78	135.27	112.50	558.48
Silver	398 632.70	249 951.73	127 750.10	1 027 251.00

Source: Authors' calculations.

Annex B

Regressions

We use a similar model to the one in Bhattacharyya and Mamo (2021). We estimate the linear probability model:

$$C_{i,t+j} = \mu_i + \mu_{g,t} + Discov_{i,t} + PastDiscov_{i,t} + \varepsilon_{i,t} \quad (4.3)$$

where $c_{i,t+j}$ is a binary variable taking the value 1 if there is a conflict in period $t+j$ in cell i. μ_i is a cell fixed effects and $\mu_{g,t}$ is a country-year fixed effect. Discov is a binary variable worth 1 of a mine was discovered and PastDiscov is the number of years in the past 10 years that had a mine discovered. We estimate equation 5 for different leads j of the conflict variable.

Table 4-6: Discovered mines effect on conflicts (lag 6 to 10)

	Conflict Event				
	1	2	3	4	5
Disc lead(6)	−0.013				
	(0.017)				
Pas Disc(6)	0.006				
	(0.010)				
Disc lead(7)		−0.013			
		(0.017)			
Pas Dis(7)		0.017			
		(0.010)			
Disc lead(8)			0.014		
			(0.016)		
Pas Dis(8)			0.018+		
			(0.010)		
Disc lead(9)				−0.003	
				(0.015)	
Pas Dis(9)				0.031**	
				(0.010)	
Disc lead(10)					0.033+
					(0.018)
Pas Dis(10)					0.024*
					(0.011)
Nbs Ob	240 120	240 120	240 120	240 120	240 120

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001, Each regression includes time country-year fixed-effects and grid-cell, fixed-effects. Standard-errors are in parentheses and clustered by grid-cell.

Table 4-7: Observations with discovered mines and conflicts

	Number of obs.	Percent
Lag: 0	40	0.00017
Lag: 1	52	0.00022
Lag: 2	55	0.00023
Lag: 3	61	0.00025
Lag: 4	65	0.00027
Lag: 5	64	0.00027
Lag: 6	64	0.00027
Lag: 7	64	0.00027
Lag: 8	71	0.00030
Lag: 9	62	0.00026
Lag: 10	71	0.00030

Source: Authors' calculations.

Table 4-8: Main results using 2WFE estimates

Mine act. definition	Keep	Force	Keep	Force	Keep	Keep	Force	Force
Control group	All	All	Discov. mine	Discov. mine	Discov. mine	Discov. mine	Discov. mine	Discov. mine
IPW	No	No	No	No	Yes	Yes (lag)	Yes	Yes (lag)
	-1	-2	-3	-4	-5	-6	-7	-8
Mine act. = 1	0.033+	0.042*	0.010	0.011	0.014	0.005	0.005	−0.001
	(0.018)	(0.017)	(0.021)	(0.019)	(0.026)	(0.023)	(0.024)	(0.022)
Num.Obs.	237 590	238 165	8441	9016	8441	8074	9016	8624

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001Each regression includes time country-year fixed-effects and grid-cell fixed-effects.

Standard-errors are in parentheses and clustered by grid-cell.

Chapter 5. General Conclusion and Recommendations

In conflict-affected countries, especially in Africa, governments are faced with several challenges. Among these challenges is the state's capacity to mobilize resources to finance both the war effort and social investments such as education and health. This challenge gains heightened significance against the backdrop of declining foreign aid and the compounding crises, including the ongoing repercussions of the COVID-19 pandemic and the conflict in Ukraine.

In this context, this dissertation aimed to analyze the impact of conflict on resource mobilization in a developing setting. More specifically, it addressed three crucial research questions:

(i) Does political instability affect the impact of remittances on domestic tax collection in Africa?

(ii) How does neighboring terrorism affect the occurrence of customs fraud in Africa?

(iii) Do mineral prices impact conflict in Africa?

In Chapter 2, the dissertation established the link between migrant remittances, political stability and domestic taxes. The analysis covered 40 African nations from 2000 to 2019. It documents that the impact of migrant remittances is positively correlated with domestic tax revenues in stable countries: in countries with stable institutions, the development of official channels, enhances tax mobilization through the capture of remittance-related domestic tax revenues. Conversely, periods of economic downturns, social unrest, and tax fraud, associated with instability, may adversely affect migrant remittances, subsequently impacting tax revenues through both consumption and investment.

Chapter 3, explored the effect of terrorism contagion on gold customs fraud in Africa, in a panel of 50 African countries over the period from 2000 to 2019. The findings demonstrate a positive correlation between neighboring terrorism and gold customs fraud. This suggests that terrorist groups may exploit porous borders to facilitate illicit gold trade across state boundaries. Additionally, the study attested that the rule of law in neighboring countries acts as an inhibitor, mitigating the impact of neighboring terrorism on gold customs fraud in Africa.

Lastly, Chapter 4 analyzed the impact of mineral price variation on conflict, using discovered

mines as a control group. The analysis reveals that the estimated effect of mineral prices on conflict decreases by 20% to 40% when utilizing discovered mines as the control group. Furthermore, the research emphasizes that riots are significantly more influenced by mineral prices than by other conflict-related events, such as violence against civilians, protest events, explosion events, or battle events. Thus, the chapter concludes that discovered mines serve as inhibitors in the relationship between mineral prices and conflict in Africa from 1997 to 2019.

The dissertation could be significantly strengthened and serve as a valuable foundation for future research on the impact of conflict on resource collection in developing contexts. A key area for improvement is the integration of the large informal sector, which plays an outsized role in conflict zones and could potentially distort findings—particularly in the assessment of customs fraud related to gold smuggling. The informal economy, which often flourishes in regions with weak governance and ongoing conflicts, complicates the accurate measurement of illicit activities such as gold smuggling. Consequently, future research examining the relationship between terrorism and customs fraud should incorporate the informal economy at a micro level, utilizing micro-level datasets, to provide a more holistic view of these intricate dynamics.

Moreover, the flow of remittances through informal channels may skew the perceived impact of remittances on macroeconomic outcomes, especially in conflict-affected regions. Informal remittance systems, which are frequently unrecorded in official data sources like the World Bank, can lead to an underestimation of actual financial inflows, thereby obscuring the true influence of remittances on domestic resource mobilization and economic stability. To address this gap, future studies should account for informal remittance flows, based on survey data, to more accurately assess the impact of migrant remittances on domestic resources. This approach is particularly critical for conflict-affected African countries, where informal financial channels are prevalent, to ensure a more precise and nuanced analysis of the interplay between remittances, resource collection, and economic resilience.

In conclusion, our research highlights the limited capacity of African states to mobilize resources, particularly domestic taxes, within a context shaped by conflict. This reality calls for targeted

efforts to strengthen resource collection and enhance economic stability. Strengthened regional cooperation through institutions such as ECOWAS (Economic Community of West African States) and CAEMC (Central African Economic and Monetary Community) is essential to secure borders and improve tax collection mechanisms. Given that the Sahel is the region most affected by terrorism, it is crucial for countries to establish robust information-sharing systems within tax administrations to counter the destabilizing effects of terrorism. Coordinated regional efforts, including joint initiatives among tax administrations and the development of shared operational standards, will help mitigate revenue losses from conflict-related illicit trade. Such initiatives bolster the capacity of the Sahel, and African countries more broadly, to mobilize domestic resources, fostering economic resilience and stability in the face of growing security challenges.

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