

How Effective is Tackling Illicit Financial Flows in Africa? Evidence from Spatial Panel Analysis

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Abstract

Sub-Saharan African countries experience high levels of illicit financial flows (IFFs), which significantly undermine domestic resource mobilization. Recognizing the transnational nature of IFFs, some Regional Economic Communities (RECs) have adopted anti-IFF instruments to address these challenges. This study inventories regional anti-IFF policies and evaluates their effectiveness in reducing IFFs and enhancing domestic resource mobilization. Expanding the World Bank Residual approach to include remittances, we estimate total IFFs at USD 3,646.7 billion (15.4% of GDP) between 1980 and 2021. Using a spatial panel model, we assess two anti-IFF instruments—anti-corruption and anti-criminality—within Economic Community of West African States (ECOWAS) and Southern African Development Community (SADC), accounting for both direct and spillover effects. Results reveal significant spatial inter-dependencies. In ECOWAS, ratifying anti-IFF instruments enhances domestic resource mobilization, with positive spillover effects in neighboring countries but no significant reduction in IFFs. In contrast, in SADC, these instruments effectively reduce IFFs while simultaneously improving domestic resource mobilization, albeit with negative spillover effects. Key policy recommendations include strengthening cross-border anti-corruption frameworks in ECOWAS, enhancing financial oversight, and improving governance structures to prevent IFF displacement. In SADC, efforts should focus on reinforcing regulatory enforcement, mitigating spillover effects through regional coordination, and balancing trade openness with financial safeguards. These findings underscore the need for a coordinated regional and continental approach to tackling IFFs in Africa.

Keywords: Illicit financial flows, Domestic resources, Spatial panel data, Africa

JEL codes: C23, F36, G28, R11

1 Introduction

Illicit Financial Flows (IFFs) are defined as “financial flows that are illicit in origin, transfer, or use, often reflecting exchanges of value that cross country borders” (UNCTAD, 2020). These flows encompass a wide range of activities, including illicit commercial and tax practices, illegal markets, corruption, and the financing of crime and terrorism. A common thread among these activities is the illegal cross-border movement of money and assets, whether in their source, transfer, or use. IFFs have been recognized as a significant impediment to sustainable development, and they are explicitly addressed in the Sustainable Development Goals (SDGs) under indicator 16.4.1, which seeks to significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets, and combat all forms of organized crime.

The magnitude of IFFs is alarming, with over US\$1 trillion leaking annually from developing economies, and Africa alone losing more than US\$50 billion each year (Global Financial Integrity, 2020; UNECA, 2015). These flows erode the tax base, reduce government revenues, and divert resources away from development. They also undermine institutions, weaken the rule of law, and hinder structural transformation and sustainable economic growth. In low-income countries, particularly in Africa, IFFs pose a significant challenge to domestic resource mobilization (DRM), which is essential for providing public services and financing development.

The existing literature has extensively documented the detrimental effects of IFFs on DRM, particularly through the reduction of tax revenues in low-income countries (Ajayi, 1997; Ndikumana, 2009). However, there is a significant gap in the literature concerning the effectiveness of anti-IFF policies, particularly at the regional level in Africa. While anti-IFF policies have shown effectiveness in advanced economies, their impact in African countries remains unclear. This study seeks to address this gap by examining the effectiveness of anti-IFFs instruments within the regional economic communities (RECs) in Africa, focusing on their direct and spillover effects on both illicit flows and domestic resources.

To achieve this, we employ a spatial panel approach that accounts for interaction effects within and/or between RECs. We extend the measurement of IFFs to include remittances, as a potential channel through which unrecorded or illicit flows may occur, while recognizing that most remittances are legitimate transfers. In parallel, we conduct a quasi-exhaustive inventory of anti-IFFs instruments within African RECs. The data for this study includes estimates of IFFs based on the World Bank Residual approach, expanded to account for remittances, which are considered as potential sources of IFFs. Our analysis covers the period from 1980 to 2021, providing a comprehensive assessment of the effectiveness of anti-IFFs policies in African RECs.

Our findings reveal significant spatial interdependencies. In the Economic Community of West African States (ECOWAS), ratifying anti-IFF instruments enhances domestic resource mobilization, with positive spillover effects in neighboring countries but no significant reduction in IFFs. In contrast, in the Southern African Development Community (SADC), these instruments effectively reduce IFFs while simultaneously improving domestic resource mobilization, albeit with negative spillover effects. This study contributes to the literature in two ways. First, it provides updated estimates of IFFs in African countries, incorporating remittances as a new source of IFFs. Second, it offers insights into the direct and spillover effects of anti-IFF instruments on both IFFs and Domestic Resources Mobilization (DRM) within African RECs.

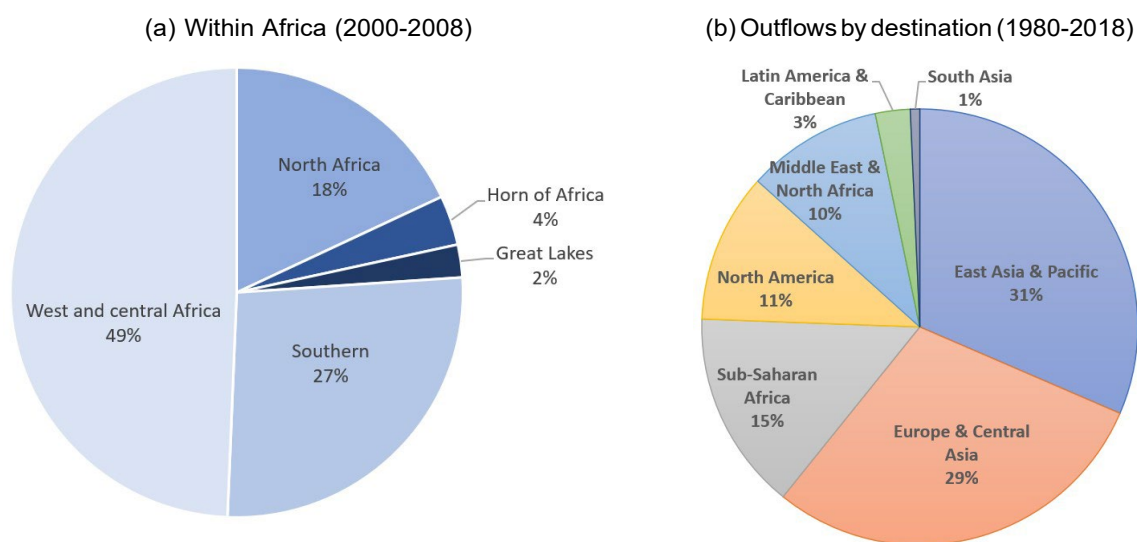
The remainder of this paper is structured as follows. Section 2 presents the background and key stylized facts. Section 3 reviews the literature on IFFs. Section 4 presents research hypotheses, while Section 5 inventories the anti-IFF instruments and policies in Africa. Section 6 outlines the empirical strategy employed in this study. Section 7 presents the estimated values of IFFs in African countries. Section 8 presents and discusses the results for ECOWAS and SADC. Sections 9 and 10 present endogeneity issues and robustness of spatial effects, respectively. Finally, Section 11 concludes the paper and presents some policy implications.

2 Background and stylized facts

IFFs constitute a major challenge for development in low-income countries (Brandt, 2020), particularly in sub-Saharan African (SSA) countries, given their impact on domestic investment and development. Previous research showed that IFFs reduce the capacity of domestic investment in these countries (Afolabi, 2022a; Leykun Fisseha, 2022). Since taxes are the main domestic resources for most African countries — with trade taxes alone accounting for about 44% of tax revenue on average — any loss through IFFs severely weakens the tax base. Thus, the magnitude of IFFs in these countries illustrates the weak capacity of Domestic Resources Mobilisation (DRM) (Afolabi, 2022b; Asmah et al., 2020; Thiao, 2021), which is a core means for development strategies and financing in developing countries. Mainly, DRM is imperative for providing crucial public services and an extra lever of development financing out of FDI and Official Development Aids (ODA) (Brandt, 2022). In addition, the increase of DRM becomes a requirement for African countries for financing the Agenda 2063 and SDGs in the context of Vision 2030 (UN, 2021). However, the level of DRM is below of the minimum desirable tax-to-GDP ratio of 15% and then still far from the level required for achieving different development goals (Addison et al., 2018; Boly et al., 2019). This gap in the domestic resources is mostly attributed to the IFFs which cause losses over 60 to 89 billion USD yearly in African countries (Boly et al., 2019; Mpofu, 2022).

Developing and emerging economies lost US\$7.8 trillion in illicit financial flows from 2004 through 2013 with illicit outflows increasing at 6.5% on average per year—nearly twice as fast as global GDP (Kar and Spanjers, 2015). In terms of destinations, East Asia and the Pacific have historically received the largest share of global IFFs, hosting 31% of these flows between 1980 and 2018 (Signé et al., 2020). Europe and Central Asia followed closely with 29%, while North America, Latin America and the Caribbean, and South Asia accounted for smaller portions (Figure 1b). However, when considering IFFs relative to GDP, SSA again stands out with the highest ratio, underscoring the region’s vulnerability to these illicit flows. Within Africa, West and Central Africa were the primary sink of IFFs accounting for 49% of the continent’s total between 2000 and 2008 (Figure 1a).

Figure 1: Illicit Financial Flows by region (%)



Source: Signé et al. (2020)

Efforts to curb IFFs in Africa have included various initiatives at the regional level, particularly through Regional Economic Communities (RECs). These initiatives target different sources of IFFs, such as illegal arms dealing and corruption, which are prevalent in many African nations. For example, the Regional Centres on Small Arms (RECSA) in the East African Community (EAC) and the Southern African Regional Police Chiefs Cooperation Organisation (SARPCCO) in the Southern African Development Community (SADC) have implemented measures to trace and control illicit small arms and light weapons (SALW), a significant source of IFFs (Alusala, 2018). Similarly, anti-corruption protocols within ECOWAS and SADC aim to reduce IFFs by establishing specialized anti-corruption agencies and promoting legal cooperation in confiscating proceeds from illicit activities (ECOWAS protocol, 2001; SADC protocol, 2001). Despite these efforts, the effectiveness of anti-IFFs instruments varies across regions, and challenges remain, particularly in countries affected by violence and armed conflicts, where both corruption and illegal arms dealing are significant sources of IFFs. The African Union's initiatives, such as the "Africa Amnesty Month for the Surrender and Collection of Illicit Weapons", are aligned with global targets, including SDG 16.4, which aims to significantly reduce illicit financial and arms flows by 2030 (Alusala, 2018).

In summary, IFFs continue to pose a substantial threat to the economic stability and development of African countries. While regional initiatives have been implemented to address this issue, their effectiveness varies, and more robust, evidence-based approaches are needed to free up resources that could be used for sustainable development. The persistence of IFFs, despite these efforts, highlights the need for continued research and policy development to better understand and combat these flows at both regional and global levels

3 Literature review

3.1 Impacts of IFFs and economic variables on the development

The negative impact of IFFs on economic development is well-documented. For instance, studies by [Nazar et al. \(2023\)](#) reveal that money laundering adversely affects key economic indicators. Similarly, [Adebimpe and Akin \(2022\)](#) and [John et al. \(2023\)](#) find that fraud and corruption undermine economic growth by weakening capital markets. [Afolabi \(2022a,2\)](#) and [Leykun Fisseha \(2022\)](#) emphasize that domestic investment is a critical channel through which IFFs negatively affect national economies, making them a significant obstacle to DRM ([Brandt, 2022](#)).

Recent data from [UNCTAD \(2023\)](#), covering the period 2010–2020, indicates that African countries with high levels of IFFs spend, on average, 25% less on health and 58% less on education. Furthermore, [UNECA \(2013\)](#) estimates that if Africa were to repatriate the illicit funds, the continent's capital stock could expand by over 66%, potentially increasing GDP per capita by 16%. The loss of these funds hampers investment in critical areas such as infrastructure, technology, value addition, and agricultural productivity. Analyzing the effect of IFFs on government revenue in WAEMU countries, [Thiao \(2021\)](#) found that IFFs have a significant negative impact on revenue, exacerbated by factors like per capita income, corruption, and governance.

In addition to anti-IFF instruments, a range of macroeconomic and institutional variables are known to influence both IFFs and DRM. Their inclusion as control variables in the empirical approach is grounded in well-established empirical and theoretical literature. Gross National Income (GNI) is included to capture a country's overall economic capacity and income level. Higher income levels are often associated with stronger tax bases and improved public finance systems ([Whiteside et al., 2019](#)). However, they may also attract illicit flows due to increased economic activity and financial complexity. Trade openness, typically measured as the ratio of exports and imports to GDP, plays a dual role. On one hand, greater openness can enhance DRM by expanding the tax base and facilitating economic growth. On the other hand, it increases exposure to trade mis-invoicing, a key component of IFFs, as shown by [Cobham and Janský\(2017\)](#). Trade-intensive economies are particularly vulnerable to fraudulent customs practices and capital flight via under-invoicing and over-invoicing. Institutional quality is critical in shaping both the scale of IFFs and the effectiveness of DRM. Robust institutions—characterized by government effectiveness, regulatory quality,

and rule of law—improve transparency and enforcement capacity, reducing opportunities for illicit flows (Adegboye et al., 2020). Governance quality also enhances the efficiency of tax systems and public resource management, making it a key enabler of DRM (Mamba, 2021). This is consistent with the “institutional economics” perspective, which emphasizes that weak institutions are at the core of capital leakages in developing countries. Financial development reflects the depth, access, and efficiency of the banking and capital markets. A well-functioning financial system not only facilitates savings mobilization and investment but also improves financial traceability, thereby limiting avenues for illicit transactions (Al Bakri and ALDulaimi, 2019). It is a crucial determinant of DRM capacity and a moderating factor in the relationship between openness and IFFs.

Together, these variables provide an empirical framework for isolating the net effects of anti-IFF instruments, while controlling for country-specific structural and economic characteristics that directly shape both IFF dynamics and the ability to mobilize domestic resources.

3.2 Anti-IFF Strategies

In response to the adverse effects of IFFs, various strategies have been implemented at national, regional, and international levels. At the national level, efforts include ethical or moral campaigns against corruption, drug legalization, and the use of institutional and technological tools to mitigate the trend of IFFs (Adam and Fazekas, 2021; Falisse and Leszczynska, 2022; Flentø, 2022; Reichborn-Kjennerud et al., 2019). Internationally, conventions like the African Union Convention on Preventing and Combating Corruption (AUCPCC) and UN drug conventions have been established as key anti-IFF measures (Mbandlwa and Anwana, 2021; Nelson and Obot, 2020). These initiatives provide a framework for countries to establish agencies dedicated to combating corruption and drug trafficking.

However, the effectiveness of these actions has been mixed. For instance, moral campaigns against corruption have yielded varying results, with some studies suggesting that anti-corruption messaging may paradoxically increase the willingness to pay bribes (Cheeseman and Peiffer, 2022). In Nigeria, the effectiveness of anti-corruption agencies like the Independent Corrupt Practices and Other Related Offences Commission (ICPC) and the Economic and Financial Crimes Commission (EFCC) has been contested, since corruption continues to soar in the country (Abdulrauf, 2020). In the commercial sector, digitalization has become a key strategy for addressing issues like trade misinvoicing and tax evasion. The use of Information and Communication Technology (ICT) as an anti-corruption tool has been widely adopted for enhancing transparency and accountability (Adam and Fazekas, 2021). Regional initiatives, such as ECOWAS and SADC protocols on corruption and the Southern African Regional Police Chiefs Cooperation Organisation (SARPCCO) in East and Central Africa, have also been instrumental in combating IFFs (Alusala, 2018).

Despite these efforts, the persistence of IFFs highlights the need for more robust and coordinated international strategies. The digitalization of governance, the strengthening of regional protocols, and the adoption of new technologies are essential steps in the fight against IFFs.

3.3 Contributions

This study makes two key contributions to the literature on illicit financial flows (IFFs) and domestic resource mobilization (DRM) in Africa, directly addressing gaps identified in prior empirical and policy research.

First, it extends existing IFF measurement approaches by incorporating remittances, a financial flow traditionally viewed as development-enhancing, into the estimation of IFFs. While previous studies emphasized the positive role of remittances in supporting household welfare and macroeconomic stability (Nyamongo et al., 2012), few have empirically examined their potential misuse as channels for money laundering or

unrecorded capital transfers, particularly in countries with weak financial oversight (Campbell et al., 2022; Ley et al., 2019). This study provides updated IFF estimates for 48 African countries over the period 1980–2021 using an expanded version of the World Bank Residual method, thereby filling a methodological and empirical gap in the literature by offering a more comprehensive understanding of the scale and nature of IFFs.

Second, the paper contributes to the evaluation of anti-IFF instruments at the regional level, which has been insufficiently studied despite the growing body of work on the economic consequences of IFFs. While much of the existing literature focuses on the effects of IFFs on macroeconomic indicators such as investment, tax revenue, and public services (Brandt, 2022; Nazar et al., 2023; Thiao, 2021), few studies assess the effectiveness of regionally coordinated responses, particularly those implemented by African RECs. By analyzing the direct and spillover effects of anti-corruption and anti-criminality instruments within ECOWAS and SADC using a spatial panel approach, this paper deepens our understanding of how these policies affect both IFF reduction and DRM across borders. The findings thus contribute to both the policy evaluation literature and to the broader governance and development finance discourse in Africa.

4 Research hypotheses

This study formulates three hypotheses grounded in prior theoretical and empirical work on IFFs, institutional effectiveness, and spatial externalities:

(H1) – Direct Reduction Hypothesis

Anti-corruption and anti-criminality instruments are designed to raise the expected cost of hiding and moving illicit proceeds. From a deterrence perspective, improvements in monitoring, legal sanctions, and cross-border cooperation reduce opportunities for trade misinvoicing, profit shifting, and embezzlement. Empirically, improved governance and stronger enforcement have been associated with lower IFF and financial crime in several studies (Kar and Spanjers, 2015; Ndikumana and Boyce, 2011). However, effectiveness depends on implementation: weak enforcement or a narrow legal scope can limit impact. We therefore expect a negative within-country effect of well-implemented anti-IFF instruments on measured IFFs, with the effect size increasing in enforcement capacity and governance quality.

H1 — Hypothesis statement: Anti-IFF instruments reduce IFFs in countries where they are implemented (direct negative effect).

(H2) – Resource Mobilization Hypothesis

IFFs reduce the tax base and public revenues by diverting taxable economic value outside the formal economy (Brandt, 2022; Thiao, 2021). By curbing leakages, anti-IFF instruments should increase the resources available for public spending and investment through higher tax compliance, improved collection, and recovery of assets. Institutional reforms that improve transparency and oversight also foster a larger formal financial sector and higher taxable activity (Addison et al., 2018). Nevertheless, the DRM benefit can be conditioned by administrative capacity: countries with weak fiscal administrations may see smaller direct revenue gains even if IFFs fall. Therefore, we expect a positive within-country effect of well-implemented anti-IFF instruments on DRM, with the effect size increasing in administrative capacity.

H2 — Hypothesis statement: Anti-IFF instruments improve DRM in countries that adopt and effectively implement them (direct positive effect).

(H3) – Spillover Hypothesis

Policy actions in one country can affect neighboring countries through two competing spatial channels. First, displacement (negative spillover): illicit actors relocate activities to neighbors with weaker enforcement, rais-

ing IFFs and reducing DRM there (an effect analogous to “pollution havens” in the environmental literature; Reuter & Truman, 2004). Second, diffusion/coordination (positive spillover): stronger enforcement in one country can improve regional compliance norms, information sharing, and capacity building, thereby raising DRM and reducing IFFs in neighbors. The net sign of cross-border effects depends on enforcement asymmetries, the intensity of cross-border economic links, and the extent of regional cooperation. Thus, we expect spatial effects but do not a priori fix their sign for all settings—rather, we expect displacement where enforcement asymmetry is large, and positive spillovers where cooperation and harmonization exist.

H3 — Hypothesis statement: Anti-IFF instruments generate cross-border (spillover) effects. Specifically, they may (a) displace illicit flows to neighbouring countries with weaker enforcement (negative spillovers on neighbours’ DRM), or (b) produce positive spillovers through policy diffusion and improved regional cooperation; the dominant effect depends on regional enforcement asymmetries and institutional coordination.

These hypotheses will be tested using a spatial panel model that accounts for both within-country effects and cross-border spillovers in IFFs and domestic resource outcomes, allowing us to distinguish the direct and indirect effects of anti-IFF instruments across African RECs.

5 Anti-IFFs instruments in Africa: an inventory

5.1 Instruments

The United Nations Convention Against Corruption (UNCAC) is the only legally binding universal anti-corruption treaty at both international and multilateral levels, covering areas such as preventive measures, criminalization, law enforcement, international cooperation, asset recovery, and technical assistance. At the regional level in Africa, ECOWAS and SADC have established internal protocols and conventions to combat IFFs, focusing on corruption and criminal sources. These protocols act as supplementary instruments to the UNCAC. Additionally, the African Union (AU) adopted the Convention on Preventing and Combating Corruption (AUCPCC) in 2003, which came into force in 2006. To date, 44 countries have ratified this convention. These instruments address corruption activities such as foreign bribery, lobbying, embezzlement, and money laundering. The shared objectives of these anti-corruption instruments include promoting and strengthening mechanisms for preventing, detecting, and eradicating corruption, encouraging cooperation among states, and harmonizing policies and legislation across member states.

Commercial transactions are a significant source of IFFs in Africa, particularly through trade misinvoicing and transfer pricing. However, no specific internal anti-IFF instruments exist for commercial sources within any African REC. This gap highlights the need for developing such instruments at the continental or regional level. External measures like double tax agreements (DTAs) are widely used in the absence of tailored regional instruments. DTAs are treaties between two or more countries designed to avoid double taxation of income and property and to prevent fiscal evasion (Quak and Timmis, 2018). Approximately 3,000 DTAs are currently in force worldwide, with 205 involving African countries (Quak and Timmis, 2018).

The United Nations Convention against Transnational Organized Crime (UNTOC) is the primary international instrument in the fight against transnational organized crime and is the only legally binding anti-criminal treaty at the international and multilateral levels. It represents a significant step forward in addressing the challenges posed by transnational organized crime and underscores the need for close international cooperation. Within Africa, ECOWAS has established a convention specifically addressing illegal arms trafficking, while SADC has adopted three supplementary protocols to UNTOC, targeting illegal trafficking of arms, wildlife, and drugs, respectively.

IFFs are a major obstacle preventing countries from fully benefiting from their natural resources, as much of the wealth is siphoned off by foreign interests. In Africa, where trade mispricing in the export of natural

resources is prevalent, there is a notable lack of binding instruments specifically targeting IFFs from extractive industries. However, in West Africa, the ECOWAS Mining Directive was adopted in 2009 to improve transparency in mineral resource management and to engage states and companies in accountability practices, including respecting human rights and preserving the environment. This directive is legally binding only on member states, not on companies or individuals.

5.2 Recapitulation of anti-IFFs instruments

At international (UN), African (AU), regional (RECs), and national levels, a variety of anti-IFF instruments have been established to combat IFFs. Given the interconnectedness of markets, which diminishes the effectiveness of national-level anti-IFF policies, this study focuses on key instruments in force within African RECs. The analysis covers five AU-recognized RECs: Arab Maghreb Union (AMU), Economic Community of Central African States (ECCAS), Common Market for Eastern and Southern Africa (COMESA), Economic Community of West African States (ECOWAS), and Southern African Development Community (SADC). The emphasis is on treaties, particularly conventions and protocols, as they require ratification, signaling a signatory's commitment to abide by the established principles and rules.

Table A5 in the appendix summarizes the relevant anti-IFF instruments by RECs in Africa, distinguishing between internal and external instruments. Internal instruments are conventions and protocols established within a REC that directly impact member states, while external instruments, such as those developed at the continental (AU) or global (UN) level, have broader applicability across regions. For example, the ECOWAS protocol on corruption is an internal instrument specific to that region, while AU or UN protocols and conventions are considered external instruments. In the empirical analysis, the study prioritizes internal anti-IFF instruments to assess their direct, spillover, and overlapping effects within and between countries and RECs.

The inventory categorizes anti-IFF instruments by the source of IFFs: commercial, corruption, criminal, and illegal market. However, not all RECs have internal instruments addressing every IFF source. For instance, there is no internal protocol or convention related to commercial sources, particularly on tax avoidance and evasion, within the selected RECs. Instead, they rely on the "Convention on Mutual Administrative Assistance in Tax Matters," developed jointly by the Organisation for Economic Cooperation and Development (OECD) and the European Union (EU). Similarly, for other IFF sources, when internal protocols or conventions are lacking, regional or community-wide instruments are utilized. This is the case for the Arab Maghreb Union (AMU) in the areas of corruption, criminal activities, and illegal markets, where the Arab Convention Against Corruption, the Arab Convention for the Suppression of Terrorism, and the League of Arab States (LAS) decisions on combating illicit trade of small arms and light weapons are employed, respectively. The ratification dates of these instruments are used in the econometric analysis to evaluate their impact.

5.3 New estimates of IFFs

Since [Claessens et al. \(1993\)](#), measurement approaches have focused on anomalies in the capital account (unrecorded capital movements) and current account (trade mispricing). Two commonly used methods are the “World Bank Residual” (WBR) and “Hot Money Narrow” (HMN). The WBR method estimates IFFs by calculating the residual difference between capital inflows and the uses of foreign exchange ([Kar and Cartwright-Smith, 2010](#); [Ndikumana and Boyce, 2008](#)). The Balance of Payment (BoP) identity is expressed as:

$$CAB + NEF + OSK + FPI + DMB + CR + NEO + CEB = 0 \quad (1)$$

where the terms of the equation represents: Current Account Balance (CAB), Net Equity Flows (NEF), Other Short-term Capital of Other Sectors (OSK), Foreign Portfolio Investment (FPI), Deposit-Money Banks’ Foreign Assets (DMB), Change in Central Bank Reserves (CR), Net Errors and Omissions (NEO), and Change in External Debt (CEB), respectively.

Using this identity, WBR captures the difference between recorded inflows and recorded uses ([Kar and Cartwright-Smith, 2010](#); [Ndikumana and Boyce, 2008](#)):

$$-(CAB + CR) = CEB + (OSK + FPI + NEF + DMB) + NEO \quad (2)$$

While this method assumes that unrecorded flows are illicit, it may overestimate IFFs by including licit flows. The HMN method, which focuses on the NEO component, also faces challenges in isolating illicit flows, as legal transactions may remain unrecorded for legitimate reasons.

For this study, we adopt the WBR method with modifications to account for emerging financial flows in Africa, particularly remittances. Remittances have become the largest source of external financial flows in Africa, totaling \$54 billion in 2022 ([Bank/KNOMAD, 2024](#)). However, the high costs of remittances in Sub-Saharan Africa (averaging 7.9% in 2023) often push transactions into informal channels, increasing the risk of their use in illicit activities such as money laundering and smuggling ([Nationen, 2018](#)).

To estimate IFFs, we modify the WBR equation as follows:

For a country i in year t ,

$$IFF_{it} = [CEB + (OSK + FPI + NEF + DMB) + REM] - [CAB - CR] \quad (3)$$

≡

$$IFF_{it} = [\Delta DEBT_{it} + FDI_{it} + REM_{it}] - [CA_{it} - \Delta RES_{it}] \quad (4)$$

i denotes the country as previously. t is the dimension of the time series, that is, from 1980 to 2021. $\Delta DEBT$ represents the change in the country’s stock of external debt, adjusted for cross-currency exchange rate fluctuations; FDI is net foreign direct investment; CA is the current account deficit; ΔRES is the change in the stock of international reserves; finally, REM (level or variation) represents net remittances as new channels through which IFFs can occur in African countries.

This approach captures the unaccounted funds as IFFs, though it does not provide details on the types of IFFs or related activities.

5.4 Assessing the Impact of Anti-IFFs Instruments on IFFs and DRM

In the final research step, we assess the impact of anti-IFF instruments on IFFs and DRM using spatial econometrics, which accounts for interaction effects among geographical units. This approach is well-suited for exploring the regional economic and geographic dependencies that influence IFFs. We apply a spatial panel data model based on [LeSage and Pace \(2009\)](#), which captures both direct and indirect effects of anti-IFFs instruments on IFFs and domestic resources:

$$IFF_{it} = \Phi_k \sum_{k=1}^K D_i^k \times \theta'X + \mu_i + \eta_{it} \quad (5)$$

$$DR_{it} = \Psi IFF_{it} + \Phi_k \sum_{k=1}^K D_i^k \times (1 + \Theta IFF_{it}) + \theta'X + \mu_i + \eta_{it} \quad (6)$$

i denotes the country as previously. t is the dimension of the time series, that is, from 1980 to 2021. DR represents Domestic Resources that are captured by the sum of resource and non-resource revenue excluding social contribution. D_i^k ($k = 1, 2, \dots, K$) denotes the Dummy Variable with $D_i^k = 1$ if the country or REC has ratified the Anti-IFFs Instruments. X = Vector of Control Variables including GNI growth, Trade Openness, Governance Quality, and Financial Development, which are selected based on the literature. Ψ and Θ account for direct and indirect effects of IFFs on domestic resources. θ is the vector of key parameters related to control variables in the model. μ_i is an individual effect that cannot be directly observed and quantified. η_{it} is a disturbance term that varies with the individual and time. If μ_i is related to explanatory variables, the panel data model is a fixed effects model; otherwise, it is a random effects model.

The model accounts for both contemporaneous and lagged effects of anti-IFFs instruments, recognizing that their impact may not be immediate. When multiple anti-IFF instruments are adopted by a Regional Economic Community (REC), overlapping effects may arise, potentially biasing the analysis. To address this, one approach is to introduce these instruments sequentially, allowing the isolation of the direct effects of each. Due to historical, political, or economic factors, countries are often members of more than one REC, leading to overlapping memberships and potential conflicts between anti-IFF instruments. In cases where overlapping effects occur, we resolve this by analyzing the country within a single REC, selected based on economic relevance. Diagnostic tests for spatial dependence (Table A6), autocorrelation (Table A7), and unit roots (Table A8), along with a Moran scatter plot (Fig 6), were conducted to support the spatial panel model (see Appendix B).

5.5 Empirical strategy: Spatial Panel Models

Given the transborder nature of IFFs, spatial econometric models are appropriate for testing the hypotheses of this study. These models quantify direct and indirect effects, both short-term and long-term, and can distinguish between different types of spatial interactions ([Elhorst and Fréret, 2009](#)). The general form of the spatial panel data model ([Elhorst, 2014](#)) is as follows:

$$y_{it} = \rho W y_t + \Phi_k \sum_{k=1}^K D_i^k \times IFF_{it} + \theta'X + \delta'WH_t + \mu_i + \eta_{it} \quad (7)$$

$$\eta_{it} = \lambda W \eta_t + \epsilon_{it}$$

where $W y_t$ and WH_t capture endogenous and exogenous spillover effects across countries, respectively, while $W \eta_t$ captures the interaction effect among the error terms of different countries. The coefficient ρ , the spatial autoregressive coefficient, indicates the extent of spatial dependence of the dependent variable across countries. It measures how the dependent variable in a particular country is influenced by the dependent variable in neighboring countries. The spatial autocorrelation coefficient, λ , reflects the degree of correlation between the error terms of neighboring countries, signifying how unobserved factors influencing the dependent variable are spatially correlated. The vector δ represents the parameters that capture the marginal effect of independent variables from nearby observations on the dependent variable, which is known as an indirect effect (or a spillover effect). In contrast, the coefficients Φ and θ denote the direct effects of

the independent variables within the country, where Φ is associated with specific variables like anti-IFFs instruments, and θ with other exogenous factors in the model. When testing our hypotheses, we expect that a significant negative (or positive) Φ coefficient, coupled with a positive (or negative) δ , will validate the hypothesis that anti-IFFs instruments negatively (or positively) influence illicit financial flows (or domestic resources) within a country while simultaneously having a positive (or negative) effect on these variables in neighboring countries. This distinction between direct and indirect effects helps in understanding both the within-country impact and the cross-border spillover effects of various policies.

These models allow us to explore how IFFs and domestic resources in one country are influenced by those in neighboring countries, capturing the spillover effects of anti-IFFs instruments across regions. According to [Elhorst \(2014\)](#), a family of linear spatial models can be derived from the general form presented in equation 7 depending on the restrictions made on spatial parameters (ρ , δ , and λ). The four common spatial models with its corresponding restrictions on parameters are shown in the following Table 1.

Table 1: Spatial panel models

Spatial models	Specification	Restrictions
Spatial autoregressive model (SAR)	$y_{it} = \rho W y_t + \Phi_k \sum_{k=1}^K D_i^k \times IFF_{it} + \theta' X + \mu_i + \epsilon_{it}$	$\delta = \lambda = 0$
Spatial durbin model (SDM)	$y_{it} = \rho W y_t + \Phi_k \sum_{k=1}^K D_i^k \times IFF_{it} + \theta' X + \delta' W H_t + \mu_i + \epsilon_{it}$	$\lambda = 0$
Spatial errors model (SEM)	$y_{it} = \Phi_k \sum_{k=1}^K D_i^k \times IFF_{it} + \theta' X + \mu_i + \eta_{it}$ $\eta_{it} = \lambda W \eta_t + \epsilon_{it}$	$\rho = \delta = 0$
Spatial autoregressive confused model (SAC)	$y_{it} = \rho W y_t + \Phi_k \sum_{k=1}^K D_i^k \times IFF_{it} + \theta' X + \mu_i + \eta_{it}$ $\eta_{it} = \lambda W \eta_t + \epsilon_{it}$	$\delta = 0$

Source: Authors

In spatial econometrics, a connectivity matrix W is required to quantify the spatial structure between countries ([Fotheringham and Rogerson, 2008](#)). The spatial relationships can be based on factors such as adjacency, distance, or population density. The simplest form is a binary adjacency matrix, where $w_{ij} = 1$ if countries i and j share a border, and $w_{ij} = 0$ otherwise. Another common option is the inverse distance weight matrix, where $w_{ij} = 1/d^\alpha$, with d representing the distance between countries and α being a positive exponent. By convention, $w_{ii} = 0$ as countries cannot exert spillover effects on themselves. There is no universal agreement on the appropriate weighting matrix for spatial econometric models. [Arora and Brown \(1977\)](#) suggested neutral weights, while [Hordijk \(1979\)](#) proposed using a general weighting matrix. [Anselin \(1988\)](#) emphasized the importance of carefully selecting the structure of spatial dependence, aligning it with broader theories of spatial interaction, such as accessibility and potential.

In this study, we use a spatial weights matrix based on economic distance, specifically the trade openness rate between African countries. Trade openness, as a key driver of domestic resource mobilization (DRM) and a conduit for capital outflows through illicit financial flows (IFFs), is an appropriate measure for capturing spatial relationships ([Spanjers, 2015](#); [Thiao, 2021](#)). The spatial weights matrix, therefore, is constructed using trade openness, measured as the sum of exports and imports between countries i and j , normalized by the GDP of country i : $q_{ij} = (Export_{ij} + Import_{ji})/GDP_i$. Thus, the spatial weights matrix W is developed as follows:

$$w'_{ij} = \begin{cases} q_{ij} & \text{if } i \neq j \\ 0 & \text{if } i = j \end{cases} \quad (8)$$

$$w_{ij} = \frac{w'_{ij}}{\sum_{j=1}^{54} w'_{ij}} \quad (\text{row - standardization}) \quad (9)$$

$$\sum_{j=1}^N w_{ij} = 1, \quad i = 1, \dots, N \quad (\text{condition for row - standardized}) \quad (10)$$

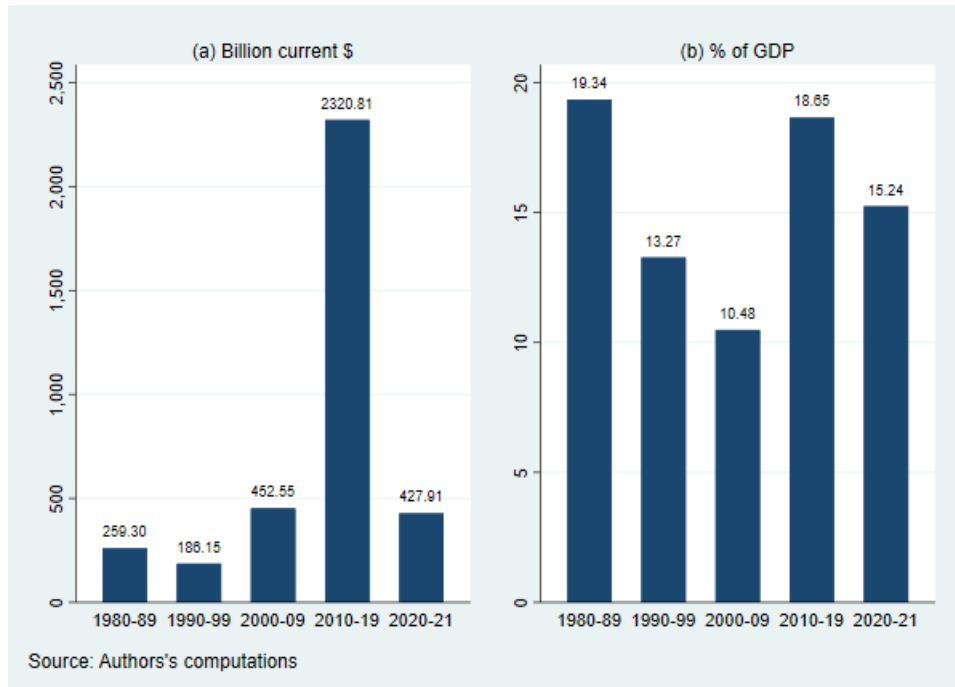
5.6 Data

The analysis covers the period 1980-2021, utilizing data from international sources such as the World Bank, IMF, and ICTD/UNU-WIDER. The choice of 2021 as the endpoint is driven by data consistency. While more recent figures are available for some variables, harmonized and comparable data on IFFs and related macroeconomic indicators, DRM in particular, are not yet released beyond 2021. Restricting the sample to 2021 ensures robustness, comparability across countries, and reliability of the results, while still providing more than four decades of coverage. Variables include estimates of IFFs, measures of domestic resources, relevant control variables, and additional indicators used to compute IFF estimates. A governance index was constructed with indicators from World Governance Indicators using the principal components analysis (PCA) approach, while the financial development index comes from the IMF dataset. The analysis includes 40 African countries within the framework of Regional Economic Communities (RECs). The description of variables with data sources and expected signs of variables are presented in Table A1 in the appendix. Table A4 in the appendix presents the selected countries within Regional Economic Communities (REC).

6 Estimates of IFFs

Using the WBR approach, we estimated the IFFs in 48 African countries from 1980 to 2021, where data was available. The cumulative IFFs over this period amount to an estimated US\$ 3,646.7 billion, which represents 15.4% of the total GDP of these countries. Figure 2 illustrates the trend in IFFs over time, showing a significant increase from US\$ 259.3 billion in the 1980s to US\$ 2,320.8 billion in the 2010s. This sharp rise, particularly in the last decade, underscores the global escalation of IFFs. The dramatic increase in the 2010s is largely driven by five countries: Egypt (346%), Ghana (361%), Morocco (137%), Nigeria (693%), and South Africa (82.9%). In these nations, the surge in debt has been a primary factor contributing to this upward trend. The IFFs-to-GDP ratio was notably high in the 1980s (19.34%) and 2010s (18.65%), while it dipped in the 1990s and 2000s (10.48%). Our estimates align closely with those of the Global Financial Integrity (GFI). According to Kar and Cartwright-Smith (2010), IFFs in the 1980s and 1990s were estimated at US\$ 203.9 billion and US\$ 155.7 billion, respectively. For the period 2000-2008, cumulative illicit flows were calculated at US\$ 437.2 billion, which is comparable to our estimate of US\$ 452.6 billion for 2000-2009. Furthermore, between 2004 and 2013, IFFs were estimated at US\$ 675.0 billion, representing 6.1% of GDP, as reported by Kar and Spanjers (2015), which is in line with our findings.

Figure 2: IFFs by period, 1980-2021



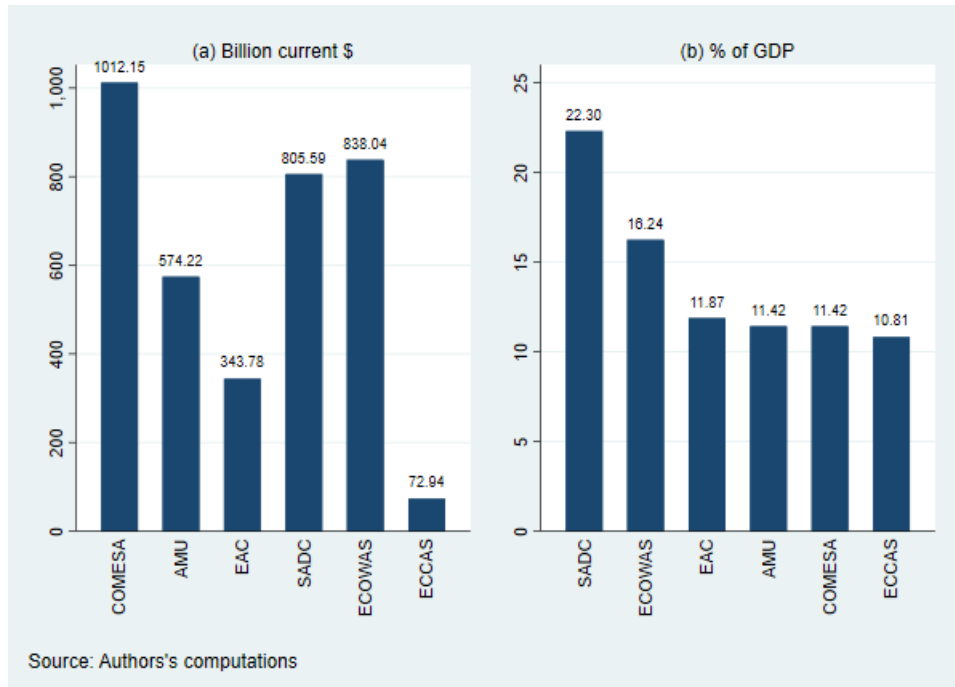
Comparing our results with those of [Ndikumana and Boyce \(2018\)](#), who estimated capital flight using the BoP residual method for 30 African countries, we see differences in absolute values—US\$ 314.5 billion, US\$ 116.8 billion, and US\$ 186.2 billion for the 1980s, 1990s, and 2000s, respectively. However, the overall trends are consistent, indicating that updates to the methodology, as employed by Ndikumana and Boyce, could further refine our estimates. Table 2 presents the nominal value of IFFs by country and decade. During the 2004-2013 period, South Africa and Nigeria ranked 7th and 10th among the top ten countries with the highest cumulative IFFs, registering US\$ 209.2 billion and US\$ 178.0 billion, respectively. Over the entire period from 1980 to 2021, the top ten countries with the highest nominal IFFs include Egypt, South Africa, Mozambique, Morocco, Nigeria, Ghana, Kenya, Tunisia, Sudan, and Tanzania. Patterns of the IFFs-to-GDP ratio by country are detailed in Table A3 in the appendix.

Figure 3 provides a breakdown of IFFs by Regional Economic Communities (RECs). From 1980 to 2021, COMESA recorded the highest IFFs at US\$1,012.2 billion, followed by ECOWAS with US\$838.0 billion and SADC with US\$805.6 billion. The EAC and ECCAS regions exhibited relatively lower levels of IFFs during this period. This distribution mirrors findings by [Kar and Cartwright-Smith \(2010\)](#), where West and Central, as well as Southern African regions, were identified as having the highest levels of IFFs from 1970-2008. In terms of GDP, SADC (22.3%) and ECOWAS (16.2%) experienced the highest IFFs, indicating that these regions face significant challenges related to illicit financial flows. The relationship between IFFs and natural resource wealth is particularly noteworthy. Resource-rich countries accounted for 55.4% of total IFFs over the period. These nations are often more susceptible to IFFs due to weak governance, corruption, and difficulties in managing vast natural resources. This "resource curse" often leads to mismanagement and corruption, making these countries more vulnerable to IFFs as elites and corporations seek to transfer wealth abroad illicitly ([Murshed and Murshed, 2018](#); [Votava et al., 2018](#)).

Table 2: Nominal IFFs, Billion current \$

Country	Decade					
	1980-89	1990-99	2000-09	2010-19	2020-21	1980-2021
Algeria	17.757	-2.488	-83.499	121.197	12.643	65.609
Angola Benin	0.000	-7.248	-8.300	-21.361	-15.338	-52.247
Botswana	2.172	2.126	4.530	12.421	4.459	25.709
Burkina Faso	-0.010	-2.510	-0.380	0.351	0.875	-1.674
Burundi	0.000	0.000	4.538	17.210	0.989	22.737
Cabo Verde	0.000	0.000	-0.395	3.717	0.000	3.322
Cameroon	0.368	1.434	3.707	5.495	1.564	12.567
Central African Republic	7.709	8.869	-0.508	29.889	6.626	52.585
Chad	0.931	0.371	0.000	0.000	0.000	1.303
Comoros	0.464	0.428	0.000	0.000	0.000	0.891
Congo, Dem. Rep. of the	0.279	0.183	0.686	1.423	0.547	3.117
Congo, Republic of	0.000	0.000	6.258	37.230	5.791	49.279
Côte d'Ivoire	5.408	5.279	7.511	14.584	-3.106	29.675
Djibouti	0.000	0.000	1.405	14.988	13.817	30.210
Egypt	0.000	-0.402	1.591	2.156	0.747	4.092
Eritrea	72.582	34.788	90.403	403.959	122.749	724.481
Eswatini	0.000	0.887	0.246	0.000	0.000	1.133
Ethiopia	1.025	1.795	2.310	-0.091	0.081	5.120
Gabon	8.535	-1.991	14.709	94.061	14.948	130.261
Gambia, The	3.714	-1.845	-10.025	-2.924	0.000	-11.080
Ghana	0.132	0.000	0.696	3.220	1.455	5.504
Guinea	2.467	9.138	23.316	107.503	27.119	169.544
Guinea-Bissau	0.930	2.864	4.083	12.904	-6.165	14.616
Kenya Lesotho	0.287	0.679	0.685	0.965	0.830	3.446
Liberia	5.489	14.097	12.143	95.993	23.827	151.549
Madagascar	5.844	11.395	4.497	8.014	1.200	30.950
Malawi	0.000	0.000	0.181	23.682	2.282	26.145
Mali	4.025	3.842	9.697	14.792	3.165	35.520
Mauritania	0.000	1.829	2.713	16.354	4.343	25.239
Mauritius	3.427	4.262	7.148	23.626	5.824	44.287
Morocco	2.427	0.562	0.000	11.037	2.394	16.420
Mozambique	0.000	1.748	8.575	13.466	3.630	27.418
Niger	29.958	28.522	71.460	169.810	31.918	331.667
Nigeria	0.000	0.000	8.071	127.615	25.607	161.293
Rwanda	2.123	1.928	4.792	23.674	7.040	39.558
Senegal	50.969	1.002	-38.956	231.325	62.237	306.578
Sierra Leone	0.000	0.000	0.000	17.026	5.747	22.774
South Africa	5.768	5.874	17.156	50.907	22.730	102.436
Sudan	0.628	0.938	1.738	13.657	1.483	18.445
Sao Tomé and Príncipe	0.000	18.124	150.875	276.022	-1.143	443.879
Tanzania	8.522	9.872	53.154	68.406	9.110	149.064
Togo	0.223	0.104	0.508	1.412	0.289	2.537
Tunisia	0.000	4.174	15.997	65.378	4.837	90.386
Uganda	0.593	1.687	4.551	7.956	1.474	16.260
Zambia	11.374	19.985	41.610	75.199	12.359	160.527
Zimbabwe	0.000	0.674	11.269	48.310	15.494	75.747
Total (48 countries)	0.000	0.000	1.806	38.588	-9.651	30.743
Resource rich	3.183	3.172	0.000	39.663	1.085	47.103
Non-resource rich	259.302	186.145	452.553	2320.810	427.913	3646.723
	139.032	90.496	240.615	1345.090	203.261	2018.494
	120.269	95.649	211.938	975.720	224.652	1628.228

Figure 3: IFFs by region, 1980-2021



Analyzing the IFFs-to-GDP ratio allows for a deeper understanding of both the extent and trajectory of IFFs in Africa over the period. This, combined with average estimates by decade and region, provides crucial insights. The regional analysis is especially important for this study, as it considers the presence or absence of anti-IFF instruments and their impact on both illicit flows and revenue.

7 Results of spatial panel models

As indicated above, the analysis concerns two anti-IFF instruments: (i) the Protocol on the Fight against Corruption and (ii) the Convention on Small Arms and Light Weapons, Ammunition, and other materials. These instruments are captured through Anti-Corruption and Anti-Criminality variables in the result tables.

The appropriate model selection has relied on the Comparison of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) statistics. The primary goal is to balance model complexity, ensuring that the selected model captures spatial dependencies without overfitting the data. Globally, the AIC and BIC statistics, in Table A2 in the appendix, suggest the fixed-effects model for all specifications of spatial panel models except the SAC model, for which a fixed-effects specification is unavailable for estimation. The spatial parameters are estimated using the quasi-maximum likelihood estimator (Lee and Yu, 2010), and the p-values are derived from the robust standard error.

7.1 Effectiveness of anti-IFFs instruments in ECOWAS

Tables 3 and 4 report the results of the effectiveness of the two anti-IFF instruments in ECOWAS for IFFs and DOM, respectively.

Table 3: ECOWAS: Spatial panel models estimates for IFFs to GDP ratio

	Instrument 1: Protocol against corruption					Instrument 2: Convention related to firearms				
	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC
Main/Direct										
Anti-Corruption	-5.103***	-4.625**	26.05***	-4.941**	-1.197					
Anti-Criminality						13.33***	13.42***	17.73***	14.09***	9.916***
GNI growth	2.645	2.962	4.293	3.116	1.025	1.105	1.653	3.661	2.070	0.416
Trade	-0.00231	-0.00571	-0.00653	-0.00946	0.00915	-0.0204	-0.0236	-0.0399	-0.0287	-0.00523
FIndex	-8.434	-2.298	41.93*	0.668	-13.86	-33.73*	-24.36	30.60	-16.52	-32.45*
GIndex	4.789***	4.754***	4.464***	4.673***	4.937***	4.727***	4.718***	5.335***	4.501***	5.670***
Constant	23.59***					24.93***				
Spatial/Spillover										
ρ		0.0863*	0.0625		0.579***		0.103**	0.0640		0.593***
λ				0.0757*	-0.621***				0.101**	-0.647***
Wx										
Anti-Corruption			-29.60***							
Anti-Criminality								2.141		
GNI growth			-8.888					-10.24		
Trade			0.145*					0.124*		
FIndex			-155.1***					-202.6***		
GIndex			0.124					2.637		
Variance										
σ^2		714.7***	678.6***	715.6***	630.1***		710.4***	679.7***	711.1***	616.8***
Statistics										
N	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo R^2	0.023	0.048	0.003	0.044	0.060	0.027	0.034	0.004	0.030	0.049
F-stat / LR stat	0.000					0.000				
LR test of common										
Spatial terms										
AIC	15828.1	15824.5	15746.5	15826.1	15786.1	15821.5	15815.3	15749.1	15816.8	15765.5
BIC	15860.7	15862.5	15811.6	15864.1	15829.5	15854.0	15853.3	15814.3	15854.7	15808.9

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For the anti-IFFs instruments Anti-Corruption and Anti-Criminality, the value 0 is reference.

Table 4: ECOWAS: Spatial panel models estimates for domestic resource to GDP ratio

	Instrument 1: Protocol against corruption					Instrument 2: Convention related to firearms				
	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC
Main/Direct										
IFF-to-GDP ratio	0.00005	0.00006	0.00007*	0.00006	0.00005	0.000002	0.00001	0.000049	0.00002	-0.000009
Anti-Corruption	0.0183***	0.0147***	0.0120*	0.0177***	0.0145**					
Anti-Criminality						0.0351***	0.0286***	0.0138**	0.0282***	0.0261***
GNI growth	0.00749	0.00798	0.00742	0.00925*	0.00790	0.0130**	0.0123**	0.00908*	0.0130**	0.00949*
Trade	0.000503***	0.000500***	0.000584***	0.000484***	0.000500***	0.000511***	0.000504***	0.000573***	0.000491***	0.000498***
FIndex	0.0324	0.0133	-0.0262	0.00258	0.0138	0.0810***	0.0475*	-0.0198	0.0426	0.0486*
GIndex	0.00819***	0.00873***	0.00721***	0.00918***	0.00870***	0.00999***	0.0102***	0.00881***	0.0104***	0.00892***
Constant	0.129***					0.130***				
Spatial/Spillover										
ρ		0.186***	0.162***		0.195		0.213***	0.125**		0.456***
λ				0.195***	-0.0100				0.189***	-0.380***
Wx										
IFF-to-GDP ratio			-0.000114					-0.000169**		
Anti-Corruption			-0.00250							
Anti-Criminality								0.0226***		
GNI growth			-0.00722					0.0000336		
Trade			0.000231**					0.000252**		
FIndex			0.148***					0.169***		
GIndex			-0.00869***					-0.00427		
Variance										
σ^2		0.00117***	0.00113***	0.00117***	0.00119***		0.00117***	0.00112***	0.00118***	0.00112***
Statistics										
N	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
Fixed effect	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 / Pseudo R^2	0.148	0.359	0.372	0.327	0.360	0.141	0.336	0.383	0.304	0.367
F-stat / LR stat	0.000					0.000				
LR test of common										
Spatial terms										
AIC	-6529.6	-6553.2	-6591.0	-6552.8	-6551.2	-6515.8	-6549.3	-6613.2	-6533.2	-6567.2
BIC	-6491.6	-6509.8	-6515.0	-6509.4	-6502.4	-6477.8	-6505.9	-6537.2	-6489.8	-6518.3

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For the anti-IFFs instruments Anti-Corruption and Anti-Criminality, the value 0 is reference.

In Table 3, the anti-corruption variable significantly and negatively affects the IFFs-to-GDP ratio in most models, except for the SAC model. The SDM model indicates a strong positive coefficient for the Anti-Corruption variable, possibly suggesting model misspecification. For instrument 2, the Anti-Criminality variable is significant and positive across all models, with the SAC model providing the most realistic coefficient. The best model selected for both instruments is the SAC model. In Table 4, both instruments show significant effects on domestic resources across models. The anti-corruption variable has a positive impact, while the Anti-Criminality variable shows a consistent relationship with domestic resources. The SDM model is selected as the best model for both instruments.

The predictive power of the selected spatial models is shown in Figure 4. The fixed effects of SAC (IFFs equation) and SDM (DOM equation) models fit the data well, as represented by the deviation between the observed values and the model estimates. For the estimation, we distinguish between a reduced-form prediction, which incorporates spatial spillovers and indirect effects, and a naïve prediction, which corresponds to fitted values obtained without accounting for spatial interactions.

Figure 4: ECOWAS postestimation test: the predictive power

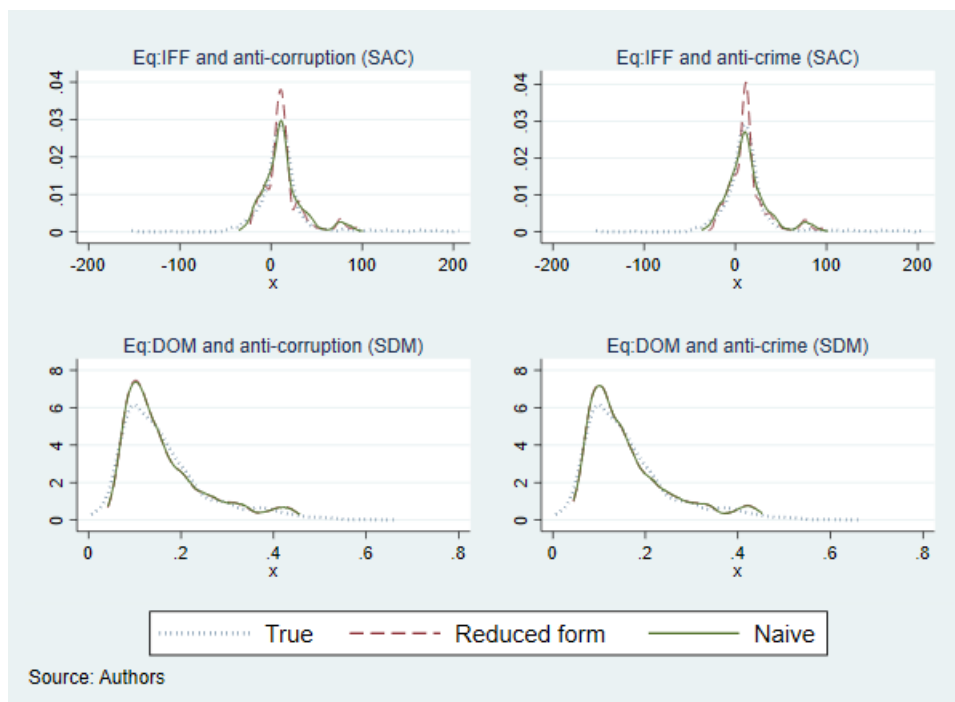


Table 5 presents the long-run spatial effects of two anti-IFF instruments in ECOWAS, estimated using the SAC model for IFFs (columns 1 and 3) and the SDM model for domestic resource mobilization (DOM; columns 2 and 4). The results show a nuanced and mixed effectiveness of these instruments across outcomes.

Starting with Instrument 1 (Anti-Corruption Protocol), the direct effect on IFFs (column 1) is -1.33, statistically significant at the 1% level. This suggests that while the protocol has a deterrent effect (supporting Hypothesis 1), its economic impact on IFFs reduction is relatively weak, likely due to fragmented implementation or limited institutional enforcement. Conversely, the indirect effect is -1.59, also significant (column 1), indicating that the protocol has not induced a displacement effect (not supporting Hypothesis 3), likely through regional cooperation or norm diffusion. The total effect of -2.92 reinforces the argument for regional coordination in anti-corruption efforts, even if domestic enforcement remains uneven.

For Instrument 2 (Anti-Criminality Convention), however, the direct effect on IFFs is 10.75 (column 3), statistically significant at 1%, and economically large. Though it contradicts Hypothesis 1, this counterintuitive

possible explanation lies in illicit adaptation. While the convention primarily targets arms trafficking and organized crime, limited enforcement scope may have encouraged illicit actors to diversify into alternative channels such as trade misinvoicing, smuggling, or money laundering. In such cases, the overall volume of illicit flows can rise even as one specific activity is curtailed. Another mechanism may be improved monitoring and reporting: by strengthening institutional oversight, the convention could have led to better detection and recording of previously hidden flows, thereby increasing the measured level of IFFs without necessarily implying a real deterioration. Still, the convention exhibits a strong and significant indirect effect of 13.88 (Column 5), raising the total effect to 24.63. This reinforces the concern that anti-criminality measures, without strong cross-border enforcement and institutional alignment, can inadvertently shift illicit activities rather than suppress them. This result is consistent with the displacement effect outlined in Hypothesis 3.

Looking at the control variables, the Governance Index (columns 1 and 3) has a large and significant positive effect on IFFs (5.34 and 6.17), which might seem paradoxical. This could reflect either a lag between reforms and impact or the exposure of hidden flows due to improved transparency. In contrast, the Financial Index shows a significant negative direct effect (-33.82, column 3), suggesting that deeper financial regulation and oversight may be critical in reducing IFFs, although results are less robust for Instrument 1.

Table 5: Long run spatial effects of anti-IFFs instruments in ECOWAS

Variables	Instrument 1		Instrument 2	
	IFF (SAC)	DOM (SDM)	IFF (SAC)	DOM (SDM)
Long-run direct effect				
Anti-Corruption	-1.330***	0.0123*		
Anti-Criminality			10.75***	0.0145**
IFF-to-GDP ratio		0.000699*		0.000465
GNI growth	1.217	0.00706	0.559	0.00891*
Trade	0.00834	0.000598***	-0.00726	0.000584***
FIndex	-13.41	-0.0228	-33.82**	-0.0169
GIndex	5.344***	0.00701***	6.166***	0.00874***
Long run indirect effect				
Anti-Corruption	-1.589***	-0.000851		
Anti-Criminality			13.88***	0.0272***
IFF-to-GDP ratio		-0.000120		-0.000183**
GNI growth	1.522	-0.00726	0.762	0.00105
Trade	0.00990	0.000386***	-0.00983	0.000370***
FIndex	-16.06	0.169***	-43.19**	0.188***
GIndex	6.576***	-0.00887***	7.998***	-0.00369
Long run total effect				
Anti-Corruption	-2.918***	0.0114***		
Anti-Criminality			24.63***	0.0417***
IFF-to-GDP ratio		-0.000499		-0.000137
GNI growth	2.739	-0.000195	1.321	0.00996
Trade	0.0182	0.000984***	-0.0171	0.000954***
FIndex	-29.47	0.146***	-77.01**	0.171***
GIndex	11.92***	-0.00186	14.16***	0.00506
N	1680	1680	1680	1680
R ²	0.060	0.372	0.049	0.383

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Turning to the domestic resource mobilization equation (columns 2 and 4), both instruments have positive and statistically significant total effects: 0.0114 for Anti-Corruption and 0.0417 for Anti-Criminality. These findings provide strong support for Hypothesis 2, affirming that anti-IFF policies can enhance a country's capacity to retain resources for development, even if they don't always succeed in reducing IFFs directly.

While numerically small, these are economically meaningful when considering their long-term cumulative effect across years and countries. The indirect effects are particularly important, 0.0272 for Anti-Criminality, for instance, highlighting how cross-border institutional coordination improves fiscal outcomes beyond national boundaries. This result is not consistent with the spillover effect outlined in Hypothesis 3.

Among the control variables, trade openness consistently contributes positively to DRM (0.000984 and 0.000954, both highly significant), confirming its role in expanding the tax base. Similarly, the Financial Index has strong positive indirect effects (0.169 and 0.188, columns 2 and 4), underscoring that stronger and more inclusive financial systems support greater resource mobilization across ECOWAS. Finally, the Governance Index has a mixed impact; its direct effects are positive and significant (0.0070 and 0.0087, columns 2 and 4), but the total effects are small or insignificant, suggesting that governance quality must be deepened and harmonized across borders to fully leverage its fiscal benefits.

In summary, Hypothesis 2 is validated in ECOWAS, while Hypotheses 1 and 3 are only partially supported, with their validity depending on the instrument and context.

7.2 Effectiveness of anti-IFFs instruments in SADC

Tables 6 and 7 report the results of the effectiveness of the two anti-IFF instruments in SADC for IFFs and DOM, respectively.

Table 6: Spatial panel models estimates for IFFs to GDP ratio

	Instrument 1: Protocol against corruption					Instrument 2: Convention on small arms ...				
	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC
Main/Direct										
Anti-Corruption	-28.36***	-27.79***	-27.89***	-29.22***	-29.80***					
Anti-Criminality						-39.26 ***	-38.79***	-48.62***	-42.50***	-47.04***
GNI growth	3.007	3.352	3.360	3.532	2.915	1.892	2.292	1.853	2.651	1.725
Trade	-0.0462	-0.0476	-0.0510	-0.0541	-0.0622	-0.0603	-0.0620	-0.0753*	-0.0733*	-0.0807**
FIndex	36.70*	42.00*	53.10**	45.03*	57.13***	44.73**	50.91**	50.88**	56.16***	57.15***
GIndex	4.985***	4.968***	4.899***	4.883***	4.573***	5.083***	5.068***	5.733***	5.032***	5.074***
Constant	21.48***					21.72***				
Spatial/Spillover										
ρ		0.0719*	0.0723*		-0.570***		0.0770*	0.104**		-0.540***
λ				0.0864*	0.556***				0.129***	0.553***
Wx										
Anti-Corruption			15.19**							
Anti-Criminality								34.99***		
GNI growth								-8.765		
Trade								0.156**		
FIndex								-148.3***		
GIndex								-0.295		
Variance										
σ^2		683.9***	672.9***	683.0***	616.4***		663.9***	643.4***	659.7***	595.5***
N	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.066	0.020	0.003	0.017	0.004	0.093	0.013	0.002	0.010	0.003
F-stat/LR stat	0.000						0.000			
LR test of common Spatial terms										
AIC	15751.8	15749.8	15732.6	15748.2	15722.9	15702.9	15700.1	15658.8	15692.4	15654.5
BIC	15784.4	15787.8	15797.7	15786.2	15766.3	15735.4	15738.1	15723.9	15730.4	15697.9

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For the anti-IFFs instruments Anti-Corruption and Anti-Criminality, the value 0 is reference.

Table 7: Spatial panel models estimates for domestic resource to GDP ratio

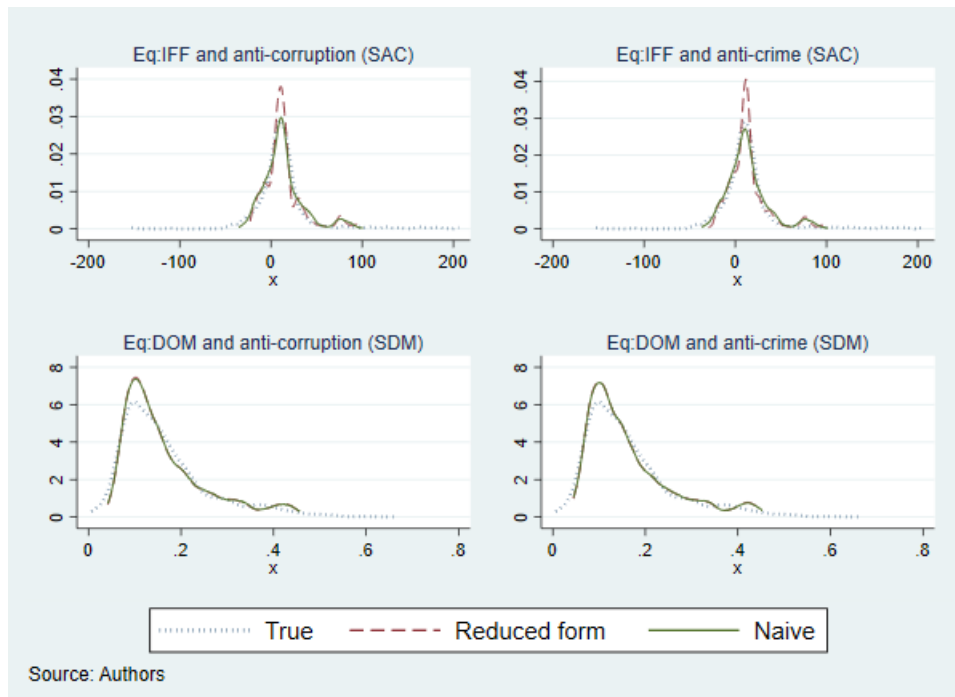
	Instrument 1: Protocol against corruption					Instrument 2: Convention on small arms ...				
	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC	(1) SLM	(2) SAR	(3) SDM	(4) SEM	(5) SAC
Main/Direct										
IFF-to-GDP ratio	0.0000635	0.0000540	0.0000651*	0.0000634*	0.0000368	0.0000844*	0.0000722*	0.0000725*	0.0000822*	0.0000518
Anti-Corruption	0.0182***	0.0112**	-0.00884	0.00878	0.00994**					
Anti-Criminality						0.0269 ***	0.0193***	0.000707	0.0185***	0.0164***
GNI growth	0.0117**	0.0114**	0.00771	0.0125**	0.00858*	0.0124**	0.0118**	0.00773	0.0128**	0.00905*
Trade	0.000558***	0.000536***	0.000586***	0.000509***	0.000528***	0.000569***	0.000547***	0.000604***	0.000524***	0.000539***
FIndex	0.0589*	0.0311	-0.0211	0.0178	0.0340	0.0511*	0.0234	-0.0291	0.0138	0.0249
GIndex	0.00884***	0.00945***	0.00761***	0.0102***	0.00762***	0.00866***	0.00925***	0.00794***	0.00988***	0.00762***
Constant	0.128***					0.128***				
Spatial/Spillover										
ρ		0.250***	0.186***		0.479***		0.239***	0.183***		0.462***
λ				0.263***	-0.337***				0.244***	-0.324***
Wx										
FF-to-GDP ratio			-0.000120*					-0.000121*		
Anti-Corruption			0.0237***							
Anti-Criminality								0.0208**		
GNI growth			-0.00415					-0.00317		
Trade			0.000261***					0.000269***		
FIndex			0.133**					0.115**		
GIndex			-0.0110***					-0.0107***		
Variance										
σ^2		0.00119***	0.00114***	0.00119***	0.00115***		0.00119***	0.00114***	0.00119***	0.00115***
N	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.113	0.388	0.364	0.341	0.409	0.120	0.385	0.367	0.345	0.405
F-stat/LR stat	0.000					0.000				
LR test of common										
Spatial terms										
AIC	-6461.9	-6508.9	-6583.0	-6503.2	-6516.1	-6475.6	-6518.4	-6581.9	-6511.3	-6525.2
BIC	-6423.9	-6465.5	-6507.0	-6459.8	-6467.2	-6437.6	-6475.0	-6505.9	-6467.9	-6476.3

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For the anti-IFFs instruments Anti-Corruption and Anti-Criminality, the value 0 is reference.

In Table 6, both instrument variables, Anti-Corruption and Anti-Criminality, consistently show significant negative effects across all models, indicating that the instruments effectively reduce IFFs in SADC countries. However, the Anti-Criminality variable shows a stronger effect than the Anti-Corruption variable. The SAC model is the most appropriate model selected for estimating the IFF-to-GDP ratio. In Table 7, the Anti-Corruption variable positively impacts domestic resources in the SAR and SAC models, while the Anti-Criminality variable is significant in the SAR, SEM, and SAC models. The IFF-to-GDP ratio is significant in the SDM and SEM models for both instruments and in the SAR model for Instrument 2, though the effect is small. The SDM model is the most suitable model selected for estimating Domestic Resources to GDP.

Figure 5 shows the predictive power of the selected spatial models. The fixed effects of SAC (IFFs equation) and SDM (DOM equation) models fit well the data as represented by the deviation between the true (observations) and the estimated (reduced form or naive prediction) of the outcome variable.

Figure 5: SADC postestimation test: the predictive power



The long-run effects presented in Table 8 provide insights into the effectiveness of anti-IFF instruments in the SADC region. Focusing first on the IFF equation (columns 1 and 3, SAC model), both the Anti-Corruption Protocol and the Anti-Criminality Convention show statistically significant and economically meaningful reductions in the IFF-to-GDP ratio. Specifically, the direct effect of the Anti-Corruption Protocol is -31.36 (column 1), while the Anti-Criminality Convention shows an even stronger effect at -49.21 (column 3). These values indicate that the implementation of these instruments is associated with substantial reductions in IFFs, particularly when considering the average IFF-to-GDP ratio in the region. The results provide strong support for Hypothesis 1, which posits that anti-IFF instruments reduce IFFs. Interestingly, the indirect effects for both instruments are positive and significant (12.26 and 18.50, respectively), suggesting that while IFFs are reduced within implementing countries, there may be a displacement of illicit activities to neighboring countries. This validates Hypothesis 3 in SADC, highlighting the presence of negative spillovers. Such findings support the argument for more harmonized regional enforcement mechanisms to prevent policy leakage and cross-border evasion.

In contrast, the Financial Index (FIndex) has a large and statistically significant positive direct effect on IFFs (61.91 and 61.55 in columns 1 and 3, respectively), suggesting that financial sector development, if un-

regulated, may create avenues for illicit flows. This finding aligns with theoretical expectations that financial liberalization can facilitate illicit flows when oversight is weak (Beja, 2007; Epaphra, 2015; Ndikumana and Boyce, 2011). Interestingly, the Governance Index (GIndex) also exhibits a positive and significant effect on IFFs (4.80 and 5.30 in columns 1 and 3), possibly reflecting a lagged response between governance improvements and reductions in illicit activity. An alternative explanation is that greater transparency exposes previously hidden flows, leading to a short-term increase in recorded IFFs, a dynamic noted in the literature on governance reforms and financial crime (Addison et al., 2018; OECD, 2018; Reuter, 2005).

Table 8: Long run spatial effects of anti-IFFs instruments in SADC

Variables	Instrument 1		Instrument 2	
	IFF (SAC)	DOM (SDM)	IFF (SAC)	DOM (SDM)
Long-run direct effect				
Anti-Corruption	-31.36***	-0.00776		
Anti-Criminality			-49.21***	0.00179
IFF-to-GDP ratio		0.0000628		0.0000703*
GNI growth	3.183	0.00743	1.920	0.00748
Trade	-0.0666*	0.000603***	-0.0856**	0.000621***
FIndex	61.91***	-0.0175	61.55***	-0.0262
GIndex	4.800***	0.00731***	5.298***	0.00766***
Long-run indirect effect				
Anti-Corruption	12.26***	0.0264***		
Anti-Criminality			18.50***	0.0250**
IFF-to-GDP ratio		-0.000130		-0.000130
GNI growth	-1.233	-0.00352	-0.710	-0.00237
Trade	0.0260*	0.000449***	0.0321**	0.000459***
FIndex	-24.24***	0.155**	-23.14***	0.132**
GIndex	-1.882***	-0.0115***	-1.996***	-0.0111***
Long-run total effect				
Anti-Corruption	-19.10***	0.0186*		
Anti-Criminality			-30.71***	0.0268**
IFF-to-GDP ratio		-0.0000677		-0.0000597
GNI growth	1.949	0.00391	1.210	0.00511
Trade	-0.0406*	0.00105***	-0.0535**	0.00108***
FIndex	37.66***	0.137*	38.41***	0.106
GIndex	2.918***	-0.00417	3.302***	-0.00346
N	1680	1680	1680	1680
R ²	0.004	0.364	0.003	0.367

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Turning to the domestic resource mobilization (DOM) results (columns 2 and 4, SDM model), both anti-IFF instruments show positive total effects: 0.0186 (Anti-Corruption) and 0.0268 (Anti-Criminality). While these numerical values appear small, they are economically meaningful given the cumulative impact across time and countries in the panel. This confirms that anti-IFF policies not only reduce illicit flows but also enhance a country's capacity to retain and mobilize domestic revenue (Supporting Hypothesis 2). This likely reflects improved tax compliance, financial governance, and institutional efficiency. The indirect (spillover) effects, such as 0.0264 for Anti-Corruption and 0.0250 for Anti-Criminality, underscore the importance of cross-border dynamics and regional cooperation in enhancing DRM. This result is not consistent with the spillover effect outlined in Hypothesis 3.

The results also show that trade openness has consistent and significant positive effects on DRM across both instruments (0.00105 and 0.00108 in columns 2 and 4). Though seemingly modest, even small percentage improvements in trade-related tax compliance or collection efficiency can translate into millions in additional revenue

revenue for SADC countries. On the other hand, the Financial Index shows strong spillover effects on DRM (0.137 and 0.106 total effects in columns 2 and 4), suggesting that improvements in neighboring financial systems can have a notable impact on a country's domestic resources. This emphasizes the importance of regional financial integration, complemented by regulatory harmonization. Lastly, the Governance Index has mixed implications. While its direct effects on DRM are positive (0.0073 and 0.0077, columns 2 and 4), its total effects are negative (-0.0042 and -0.0035), likely due to negative indirect effects from neighboring countries. This implies that fragmented governance reforms may unintentionally undermine regional outcomes unless addressed through coordinated institutional strengthening.

In conclusion, in SADC, Hypothesis 1 and Hypothesis 2 are fully validated. However, Hypothesis 3 is only partially supported, while displacement effects are observed in the IFF equation; such effects are not evident in the DOM equation.

8 Endogeneity issues

IFFs may be endogenous due to reverse causality and omitted variable bias stemming from macroeconomic, structural, and institutional factors. For instance, fiscal deficits, exchange rate instability, inflation, and external debt may simultaneously influence and be influenced by IFFs. Similarly, unregulated international trade and governance weaknesses (e.g., corruption, informality, and political instability) may exacerbate both IFFs and DRM.

In our empirical framework, endogeneity is particularly relevant in the DRM specification (Equation 6), where IFFs appear as an explanatory variable. In this case, reverse causality is a major concern, as IFFs may reduce DRM while weak DRM may simultaneously encourage IFFs. To address this, we employ a spatial instrumental variable strategy using the Generalized Spatial Two-Stage Least Squares (GS2SLS) estimator, following Arraiz et al. (2010) and Drukker et al. (2013).

We use fiscal deficit, exchange rate, and corruption as instruments for IFFs. Theoretically, a high fiscal deficit signals macroeconomic instability and future fiscal risks, encouraging capital flight and making it a strong predictor of IFFs, especially in sub-Saharan Africa (Ajayi, 1997; Ndikumana and Fofack, 2015). Exchange rate misalignment, particularly persistent overvaluation or volatility, incentivizes investors to transfer funds illicitly to hedge against depreciation risks (Epaphra, 2015; Ndikumana and Boyce, 2011). Corruption, by weakening enforcement and oversight, facilitates tax evasion and unrecorded financial transfers. While it may directly affect DRM, when governance is controlled for in the main model, corruption primarily channels its impact through IFFs, satisfying the exclusion restriction (Campbell et al., 2022).

For the IFF equation, IFFs are the dependent variable and therefore not subject to the same type of endogeneity. However, simultaneity with its macroeconomic and institutional determinants may still arise. To mitigate this, we include a comprehensive set of controls (e.g., trade openness, governance quality, and financial development) that capture the main channels of reverse causality.

The validity of the instrument is confirmed by three sets of diagnostic tests (reported in Appendix B, Table A9). First, the weakness of the instrument test yields an F-statistic of 127.56 ($p < 0.01$), which is above the conventional threshold of 10, indicating strong instrument relevance. Second, the over-identification test (Sargan-Hansen $X^2(2) = 226.694$; $p = 0.753$) fails to reject the null hypothesis, confirming that the instruments are not correlated with the error term. Third, the Hausman-type endogeneity test ($X^2(5) = 27.82$; $p < 0.0001$) rejects the exogeneity of IFFs, supporting the need for IV estimation.

Table 9 reports the IV-corrected long run spatial effects of anti-IFF instruments on DRM in ECOWAS and SADC.

Table 9: IV results: long run effects of anti-IFFs instruments on domestic resource

Variables	Instrument 1		Instrument 2	
	ECOWAS	SADC	ECOWAS	SADC
Long-run direct effect				
Anti-Corruption	0.0146**	-0.0106*		
Anti-Criminality			0.0197***	0.00372
IFF-to-GDP ratio	0.00234***	0.00268***	0.00315***	0.00227***
GNI growth	0.00607	0.00567	0.00741	0.00606
Trade	0.000590***	0.000586***	0.000563***	0.000621***
Findex	0.0641*	0.0761**	0.0970***	0.0503
GIndex	-0.00359	-0.00488	-0.00554*	-0.00255
Long run indirect effect				
Anti-Corruption	-0.00264	0.0397***		
Anti-Criminality			0.0194**	0.0425***
IFF-to-GDP ratio	-0.00485***	-0.00568***	-0.00232	-0.00712***
GNI growth	-0.00375	-0.000347	0.00132	0.00276
Trade	0.000352***	0.000407***	0.000304***	0.000444***
Findex	0.0513	-0.0223	0.140**	-0.107
GIndex	0.0141*	0.0146*	0.00783	0.0210**
Long run total effect				
Anti-Corruption	0.0120***	0.0291**		
Anti-Criminality			0.0391***	0.0462***
IFF-to-GDP ratio	-0.00251	-0.00300	0.000825	-0.00485*
GNI growth	0.00232	0.00533	0.00873	0.00882
Trade	0.000943***	0.000994***	0.000867***	0.00106***
Findex	0.115	0.0538	0.237***	-0.0570
GIndex	0.0105	0.00969	0.00229	0.0184*
N	1680	1680	1680	1680
R ²	0.383	0.354	0.418	0.343

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Direct effects show that, after addressing endogeneity, anti-IFF instruments significantly improve DRM in ECOWAS ($\beta \approx 0.015$ in column 1, $\beta \approx 0.02$ in column 3). In SADC, the direct effects are mixed ($\beta \approx -0.011$ in column 2, $\beta \approx 0.004$ in column 4), likely reflecting varying levels of enforcement capacity. Indirect (spillover) effects are economically meaningful, around 0.04 percentage points of GDP (columns 2 and 4), especially in SADC and under the Anti-Criminality instrument in ECOWAS ($\beta \approx 0.02$ in column 3). For instance, ratifying the Anti-Criminality Convention boosts DRM by nearly 0.04 percentage points of GDP through regional channels, which is substantial in countries where non-resource tax revenues average only 15% of GDP.

In general, the GS2SLS approach confirms the causal effectiveness of anti-IFF policies and highlights the importance of strong, regionally coordinated enforcement to sustainably improve DRM in Africa.

9 Robustness of spatial effects of IFFs instruments

To verify the robustness of our initial findings, we re-estimated the spatial models using alternative anti-IFF instruments: the Anti-Taxation and Anti-Conflict conventions. In ECOWAS, this includes (i) the Act on the Elimination of Double Taxation and (ii) the Mechanism for Conflict Prevention, Management, Resolution, Peacekeeping and Security. In SADC, this concerns the following; (i) the Agreement on Mutual Assistance in Tax Matters and (ii) the Mutual Legal Assistance in Criminal Matters. The objective is to test whether the initial results remain stable across different policy instruments within the same institutional framework.

In ECOWAS, Table 10 shows that the Anti-Conflict instrument yields significant positive direct and total effects on DRM, with coefficients of 0.0188 and 0.0203 (in column 4) respectively, confirming the fiscal relevance of regional security cooperation. The Anti-Taxation instrument also shows a robust and

economically significant total effect on DRM (0.0198 in column 2). Interestingly, both instruments do not significantly reduce IFFs, reinforcing earlier findings that ECOWAS instruments improve DRM more than they reduce illicit flows. The indirect effects remain strong and significant in some cases (e.g., 0.0272 for Anti-Criminality previously in column 4 Table 5), suggesting positive spillovers, particularly for fiscal policy integration.

Table 10: Robustness : long run effects of anti-IFFs instruments in ECOWAS

Variables	Instrument 1		Instrument 2	
	IFF (SAC)	DOM (SDM)	IFF (SAC)	DOM (SDM)
Long-run direct effect				
Anti-Taxation	2.874	0.0633***		
Anti-Conflicts			-0.674	0.0188**
IFF-to-GDP ratio		0.0000702*		0.0000726*
GNI growth	0.667	0.00723	0.674	0.00755
Trade	0.00111	0.000588***	0.00415	0.000601***
FIndex	-26.80*	-0.00623	-20.12	-0.00735
GIndex	5.531***	0.00741***	5.243***	0.00827***
Long run indirect effect				
Anti-Taxation	3.669	-0.0435***		
Anti-Conflicts			-0.838	0.00148
IFF-to-GDP ratio		-0.000179*		-0.000136
GNI growth	0.899	0.00122	0.904	-0.00372
Trade	0.00105	0.000436***	0.00500	0.000426***
FIndex	-33.80*	0.213***	-25.20	0.227***
GIndex	7.119***	-0.00839***	6.744***	-0.00468
Long run total effect				
Anti-Taxation	6.543	0.0198***		
Anti-Conflicts			-1.512	0.0203***
IFF-to-GDP ratio		-0.000109		-0.0000636
GNI growth	1.566	0.00844	1.578	0.00383
Trade	0.00217	0.00102***	0.00915	0.00103***
FIndex	-60.61*	0.207***	-45.33	0.220***
GIndex	12.65***	-0.000973	11.99***	0.00359
N	1680	1680	1680	1680
R ²	0.057	0.356	0.056	0.373

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In SADC, as shown in Table 11, both instruments, especially Anti-Taxation, demonstrate statistically significant and large negative direct effects on IFFs (e.g., -22.32 and -20.93 in columns 1 and 3), which is consistent with prior findings on the effectiveness of regional enforcement. The direct and indirect effects on DRM are also significant, particularly for Anti-Taxation (indirect effect: 0.0196 in column 2; total effect: not significant but directionally aligned). This confirms the earlier conclusion that SADC instruments are more effective at reducing IFFs, while also positively influencing DRM through both domestic and spillover channels.

Table 11: Robustness: long run effects of anti-IFFs instruments in SADC

Variables	Instrument 1		Instrument 2	
	IFF (SAC)	DOM (SDM)	IFF (SAC)	DOM (SDM)
Long-run direct effect				
Anti-2Taxation	-22.32***	-0.0283***		
Anti-Conflicts			-20.93***	-0.0138*
IFF-to-GDP ratio		0.0000551		0.0000601*
GNI growth	2.817	0.00903*	3.056	0.00900*
Trade	-0.0370	0.000594***	-0.0325	0.000607***
Findex	46.35**	-0.00387	48.72**	-0.0116
GIndex	4.188***	0.00702***	4.210***	0.00708***
Long-run indirect effect				
Anti-2Taxation	9.522***	0.0196*		
Anti-Conflicts			8.834***	0.0175*
IFF-to-GDP ratio		-0.000169*		-0.000171*
GNI growth	-1.200	-0.000918	-1.287	-0.000156
Trade	0.0158	0.000424***	0.0137	0.000437***
Findex	-19.82**	0.263***	-20.62**	0.213***
GIndex	-1.788***	-0.00991***	-1.779***	-0.0103***
Long-run total effect				
Anti-2Taxation	-12.79***	-0.00868		
Anti-Conflicts			-12.09***	0.00374
IFF-to-GDP ratio		-0.000114		-0.000111
GNI growth	1.617	0.00811	1.768	0.00884
Trade	-0.0212	0.00102***	-0.0188	0.00104***
Findex	26.53**	0.259***	28.10**	0.202***
GIndex	2.400***	-0.00289	2.431***	-0.00325
N	1680	1680	1680	1680
R ²	0.005	0.393	0.005	0.380

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Overall, these robustness checks support the stability of the main results. In ECOWAS, instruments are more effective in enhancing DRM than reducing IFFs. In SADC, instruments curb IFFs more effectively, while also promoting DRM. Spatial spillovers (indirect effects) remain statistically and economically meaningful across specifications, confirming the need for regionally coordinated responses to IFFs.

10 Conclusion and Policy Implications

This study sheds new light on the scale and determinants of IFFs in Africa by extending the World Bank Residual approach to include remittances, capturing a broader set of unrecorded flows. Between 1980 and 2021, African countries experienced IFFs totaling approximately USD 3,646.7 billion, equivalent to 15.4% of their combined GDP. Using spatial econometric techniques, we evaluated the effectiveness of regional anti-IFF instruments within ECOWAS and SADC, accounting for both direct national impacts and cross-border spillovers.

The findings reveal distinct regional dynamics. In ECOWAS, anti-IFF instruments—particularly anti-corruption protocols, significantly improve domestic resource mobilization (DRM) and generate positive spillover effects on neighboring countries, but do not directly reduce IFFs. Conversely, in SADC, both anti-corruption and anti-criminality instruments are effective in curbing IFFs and strengthening DRM, although they exhibit negative spillover effects—suggesting a displacement of illicit activities to countries with weaker

enforcement. These results highlight the critical importance of regional coordination. Strengthening institutional frameworks, enhancing financial oversight, and ensuring policy harmonization across borders are essential for curbing IFFs and supporting sustainable development.

In ECOWAS, the results call for two main policy implications: (i) strengthening anti-corruption mechanisms and (ii) promoting regional financial integrity. Although the anti-corruption protocol did not show a significant direct impact on reducing IFFs, it generated positive spillover effects in neighboring countries. This suggests that cross-border cooperation and governance reforms can enhance the effectiveness of anti-corruption measures. Then, ECOWAS policymakers should strengthen regional coordination frameworks, allowing countries to align their anti-corruption strategies and enforcement efforts to prevent IFFs from moving across borders. Collaborative efforts in governance reforms could improve the effectiveness of the regional approach to IFF reduction. Furthermore, given the significant impact of governance improvements on domestic resource mobilization, ECOWAS countries should prioritize policies that strengthen institutional governance and transparency. The region should focus on increasing the accountability and oversight of financial institutions, especially in areas vulnerable to IFFs such as extractive industries and trade. Such measures would ensure that domestic resources are protected and channeled more effectively into development efforts.

The results in SADC call for a set of three policy implications in curbing IFFs in countries: (i) building stronger regulatory enforcement, (ii) mitigating the negative spillover effects, and (iii) promoting good governance. The significant reduction of IFFs in SADC through the Anti-Criminality and Anti-Corruption instruments demonstrates the need for enhanced regulatory enforcement in curbing illicit flows. Policymakers in SADC should scale up enforcement capacities by increasing funding for financial intelligence units, customs enforcement, and other relevant authorities. In addition, regional cooperation mechanisms should be strengthened to prevent the displacement of illicit activities to neighboring countries with weaker enforcement. In addition, the displacement of IFFs to neighboring countries within the SADC, as shown by the negative spillover effect, indicates the need for harmonized enforcement strategies. SADC policymakers should collaborate on regional anti-IFF frameworks, ensuring that enforcement capacities are evenly distributed between member states. Establishing regional task forces or shared data platforms could help monitor and prevent IFF displacement, fostering a unified approach to combating illicit financial flows. Finally, the positive effect of governance on domestic resource mobilization highlights the importance of good governance practices in SADC. Policymakers should focus on institutional capacity building, anti-corruption initiatives, and transparency in public financial management to create a conducive environment to sustainable economic development. Strengthening the independence and effectiveness of anti-corruption agencies and judicial systems will help ensure that mobilized resources are used effectively to promote long-term growth.

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Appendix A Additional Tables

Table A1: Variables: definitions, measures, and sources

Variables	Name	Description	Measure	Sources
Dependent	IFFs	New estimates from equation 4	% of GDP	Estimates
	Domestic resources (DOM)	Resource and non-resource taxes revenue excluding social contribution	% of GDP	IMF/GRD ¹
Independent	IFFs	New estimates from equation 4	% of GDP	Estimates
	Anti-Corruption or Anti-Criminality (D)	Instruments in REC to tackle IFFs	1,0	REC's sites
Control variables	Gross national income (GNI)	Growth of GNI	%	WDI
	Trade openness (TRADE)	Ratio between the sum of export and import divided by the GDP	%	WDI
	Financial development (FIN)	Index of six financial indicators including market and bank-oriented of access, depth and efficiency indicators	–	IMF
	Governance (GOV)	Index from the six key dimensions of governance indicators (Voice and Accountability, Political Stability and Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption)	–	WDI
Other variables	Remittances (REM)	Flows from migrants and others groups	% of GDP	WDI
	Debt (DEBT)	External debt	USD	WDI
	Foreign direct investment (FDI)	Direct investment equity flows in the reporting economy	USD	WDI
	Current account (CA)	Current account balance	USD	BoP
	Reserves (RES)	Foreign exchange reserves	USD	BoP

¹IMF/Government revenue database

Table A2: Information criteria: AIC and BIC

instrument	REC		ECOWAS				SADC				
	IC		DOM model		IFFs model		DOM model		IFFs model		
			AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC	
instrument 1	SAR	FE	-6552.33	-6514.35	15824.53	15862.51	-6508.05	-6470.06	15749.79	15787.77	
		RE	-6301.02	-6252.18	15993.68	16042.51	-6260.95	-6212.11	15928.78	15977.61	
	SDM	FE	-6586.61	-6521.49	15746.45	15811.57	-6579.24	-6514.12	15732.56	15797.67	
		RE	-6335.51	-6259.54	15932.91	16008.88	-6328.23	-6252.26	15919.7	15995.67	
	SEM	FE	-6551.37	-6513.39	15826.09	15864.08	-6501.29	-6501.29	15748.24	15786.23	
		RE	FE	-6294.51	-6245.67	15994.83	16043.67	-6247.04	-6198.2	15927.51	15976.35
			RE	FE	-6551.16	-6513.18	15815.29	15853.27	-6515.52	-6477.53	15700.14
instrument 2	SAR	RE	-6300.28	-6251.44	15986.45	16035.28	-6268.12	-6219.28	15884.54	15933.38	
		FE	-6607.08	-6541.96	15749.15	15814.26	-6577.63	-6512.51	15658.77	15723.89	
	SDM	RE	-6355.77	-6279.8	15936.63	16012.61	-6326.98	-6251.01	15853.46	15929.43	
		FE	-6534.78	-6496.79	15816.76	15854.75	-6506.99	-6469.01	15692.42	15730.41	
	SEM	RE	-6278.29	-6229.45	15987.7	16036.54	-6252.97	-6204.14	15877.97	15926.81	

Instruments: 1 = Anti-corruption protocol, 2 = Convention on the control of firearms

Table A3: Average IFFs-to-GDP ratio, %

Country	Decade					
	1980-89	1990-99	2000-09	2010-19	2020-21	1980-2021
Algeria	3.24	-2.74	-15.15	7.05	4.64	-0.60
Angola Benin	0.00	-110.90	-5.10	-2.02	-11.15	-32.29
Botswana	18.54	9.44	6.80	10.09	13.14	11.60
Burkina Faso	5.78	-4.95	0.27	0.36	3.81	1.05
Burundi	0.00	0.00	12.27	13.65	2.67	9.53
Cabo Verde	0.00	0.00	-2.87	16.19	0.00	6.66
Cameroon	25.94	31.22	33.90	27.82	41.77	32.13
Central African Republic	9.14	7.85	-0.10	8.64	7.89	6.68
Chad	10.57	6.66	0.00	0.00	0.00	8.62
Comoros	8.28	9.45	0.00	0.00	0.00	8.87
Congo, Dem. Rep. of the	13.81	7.79	14.49	16.87	21.62	14.92
Congo, Republic of	0.00	0.00	8.78	10.80	5.84	8.47
Côte d'Ivoire	28.98	23.09	7.69	16.65	-27.09	9.86
Djibouti	0.00	0.00	1.27	2.35	10.40	4.67
Egypt	0.00	-10.11	17.56	11.23	11.21	7.47
Eritrea	24.55	4.71	6.82	14.34	15.35	13.16
Eswatini	0.00	60.79	34.89	0.00	0.00	47.84
Ethiopia	22.26	12.62	8.59	-0.23	0.58	8.76
Gabon	10.66	-3.35	9.26	15.25	6.85	7.73
Gambia, The	12.04	-3.44	-12.42	-3.01	0.00	-1.71
Ghana	20.32	0.00	11.38	21.71	38.15	22.89
Guinea	5.73	13.75	12.58	21.75	18.46	14.45
Guinea-Bissau	13.65	8.76	8.63	16.43	-19.96	5.50
Kenya Lesotho	77.48	34.48	13.91	10.03	27.67	32.72
Liberia	8.32	13.30	4.96	13.72	11.42	10.34
Madagascar	170.86	134.27	37.07	34.24	27.34	80.76
Malawi	0.00	0.00	8.89	86.04	35.60	43.51
Mali	11.06	9.91	11.26	12.40	11.63	11.25
Mauritania	0.00	13.03	4.70	17.37	17.69	13.20
Mauritius	23.01	15.19	11.34	16.98	15.79	16.46
Morocco	23.49	3.68		23.14	14.16	16.12
Mozambique	0.00	7.39	11.55	11.01	15.88	11.45
Niger	17.80	7.87	8.82	14.89	12.37	12.35
Nigeria	0.00	0.00	17.25	83.13	84.31	61.56
Rwanda	11.94	7.01	8.69	23.33	24.79	15.15
Senegal	6.37	-0.10	-2.39	4.96	7.15	3.20
Sierra Leone	0.00	0.00	0.00	21.79	27.20	24.49
South Africa	13.83	8.66	14.59	25.62	43.89	21.32
Sudan	6.17	12.73	12.12	37.04	17.87	17.19
Sao Tomé and Príncipe	0.00	2.20	5.86	6.94	-0.31	3.67
Tanzania	8.84	7.33	15.60	11.17	16.24	11.83
Togo	0.00	0.00	43.71	52.71	28.92	41.78
Tunisia	0.00	9.41	6.76	14.58	7.32	9.52
Uganda	5.77	11.35	18.32	13.30	19.69	13.69
Zambia	14.53	11.94	13.16	16.51	14.10	14.05
Zimbabwe	0.00	11.24	10.36	15.85	19.90	14.34
Total (48 countries)	0.00	0.00	5.98	15.99	-22.41	-0.15
Resource rich	4.63	8.64	0.00	22.15	5.04	10.12
Non resource rich	19.34	13.27	10.48	18.65	15.25	15.40
	10.34	4.93	5.68	17.09	15.34	10.16
	27.60	19.69	13.56	19.58	15.18	19.03

Table A5: Inventory of anti-IFFs instruments

REC	IFFs Source	Instrument	Adoption	Sources
AMU	Commercial	Convention for the Avoidance of Double Taxation and the Establishment of Rules for Mutual Assistance in respect of Taxes on Income	1990	Available
	Corruption	Arab-convention against corruption	2010	Available
	Criminality	Arab Convention for the Suppression of Terrorism	1998	Available
	Illegal market	Council Decision in support of combating the illicit trade in and proliferation of small arms and light weapons in the Member States of the League of Arab States	2018	Available
AU	Convention	Preventing and combating corruption (AUCPCC)	2003	Available
COMESA	Corruption	COMESA Business Council (CBC) Regional Code on Anti-corruption compliance for Enterprises	2019	Available
	Commercial	COMESA Investment Agreement	2007	Available
	Criminality	The Eastern and Southern Africa Anti-Money Laundering Group (ESAAMLG)	1999	Available
	Illegal market	COMESA Protocol on Rules of Origin	2015	Available
ECCAS	Commercial	ECCAS Agreement Regulation on the avoidance of double taxation	2019	Available
	Criminality	Protocol Relating to the Council for Peace and Security in Central Africa (COPAX)	2000	Available
	Criminality	ECCAS Conflict Prevention Framework	2008	Available
	Illegal market	Central African Convention for the Control of Small Arms and Light Weapons	2011	Available
ECOWAS	Corruption	Protocol on the Fight against Corruption	2001	Available
	Commercial	ECOWAS Supplementary Act on the Elimination of the Double Taxation with Respect to Taxes on Income, Capital and Inheritance and the Prevention of Tax Evasion and Avoidance	2013	Available
	Criminality	ECOWAS Counter Terrorism Strategy	2013	Available
	Criminality	Mechanism for Conflict Prevention, Management, Resolution, Peacekeeping and Security	1999	Available
	Illegal market	Convention on Small Arms and Light Weapons, Ammunition and Other Related Materials	2006	Available
OECD	Commercial	Convention on Mutual Administrative Assistance in Tax Matters	2010	Available
SADC	Commercial	Southern Africa Development Community's Agreement on Mutual Assistance in Tax Matters	2012	Available
	Corruption	Protocol against Corruption	2001	Available
	Criminality	Protocol on Mutual Legal Assistance in Criminal Matters	2002	Available
	Illegal market	Protocol on the Control of Firearms, Ammunition and Other Materials	2004	Available
	Illegal market	Protocol on Wildlife Conservation and Law Enforcement	1999	Available
	Illegal market	Protocol on Combating Illicit Drug Trafficking	1996	Available
UN	Criminality	Convention against Transnational Organized Crime	2003	Available
	Corruption	Convention Against Corruption	2005	Available
	Commercial	Double Tax Avoidance Agreements	Effective	Available

Source: Authors

Appendix B Pre-estimation tests for Spatial Panel Model

Based on the distribution of Illicit Financial Flows (IFFs) illustrated in Figure 3, this empirical analysis focuses on two Regional Economic Communities (RECs) where the IFF-to-GDP ratios are notably high: the Southern African Development Community (SADC) with 22.30% and the Economic Community of West African States (ECOWAS) with 16.24%. For the sake of parsimony, the analysis examines the effectiveness of two key anti-IFF instruments in these regions. The choice of these instruments is driven by the availability of data on their adoption and ratification. We assess the direct, indirect, and spillover effects of these instruments on both IFFs and domestic revenue across a sample of 40 African countries. The spatial weight matrix used (40×40) is constructed from bilateral trade data, considering trade openness. The normalized format of this matrix is detailed in Table A4 in the appendix.

While the use of spatial econometrics is theoretically justified, estimating spatial models necessitates certain preliminary tests, including: (i) spatial dependence, (ii) spatial autocorrelation, and (iii) unit root tests.

Following the approach of Gulyev (2020) and similar studies, we begin with tests for cross-sectional dependence by Pesaran's CD-tests (Pesaran, 2004, 1) to establish the presence of spatial dependence among residuals across countries or regions. A pvalue < 0.05 rejects the null hypothesis of no cross-sectional dependence, while it fails to reject the null hypothesis when the pvalue > 0.05 .

Table A6: Spatial dependence test

Variable	CD-test	p-value	average joint T	mean ρ	mean abs (ρ)
IFFs (% of GDP)	18.451	0.000	42.00	0.10	0.27
Domestic resources (% of GDP)	30.114	0.000	42.00	0.17	0.38

Source: Authors

The results of Pesaran (2004)'s CD-test, in Table A6, reject the null hypothesis of cross-sectional independence, confirming significant spatial dependence at the 1% level. This suggests that the shocks or unobserved factors influencing IFFs and/or Domestic resources in one country are correlated with those in neighboring countries.

Second, we assess the global spatial autocorrelation by Moran's I Test to check the interdependence between countries, which tests whether the pattern of an IFF or Domestic resources across space is random or exhibits clustering among countries. A positive (negative) value of Moran's I indicate that positive (negative) spatial autocorrelation exists across the regions (Kondo, 2021).

Table A7: Global spatial autocorrelation test

Moran's I Statistic

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
IFFs (% of GDP)	0.35558	-0.00061	0.00537	66.36620	0.00000
Domestic resources (% of GDP)	0.84846	-0.00061	0.00538	157.78760	0.00000

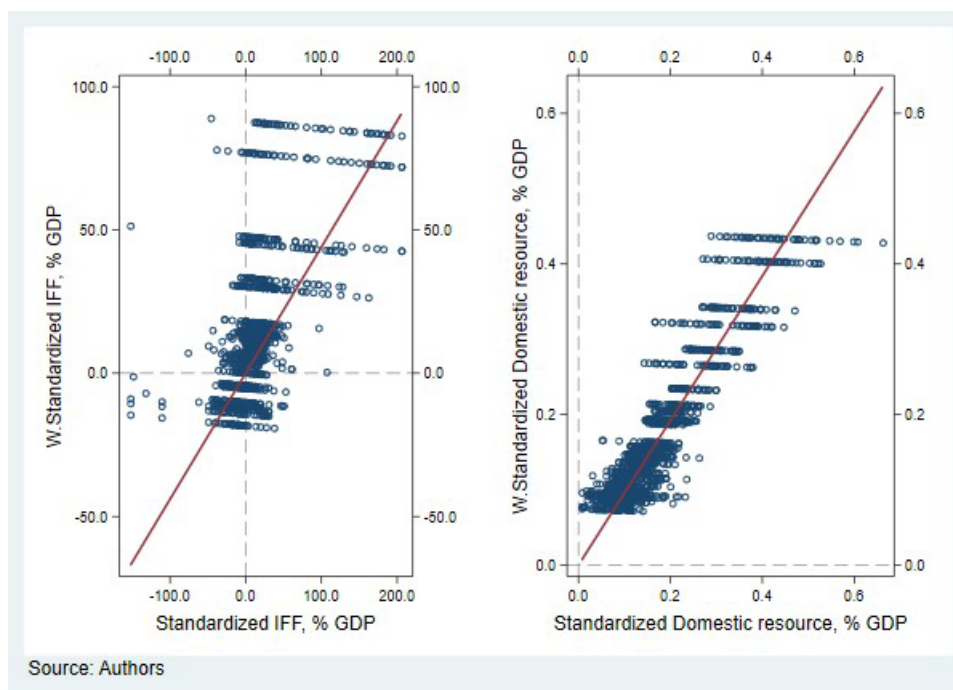
Null Hypothesis : Spatial Randomization

Source: Authors.

As shown in Table A7, the Moran's I values are positive for both IFFs (0.35) and Domestic resources (0.84), and statistically significant at the 1% level. This result rejects the null hypothesis of No spatial autocorrelation (or spatial randomization), indicating that countries with high (low) IFFs or Domestic

resources tend to be clustered together. The Figure 6 confirms this conclusion².

Figure 6: Moran Scatter plot of IFFs and domestic resources



These tests validate the necessity for a spatial panel model for the analysis of these two variables.

Third, we apply the second generation of unit root tests to examine the stationarity of variables in the model. Specifically, we use the t-test for unit roots in heterogeneous panels with cross-sectional dependence, as proposed by Pesaran (2003).

Table A8: Unit root test: Choi (2002); Pesaran (2003)

Variable	Pesaran (2003)	Choi (2002)			Decisio ⁿ
	Z	Z	L*	Pm	
IFFs (% of GDP)	-18.689 (0.0000)	-25.1594 (0.0000)	-38.6757 (0.0000)	63.6800 (0.0000)	I(0)
Domestic resources (% of GDP)	-2.740 (0.0030)	-10.3215 (0.0000)	-11.0737 (0.0000)	14.6933 (0.0000)	I(0)
GNI growth (%)	-26.256 (0.0000)	-30.0963 (0.0000)	-49.0794 (0.0000)	82.4762 (0.0000)	I(0)
Trade openness (% of GDP)	-2.652 (0.0040)	-12.7268 (0.0000)	-13.9045 (0.0000)	19.1452 (0.0000)	I(0)
Financial development index	-4.242 (0.0000)	-9.6905 (0.0000)	-10.1275 (0.0000)	13.0386 (0.0000)	I(0)
Governance index	1.191 (0.8830)	-11.2300 (0.0000)	-12.6945 (0.0000)	17.8518 (0.0000)	I(0)

Source: Authors. p-values are in brackets

The null hypothesis assumes that all series are non-stationary. Based on the results of Pesaran (2003) and Choi (2002), the null hypothesis of non-stationarity is rejected, implying that all variables are stationary.

²Both Pisati (2001) and Jeanty (2010) tests provide the same calculation results

Table A9: Diagnostic Tests for Instrument Validity and Endogeneity

Category	Test Description	Test Results	Conclusion
Relevance	Weak-instrument F-test for excluded instruments (Fiscal Deficit, Exchange Rate, Corruption)	$F(39, 1635) = 127.56;$ $p = 0.0000$	Strong instruments ($F > 10$)
Validity	Overidentification test of all instrument (Sargan-Hansen test)	$\chi^2(2) = 226.694;$ $p = 0.753$	Exogenous instruments (H_0 :Uncorrelated instruments with the second-stage residuals)
Endogeneity	Hausman-type test of exogeneity of IFFs (difference in coefficients)	$\chi^2(5) = 27.82;$ $p = 0.0000$	IFF is endogenous (Need for IV estimation)



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