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Dédicace

À mes parents.

L'université d'Orléans n'entend donner aucune approbation ni
improbation aux opinions émises dans les thèses ;
elles doivent être considérées comme propres
à leurs auteurs.

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General Introduction

General Introduction

“The enhancement of living conditions must clearly be an essential—if not the essential—object of the entire economic exercise, and that enhancement is an integral part of the concept of development.”

[Sen \(1988\)](#), The Concept of Development, Handbook of Development Economics.

Introduction

Over the past few decades, the role of fiscal policy in developing countries has changed dramatically. In the wake of the structural adjustment programs of the 1980s and 1990s, many governments scaled back their involvement in the economy, prioritizing market liberalization, deregulation, and privatization. Fiscal policy was largely viewed as a tool for maintaining macroeconomic balance—focused more on limiting public deficits than on shaping inclusive development strategies.

However, global events such as the 2008 financial crisis and, more recently, the COVID-19 pandemic, have brought the role of the state—and fiscal policy in particular—back to the forefront. In these moments of crisis, it became evident that governments are not merely regulators of economic activity but also key actors in protecting households, stabilizing demand, and steering long-term recovery. Consequently, fiscal policy has re-emerged as a powerful instrument—not only for stabilization but also for driving development, addressing inequality, and building resilience in the face of persistent shocks.

This resurgence of fiscal activism has taken place in a context of significant structural constraints for developing countries. Many of these economies continue to grapple with low revenue generation, high public debt burdens, limited access to capital markets, and large informal sectors. At the same time, they face vulnerabilities that are uniquely pressing—such as political instability, the intensifying effects

of climate change, and, in some cases, internal armed conflict. These constraints often restrict the scope of fiscal policy, forcing policymakers to navigate difficult trade-offs between short-term stabilization and long-term development.

More broadly, developing countries face challenges that impede their efforts to achieve sustainable development. These include persistent poverty, deep-rooted inequalities, vulnerability to external shocks (including economic crises and natural disasters), food insecurity, low productivity, and high unemployment. These challenges not only undermine social cohesion but also constrain economic performance and delay progress toward long-term development goals.

To address these constraints, fiscal policy has emerged as a powerful tool for governments, allowing them to regulate economic activity, promote social equity, and maintain macroeconomic stability. Fiscal policy, as defined by (Wong, 2020), encompasses the government's strategies to guide spending and taxation, which are central to managing economic outcomes. This includes both the allocation of resources and the distribution of the tax burden across different segments of the population. Building on the seminal work of Musgrave (1959), which outlines the three primary functions of fiscal policy—allocation, distribution, and stabilization—governments can use fiscal measures to address all constraints. However, for fiscal policy to be effective, it requires fiscal space—the necessary capacity of government to adjust spending or taxation without compromising debt sustainability (financial stability).

Theoretically, taxation plays a central role—reliable source of funding for development—in revenue generation Burgess and Stern (1993), with progressive tax systems recognized as especially effective in fostering inclusive economic development process Kaldor (1963). A well-designed tax structure allows governments to mobilize domestic resources, which can be channeled into critical areas such as healthcare, education, and infrastructure. Generally, developing countries often face severe limitations in their ability to fully leverage fiscal policy due to a lack of fiscal space. Ostry et al. (2010) defines fiscal space as the gap between a country's current level of public debt and its debt limit, which is determined by its historical fiscal performance and capacity for future adjustment. The availability of room in a government's budget that allows it to provide resources for a desired purpose without jeopardizing the sustainability of its financial position or the stability of the economy. Many developing countries are forced to allocate a substantial portion of their budget to debt servicing, leaving limited room for critical investments. Given the challenge, the essential points are how taxes are collected, from whom, and how revenue is spent (Moore and Prichard, 2017; Dao and Godbout, 2014).

Fiscal realities of developing countries also arise from structural challenges within their economies. Many of these countries have weak tax bases, characterized by a high degree of informality and low tax

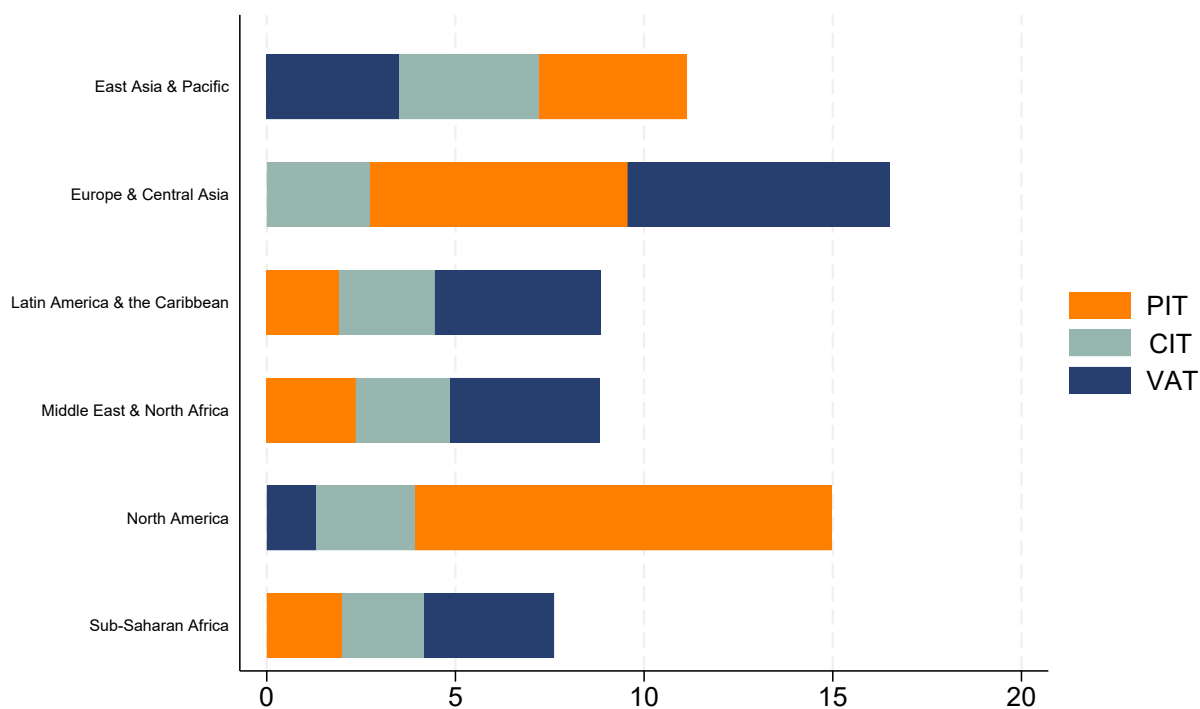
compliance. As [Stiglitz \(2006\)](#) highlight, tax compliance issues often stem from tax evasion, avoidance, and inadequate administrative capacity. Furthermore, ([Ostry et al., 2015](#); [Baum et al., 2017](#)), argues that structural factors explain the lack of fiscal space needed to pursue countercyclical policies or respond adequately to external shocks. Overall, these countries often face high levels of debt, limited access to international capital markets, and weak fiscal institutions. Currently, the resources needed to finance the SDGs are significant [Mascagni et al. \(2014\)](#) and advanced countries' ability to transfer resources through official development assistance is severely limited by their debt-to-GDP ratios, which now exceeds 100% of GDP on average and are expected to increase further.

Historically, literature on fiscal policy has focused on developed economies, where fiscal policy rules and frameworks are well-established. While some study explores fiscal policy impact in developing world, ([Williams and Hay, 2005](#); [Heller et al., 2006](#); [Perotti, 2007](#); [Vera, 2009](#); [Schick, 2009](#); [Catalano et al., 2020](#); [Ostry et al., 2010](#); [Escolano and Escolano, 2010](#); [Novignon and Nonvignon, 2015](#)) there are some relevant links to the current challenge that remain underexplored. We contribute to the literature by examining several macroeconomics relationships connected with fiscal policy challenge in these countries (Tax structure- inequality, Internal Armed conflict-tax revenue, efficiency of government spending-climate shocks, fiscal rules-development outcomes). Given the uncertainties related to obtaining external financing, domestic revenue mobilization should not be achieved at the cost of impoverishing vulnerable populations or increasing income inequality. Extensive political economy literature proves that increasing inequality is detrimental to sustainability and economic growth [Dabla-Norris et al. \(2015\)](#), the growth cycle [Berg and Ostry \(2017\)](#), poverty reduction [Ravallion \(2004\)](#), the financial crisis [Stockhammer \(2015\)](#), labor productivity [Stiglitz \(2015a\)](#), political and economic stability [Sutherland and Hoeller \(2014\)](#), and conflict resolution [Bardhan \(2005\)](#). The reliance on indirect taxes contrasts sharply with the effectiveness of well-designed direct taxes, such as personal income taxes (PIT). As argued by [Atkinson and Stiglitz \(1976\)](#), direct taxes, particularly progressive PIT, are more effective in achieving redistribution goals, as they are structured to tax individuals based on their ability to pay. This approach ensures that wealthier individuals contribute more to public finances, promoting equity.

The figure below provides a comparative overview of tax composition across global regions, focusing on PIT, Corporate Income Tax (CIT), and Value Added Tax (VAT). The data highlights significant regional differences in tax structures. Regions like Europe & Central Asia, East Asia & Pacific, and Sub-Saharan Africa show a heavy reliance on VAT, underscoring a preference for consumption-based taxation. In contrast, North America relies predominantly on PIT, placing greater emphasis on income tax, which is often progressive. Recent studies, such as [Coady et al. \(2015\)](#), further confirm the redistributive power of direct taxes and income transfers, which have reduced inequality by an average of one-third in advanced

economies.

Figure 1: Tax composition average of 1980 to 2021 around the world: Sub Saharan vs Others Regions (Author construction)

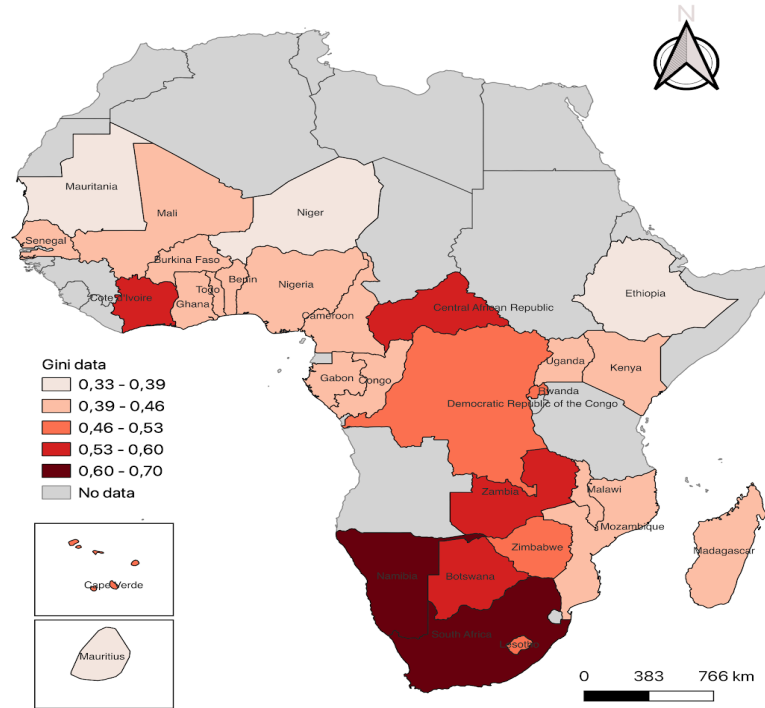


Source : Author construction based on ICTD's Government Revenue Dataset (GRD)

Fiscal policy can efficiently allocate resources to priority sectors, redistribute income to reduce inequality, and stabilize the economy in the face of shocks. In light of these constraints—limited fiscal space, internal conflicts, and the growing impact of climate change—there is a pressing need to redesign fiscal policies for long-term development in developing countries. This thesis focuses on four critical issues—income inequality, armed conflict, climate shocks and Development outcome—because of their profound relation with fiscal policy effectiveness.

Income inequality is one of the most pressing social and economic challenges of our time. For instance, Sub-Saharan Africa is one of the world's most unequal regions, containing 10 of the world's 19 most unequal countries (UNDP, 2017).

Figure 2: Income inequality in SSA (Author construction)



Source : Author construction based on WDI

Tax structure plays a key role in the debate on fiscal transition. Given its importance in the current resource mobilization process, taxation also appears to be a powerful tool for influencing income distribution (Coady and Gupta, 2012; Clements et al., 2015; Gu et al., 2015; Alavuotunki et al., 2019; Ciminelli et al., 2019). Although public spending can influence redistribution to some extent, the direct relationship between taxation and inequality makes taxation a fundamental tool for governments wishing to tackle inequality effectively. The appeal of taxation lies in its ability to provide a steady and reliable stream of funding for initiatives that aim to reduce inequality. In contrast to sporadic or limited redistribution, sound taxation provides a continuous flow of resources that can be strategically allocated to address the root causes of inequality, such as access to education, health and social services and promote equitable development. Inequality can also exacerbate social and political tensions, which in turn may

lead to instability and conflict.

In many developing countries, particularly in the Sahel, internal armed conflict is another major constraint on development . The Sahel region has been plagued by recurring conflicts that have devastated local economies, displaced populations, and are undermining fiscal capacity. These conflicts in Africa, have ranged from wars of national liberation aimed at securing independence, to internal struggles between rival groups following decolonization. Additionally, many conflicts are secessionist or identity-based, fueled by regional and ethnic divisions. Religious conflicts, particularly involving terrorist incursions in West Africa (e.g., Nigeria, Mali), have further compounded instability. Power struggles and coups d'état are common in cash economies, particularly in states characterized by deep inequalities, poor governance, or weak institutions [Hugon \(2003\)](#). Several studies have investigated the impacts and determinants of armed conflicts in developing countries, ([Gupta et al., 2004](#); [Gates et al., 2012](#); [Polachek and Sevastianova, 2012](#); [Pedersen, 2002](#)). Today, persistent instability has created an environment where governments struggle to maintain effective security, allowing terrorist groups to operate and exert control over territories. This dynamic weakens fiscal sustainability and hinders post-conflict recovery efforts. Conflict not only destroys infrastructure but also erodes the capacity of governments to raise revenue and allocate resources efficiently. [Addison et al. \(2004\)](#) highlight the fiscal dimensions of conflict, noting that wars and civil strife often force governments to divert resources toward military expenditures at the expense of development-oriented spending. Country's political stability is necessary for developing countries from the perspective of achieving the Sustainable Development Goals. We contribute to this literature in different ways. First, we look at the effect of internal armed conflict on tax revenue in the Sahel and explore how governments can rebuild and protect their fiscal space in this context. Last but not least, climate change is progressing at an alarming rate. According to the Intergovernmental Panel on Climate Change, if current trends continue, temperatures could rise by 3°C or more above pre-industrial levels by 2100. These changes result in negative climate- induced supply shocks, which contribute to a global economic downturn ([Stern, 2007](#)) with considerable fiscal implications ([Lis and Nickel, 2010](#); [Imam and Kpodar, 2022](#); [Barrage, 2020](#); [Fuje et al., 2023](#)). The figures(3 and 4) depicts geographical distribution of temperature and rainfall variation across developing countries. It illustrates the average temperature and rainfall over the period from 1995 to 2020. ¹.

¹The method used to classify the data is the Natural Breaks Classification [North \(2009\)](#)

Figure 3: Rainfall Average in developing countries

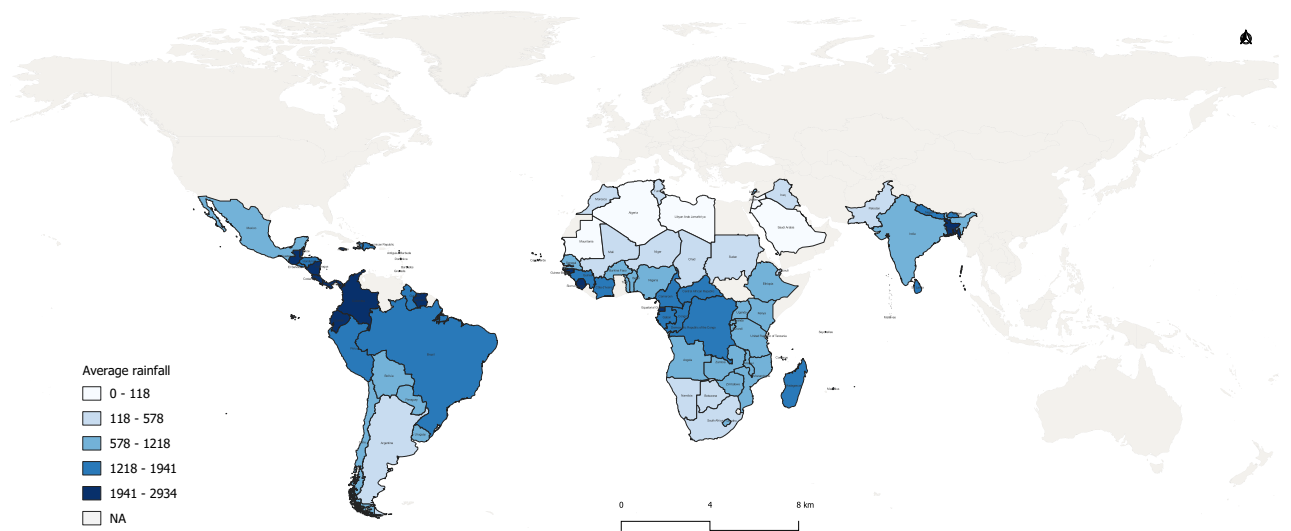
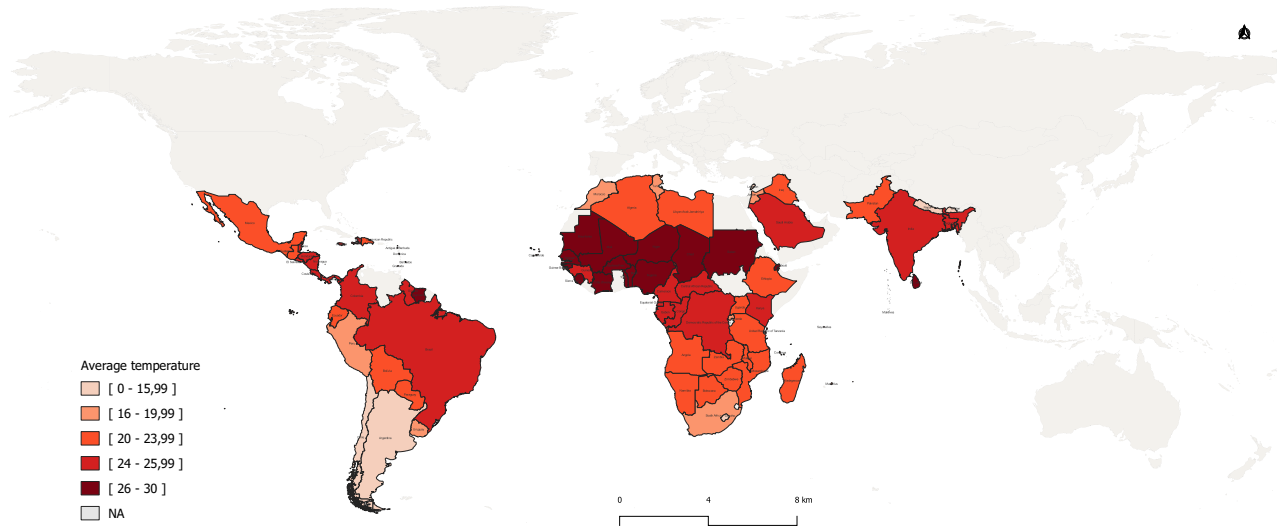


Figure 4: Temperature Average in developing countries



This provides a crucial perspective for understanding climate variability across regions. The effects of climate change, including extreme weather events, rising temperatures, floods, and droughts, impose significant fiscal burdens on governments, particularly in low-income and vulnerable countries. [Raddatz \(2009\)](#) and [Acevedo et al. \(2020\)](#) show that climate shocks can disrupt economic activity, reduce agricultural productivity, and increase infrastructure costs, leading to lower tax revenues and higher public spending needs. For developing countries, which are already constrained by limited fiscal space, these shocks can exacerbate existing vulnerabilities and undermine long-term development goals. Hence, we examine how public spending efficiency can be improved to mitigate the fiscal risks associated with climate shocks, and how fiscal policy can be used to build resilience against these shocks. Strengthening fiscal resilience is crucial to ensure the long-term sustainability of development efforts in an increasingly unpredictable climate landscape.

The ultimate goal of mitigating and adapting to the challenges of inequality, conflict, and climate through fiscal policy is to promote sustainable development. However, development outcomes in many countries remain weak due to fragile fiscal institutions. In emerging and developing nations, critical development challenges such as high infant mortality, low school enrollment, and limited access to electricity persist. For instance, despite a 51% reduction in the global under-five mortality rate since 2000 (UNICEF, 2023), millions of children still die each year before their fifth birthday. Regarding school enrollment, significant disparities remain across regions. Additionally, the World Bank reports that nearly 770 million people lacked access to electricity in 2019, the majority in sub-Saharan Africa. This lack of access hinders economic growth, as reliable electricity is essential for education, healthcare, and infrastructure development.

Fiscal policy plays a pivotal role in shaping these development outcomes. Efficient tax management is vital for ensuring that public resources are directed towards crucial sectors. Literature has shown that sound tax regulations can enhance the effectiveness of public expenditure, reducing waste and shifting resources towards areas that stimulate economic growth [Apeti et al. \(2023\)](#). Well-designed fiscal policies help maintain macroeconomic stability by controlling inflation and reducing fiscal policy volatility, which are essential for attracting private investment and fostering overall economic stability ([Sargent et al., 1981](#); [Woodford, 1995](#)). Fiscal institutions, particularly fiscal rules, offer a promising avenue for enhancing fiscal discipline and improving development outcomes in developing countries. By imposing clear, long-term constraints on fiscal policy, these rules can stabilize public finances, reduce budget deficits, and control public debt [Hemming \(2003\)](#); [Barbier-Gauchard et al. \(2021\)](#). Such stability is critical for creating an environment conducive to sustained economic growth and long-term development.

That being said, effective fiscal policy requires the appropriate use of fiscal tools, including the structure of taxation, fiscal rules, and public spending. Each of these tools plays a crucial role in shaping fiscal outcomes and addressing the challenges of inequality, conflict, and climate shocks.

In general, fiscal tools examined highlight that the tax structure is central to resource mobilization and reducing income inequality, particularly in developing countries where tax bases are often narrow, and tax compliance is low due to tax avoidance, evasion, and weak institutional capacity. Fiscal rules play a crucial role in ensuring fiscal discipline and macroeconomic stability by imposing constraints on government borrowing, spending, and debt accumulation ([Kopits and Symansky, 1998](#)). In developing countries, where political and economic instability are common, these rules help stabilize public finances and reduce the risk of debt crises. Finally, public spending efficiency is essential for achieving better

outcomes in health, education, and infrastructure(Combes et al., 2023). In the context of climate change, we explore how it undermines public spending efficiency and how it can be optimized to ensure that limited fiscal resources are effectively allocated to maximize social and economic benefits.

Despite the extensive literature on fiscal policy in both developed and developing countries, significant research has focused on taxation and inequality in advanced economies where fiscal frameworks are well-established, and access to capital markets is more robust (Piketty and Saez, 2014; Alvaredo et al., 2017), less attention has been paid to how tax structures in Sub-Saharan countries and their impact on inequality. Similarly, while armed conflict and fiscal capacity have been studied in the context of state-building and war financing in historical settings (Tilly et al., 1992), there is a dearth of empirical research on the fiscal consequences of modern conflicts in regions like the Sahel. Finally, the fiscal implications of climate change remain an emerging area of research. While there is growing recognition of the need for climate resilience in public finance management, there is limited empirical evidence on how climate affect public spending efficiency.

The objective of this thesis is to contribute to the existing body of knowledge on fiscal policy in developing countries by examining the interplay between fiscal space, inequality, armed conflict, and climate shocks, as well as the crucial role of strong fiscal institutions in improving development outcomes. We fills important gaps by providing insights into how robust fiscal frameworks can be designed to mitigate these challenges and foster sustainable development. In a post-COVID-19 world marked by the uncertainties of a fragile recovery— fuelled by climate shocks and conflicts between the world’s largest food producers—the design of fiscal policies is crucial to ensure sustainable economic recovery.

Theoretical Foundations

The theoretical foundations of this thesis are multi-faceted, drawing on pivotal economic theories to explore the role of fiscal policy in addressing pressing issues such as inequality, conflict, and climate change in developing countries. At the core are Musgrave’s Three Functions of Fiscal Policy—allocation, distribution, and stabilization Musgrave (1959). These functions form the bedrock of understanding how fiscal mechanisms can be tailored to meet the unique challenges faced by low-income nations.

The allocation function underscores the government’s duty to provide public goods—such as health-care, infrastructure, and education—that the market often underprovides. This function becomes especially critical in regions vulnerable to external shocks, as it is the state’s responsibility to ensure that the foundational systems of society remain robust. The distribution function focuses on mitigating inequality through progressive taxation and redistributive policies. Building on the seminal works of (Kaldor,

1963; Piketty and Saez, 2014), this thesis posits that progressive tax systems are essential for addressing deep-seated inequalities that hinder inclusive growth. By ensuring that the wealthiest contribute their fair share, fiscal policy can redistribute resources in a way that promotes broader societal welfare, reduces poverty, and stimulates inclusive economic growth. Meanwhile, the stabilization function takes center stage in environments where economic instability, debt crises, and inflation run high, particularly in developing countries grappling with climate change and conflict. Fiscal policy, when effectively managed, can be a powerful stabilizing force. This thesis draws on (neo)Keynesian and (neo)Classical frameworks, such as those advanced by (Phelps, 1961, 1965; Tobin, 1989), which stress that optimal fiscal policy can not only stabilize economies in crisis but also foster long-term growth by supporting high-productivity investments that “crowd in” private sector activity. Thus, well-directed government spending not only boosts immediate demand but can also transform structural dynamics within the economy, driving sustainable development.

We further emphasizes the fiscal implications of climate-related shocks, such as extreme weather events, rising sea levels, and prolonged droughts. These events compel governments to reallocate public funds toward urgent needs, such as disaster relief, infrastructure reconstruction, and climate adaptation. Climate change, as a classic negative externality, exemplifies how market failures occur when the environmental costs of activities (e.g., emissions) are not borne by those responsible but by society as a whole. Theories of public goods and externalities provide a compelling rationale for government intervention through targeted fiscal policies to correct these imbalances (Noy, 2009; Aligishiev et al., 2022). The reallocation of fiscal resources to climate resilience and adaptation, though critical, raises complex challenges regarding the long-term sustainability of public finances. Effective fiscal policies must navigate the dual pressures of increasing spending on climate adaptation and maintaining fiscal stability, offering a strategic pathway for governments to shield vulnerable populations from the worst effects of climate change while ensuring future economic resilience.

Turning to the political economy of conflict theory, this thesis draws from the influential works of (Bardhan, 2005; Tilly et al., 1992) to explore how internal conflicts drain fiscal capacity and undermine development. Conflicts, often fueled by economic inequality and institutional weaknesses, lead to a vicious cycle where resources are diverted away from productive investments in public goods—such as education and infrastructure—and channeled into military expenditures and conflict management. This not only stifles growth but also weakens the state’s ability to generate revenue and deliver essential services. The greed and grievance model introduced by (Collier and Hoeffler, 2004; Bardhan, 2005; Walter, 2002) complements this view by illustrating how resource-based conflicts and grievances arising from inequality can exacerbate instability, further eroding fiscal stability. Moreover, Stewart (2008) theory of

horizontal inequalities shows how unequal access to resources across ethnic or regional groups often acts as a precursor to conflict, necessitating fiscal policies that promote equity and inclusivity.

Lastly, the theoretical foundation on fiscal institutions and their impact on development outcomes centers on the role of fiscal rules in promoting macroeconomic stability and long-term growth. Fiscal discipline, achieved through rules that constrain borrowing and spending, enhances the credibility of governments, reduces the risk of fiscal mismanagement, and strengthens economic institutions (North, 1990; Alesina et al., 1996; Kopits and Symansky, 1998). Such rules, when designed effectively, create a stable environment for private investment and public spending efficiency, which are key to sustainable development. By providing a framework that limits opportunistic fiscal policies, fiscal rules contribute to macroeconomic stability, encouraging greater transparency and predictability in public finance. This thesis posits that fiscal rules, by fostering fiscal discipline, lay the groundwork for resilient, long-term development outcomes.

Research contributions

The primary contribution of this thesis lies in its comprehensive analysis of how well-designed fiscal policies can foster long-term economic development, particularly in developing countries. We identified and investigated channels through which sound fiscal policies can drive sustainable development. The thesis delves into the impact of disaggregated tax instruments on income inequality, providing new insights into how tax structure design influence economic equity. Furthermore, the thesis investigates the fiscal implications of internal armed conflict and how such conflicts undermine the capacity of governments to mobilize domestic revenue. This analysis sheds light on the fiscal dimensions of conflict, showing that effective governance and institutional reforms are critical to strengthening the fiscal capacity of conflict-affected states, particularly in sahel.

Additionally, we explores climate-related shocks and their effect on public spending efficiency. The findings highlight the importance of integrating climate resilience into fiscal frameworks to protect public spending efficiency amid increasing climate volatility. Another key contribution is the exploration of the causal relationship between fiscal rules and development outcomes, demonstrating that fiscal discipline, particularly through expenditure rules, leads to tangible improvements in infrastructure, education, and healthcare.

By employing advanced empirical methods, the study provides robust findings that are economically meaningful and resistant to various modeling specifications. It also uncovers heterogeneities and nonlin-

earities in these effects, shaped by the unique macroeconomic conditions and institutional frameworks of developing countries. These findings offer practical guidance for policymakers, showing how effective fiscal policies can enhance development while addressing external challenges such as climate change and armed conflict.

Chapter 1: How Does Tax Structure Affect Income Inequality? Empirical Evidence From Sub-Saharan Africa

Over the past few decades, taxation has emerged as a crucial instrument not only for financing long-term development but also for influencing income distribution. This chapter explores the impact of tax structures on income inequality across 30 Sub-Saharan African countries from 2000 to 2017. By focusing on individual tax instruments, the analysis employs both the fixed-effects least-squares dummy variable (LSDV) approach and the two-stage least squares (2SLS) instrumental variables to ensure robustness in the estimations.

The results from a comprehensive series of econometric tests and alternative specifications reveal that personal income tax is the sole tax instrument that effectively reduces income inequality in the region. In contrast, other taxes, such as indirect taxes and trade-related levies, fail to exhibit the same redistributive impact. Furthermore, the analysis highlights that strong institutional quality and the protection of property rights are critical components in fostering an environment conducive to reducing inequality. However, the effectiveness of tax progressivity is diminished in countries governed by military regimes and where ethnic conflicts are prevalent, suggesting that political and social factors significantly shape the outcomes of fiscal policy.

For policymakers, these findings underscore the need to prioritize progressive tax systems, particularly personal income tax, as the most effective tool for combating inequality. Additionally, strengthening institutional frameworks and ensuring political stability are essential for maximizing the redistributive potential of tax policies. Ultimately, the chapter underscores that tax structure design matter and moreover equitable, efficient, and socially cohesive tax policies are indispensable to achieve Sustainable Development Goal 10.

Chapter 2: Armed Conflict and Fiscal Capacity in the Sahel: An Empirical Approach

This chapter explores the impact of internal armed conflicts on tax revenue mobilization in the Sahel region. Domestic revenue generation is a key source of financing for the Sustainable Development Goals (SDGs), providing countries with the resources needed to build functional institutions, improve gover-

nance, and reduce dependency on foreign aid . With external financing falling short of the massive needs to achieve the SDGs, governments must increasingly rely on internal revenue collection—primarily through taxation. However, in many Sahelian countries, recurrent armed conflicts have severely hampered the ability to mobilize tax revenues. These conflicts, often fueled by ethnic and regional grievances, power struggles, and natural resource extraction, create an environment where tax collection becomes increasingly difficult. Armed conflicts disrupt economic activity, weaken tax administration, and erode the institutional capacity required for effective tax enforcement.

Using data from 10 Sahel countries from 2000 to 2021, this study employs several econometric techniques including Driscoll-Kraay Ordinary Least Square (OLS), fixed effects methods, two-stage least squares (2SLS) instrumental variables, and local projection. The results reveal a significant negative effect of internal armed conflicts on tax collection. Specifically, armed conflicts undermine the tax base, reduce economic activity, and weaken the capacity of governments to mobilize resources. Despite these challenges, the analysis highlights that certain factors can mitigate the adverse effects of conflict on tax revenue. Strong institutional quality, and advancements in information and communication technology (ICT) play a positive role in improving tax mobilization. These factors help governments strengthen tax administrations, enforce compliance, and leverage technology to broaden the tax base, even in conflict settings.

To conclude, as Sahel countries strive toward sustainable development, effective taxation remains crucial. However, ongoing conflicts in the region present significant barriers that undermine tax revenue mobilization. Addressing these challenges requires comprehensive institutional reforms, including the enhancement of governance frameworks and the modernization of tax administration systems. Investments in technology are essential to strengthen the capacity of tax authorities and improve revenue collection, particularly in conflict-affected areas. Moreover, international partners and donors have a critical role to play in supporting these efforts by providing technical expertise and financial assistance. Through a combination of external support and domestic reform, Sahel countries can overcome the fiscal challenges posed by conflict.

Chapter 3: Fiscal Efficiency Amid Climate Shocks: How does climate shocks affect public spending efficiency in Developing Countries?

This chapter explores the intricate relationship between climate change and public spending efficiency in developing countries. Using a comprehensive dataset spanning 35 countries from 2000 to 2019, we employ both stochastic frontier analysis and fractional logit and probit regression to assess how climate shocks—such as extreme temperature fluctuations and irregular rainfall—impact government expenditure

efficiency. The results reveal that climate change significantly undermines the efficient allocation of public funds, especially in regions already struggling with limited fiscal capacity. Moreover, our findings indicate that rainfall and temperature shocks exacerbate these inefficiencies, complicating fiscal management and intensifying the challenge of achieving sustainable development.

The increasing unpredictability of climate-related incidents shifts government priorities, often diverting funds away from essential sectors like education and healthcare toward immediate disaster relief and infrastructure rebuilding. This reallocation of funds tends to strain public budgets and reduce the efficiency of public spending, particularly in economies with limited absorption capacity. As a result, governments are forced to choose between long-term development goals and short-term climate adaptation strategies, a dilemma that can hinder overall fiscal efficiency. These economic shocks not only destabilize government budgets but also reduce the efficiency of public spending by forcing governments to allocate more resources toward mitigation and recovery efforts, often at the expense of vital social services. Our results emphasize the urgent need for governments to integrate climate resilience into their public finance management strategies. To achieve long-term sustainability, developing countries must adopt proactive fiscal measures that balance immediate climate response with investments in critical sectors like education, healthcare, and infrastructure. Strengthening institutional capacities, improving fiscal governance, and building climate-resilient infrastructure are key steps to enhancing public spending efficiency and maintaining progress toward sustainable development.

Chapter 4: Fiscal Discipline and Development Outcomes: Empirical Evidence from Fiscal Rules

This chapter investigates whether fiscal rules, by enhancing fiscal discipline, have contributed to improving development outcomes in developing countries. Drawing on entropy balancing and instrumental variable approaches, we examine the causal impact of fiscal rule adoption on key development indicators—specifically infrastructure, health, and education—across 110 developing countries over the period from 1990 to 2019. The results demonstrate that countries with fiscal rules tend to achieve better development outcomes compared to those without such frameworks, particularly in critical areas like infant mortality, school enrollment, and access to electricity.

Notably, countries with fiscal rules were found to have, on average, a 1.4 percentage point lower infant mortality rate compared to those without fiscal rules. The impact is particularly pronounced in low-income countries, where the potential for improvements is greater. Moreover, among various fiscal rule types, expenditure rules exert the most significant positive effect on development outcomes, outper-

forming debt and balanced budget rules. This suggests that fiscal rules that directly target spending allocation are more effective in driving resources toward essential public goods like education, healthcare, and infrastructure, thereby improving social welfare.

Furthermore, these findings shows that fiscal rules contribute to better development outcomes by improving public expenditure efficiency and fostering macroeconomic stability. These rules help governments avoid wasteful spending, allocate resources more effectively, and reduce fiscal volatility, thus creating a more stable environment for long-term investments in social and economic infrastructure. The findings underscore the importance of both fiscal discipline and well-designed fiscal rules in ensuring that limited resources are used efficiently to meet development goals.

Chapter 1

Chapter 1

How Does Tax Structure Affect Income Inequality? Empirical Evidence From Sub-Saharan Africa

Co-written with Bertrand Laporte & Gervasio Semedo

“We must collect taxes without causing unnecessary burden to citizens. Just as a flower is not hurt when the bee draws nectar from it, so also should the king not disturb the taxpayer when he collects taxes.”

Kautilya (c. 350-275 BCE), The
Arthashastra.

1.1 Introduction

Over the past few decades, most African countries have relied on improving internal revenue mobilization to achieve the financing needs of the Sustainable Development Goals (SDGs, 2015)¹ and strengthen accountability between citizens and the state. Various global crises have demonstrated the vulnerability to shocks of countries that are highly dependent on external resources, as well as their economic and social instability. Currently, the resources needed to finance the SDGs are significant ([Mascagni et al., 2014](#)), and advanced countries' ability to transfer resources through official development assistance is severely

¹Sustainable Development Goals

limited by their debt-to-GDP ratios, which now exceeds 100% of GDP on average and are expected to increase further following the crisis caused by COVID-19 (CEP,2020). Theoretically, taxation is seen as a powerful policy tool for collecting revenue for development (Musgrave, 1959; Burgess and Stern, 1993) whereas progressive taxes are considered strategically important to foster an increasingly inclusive economic development process (Kaldor, 1963). Thus, for Moore and Prichard (2017) as well as Dao and Godbout (2014), the essential points are how taxes are collected, from whom, and how revenue is spent. Given the uncertainties related to obtaining external financing, domestic revenue mobilization should not be achieved at the cost of impoverishing vulnerable populations or increasing income inequality. Extensive political economy literature proves that increasing inequality is detrimental to sustainability and economic growth (Dabla-Norris et al., 2015), the growth cycle (Berg and Ostry, 2017), poverty reduction (Ravallion, 2004), the financial crisis (Stockhammer, 2015), labor productivity (Stiglitz, 2015a), political and economic stability (Sutherland and Hoeller, 2014; Ostry et al., 2014), and conflict resolution (Bardhan, 2005).

In the current scientific debate on sustainable development, income inequality —more specifically, tax policy’s effectiveness in influencing income distribution —is one of the most persistent, heated and widespread issues (Bird and Zolt, 2005; Stiglitz, 2015a; Bourguignon, 2017; Piketty and Saez, 2014; Chancel and Piketty, 2021). Although progress has been made in achieving the Millennium Development Goals, most of the populations in low-income countries still face inequality, poverty, and vulnerability due to natural disasters, among other challenges. Globally, economic growth is expected to increase people’s incomes, create jobs and opportunities by increasing the tax base, and reduce inequality. However, achievement of this expectation is sometimes hampered by the lack of a direct mathematical relationship among economic growth, reducing inequality, and increasing the tax base. Public survey results indicate that rising income inequality has been accompanied by a growing public demand for income redistribution in developing countries (Clements et al., 2015). Thus, the benefits of growth must be shared across a large part of the population to realize citizens’ aspirations (high availability of public goods and the reduction of poverty and inequality) and thus induce them to comply with taxes. In this light, Williams and Krasniqi’s (2017) analysis confirmed the existence of a negative correlation between income inequality and tax compliance. Furthermore, the existence of high inequality affects economies and reduces policies’ effectiveness (Stiglitz, 2015b).

Sub-Saharan Africa is one of the world’s most unequal regions, containing 10 of the world’s 19 most unequal countries (UNDP, 2017). Recently, in studying the consequences of the COVID-19 crisis in terms of living standards, the World Bank (2020) estimated that 88–115 million people will fall into extreme

poverty and that most of these vulnerable populations will be in sub-Saharan Africa and South Asia. These estimates are confirmed by a ([UN, 2021](#)) report that concluded that 119–125 million people have fallen back into poverty. Thus, the crisis exacerbates inequalities, disrupts achievements, jeopardizes the attainment of SDG 10 focused on (Reducing Inequality), and is directly linked to SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), and especially to Aspiration 1 of the African Union’s Agenda 2063 which calls for (A prosperous Africa based on inclusive growth and sustainable development). From this perspective, the repercussions of the COVID-19 crisis are disastrous, and there exists the need for developing countries to implement economic and social policy reforms commensurate with the gravity of the situation.

Tax structure plays a key role in the debate on fiscal transition. Although many countries remain dependent on gate receipts (especially customs receipts)—a legacy of colonial rule—it is difficult (especially in warehouse countries) to mobilize domestic tax resources effectively ([Chambas, 2005](#)). Today, the theme of fiscal transition is highly prevalent in Africa and is the basis for structural transformation. Additionally, the pursuit of domestic resource mobilization objectives must be in harmony with the sustainable development goals set out in the 2030 Agenda. Given its importance in the current resource mobilization process, taxation also appears to be a powerful tool for influencing income distribution ([Coady and Gupta, 2012](#); [Clements et al., 2015](#); [Gu et al., 2015](#); [Alavuotunki et al., 2019](#); [Ciminelli et al., 2019](#)). Although public spending can influence redistribution to some extent, the direct relationship between taxation and inequality makes taxation a fundamental tool for governments wishing to tackle inequality effectively. The appeal of taxation lies in its ability to provide a steady and reliable stream of funding for initiatives that aim to reduce inequality. In contrast to sporadic or limited redistribution, taxation provides a continuous flow of resources that can be strategically allocated to address the root causes of inequality, such as access to education, health and social services. Indeed, controlling for the redistributive impact of taxes should allow for a shift toward equity-oriented tax systems without sacrificing efficiency. Lessons from optimal taxation theory show that increased mobilization of certain types of taxes can distort the functioning of the economy ([Mirrlees, 1971](#)). This theory takes into account the redistributive effects of tax revenue mobilization. In this way, the establishment of an optimal and equitable tax system is essential for financing public policies given the strong relationship between citizens and the state ([Atkinson et al., 2011](#)).

Overall, direct income taxes are more effective in achieving redistributive goals than other policy instruments [Atkinson and Stiglitz \(1976\)](#). Indirect taxes, whose regressive effect remains mixed for African countries in light of past studies. Moreover, [Sahn and Younger \(1999\)](#) found that value-added taxes are progressive in some African countries. Prominent economists such as ([Piketty and Saez, 2014](#)) propose

taxation as a powerful solution to promote a more equitable distribution of income. In addition, for [De Mooij et al. \(2020\)](#) it is essential to plan for postpandemic recovery to address inequality through a progressive approach to tax systems. The relationship between taxation and inequality in Sub-Saharan African countries remains ambiguous in the literature. Moreover, at this stage, few studies have focused on the effects of the tax structure on income inequality in African countries in particular. Thus, an important first step in this direction is offered. To provide both rational and constructive answers to our study, our concerns have been subdivided as follows: Do tax structures play a role in reducing inequality in Sub-Saharan Africa? Which tax instrument is appropriate in the context of an inclusive tax transition? Does an increased share of VAT revenues worsen income distribution? Through sensitivities, whether recent trends in government consumption expenditure offset or reinforce the effects of tax changes on income distribution was examined.

Based on the literature on tax incidence, it can be hypothesized that (i) as PIT revenues increase as a percentage of GDP, PIT becomes more progressive; (ii) increasing income taxes in general improves tax progressivity; (iii) VAT, excise duties and customs duties are assumed to be regressive. Moreover, to our knowledge, little research has analyzed the influence of the institutional variable on the relationship between tax instruments and income inequality in African countries. Thus, a larger sample of countries was used, considering the role of institutional quality in this relationship and a battery of robustness tests were performed to verify the validity of our results. The objective of this study is to assess the effects of different types of tax revenue on income inequality in Sub-Saharan Africa over the period 2000-2017. An important question is how tax instruments affect income inequality. This paper aims to quantify the effects of tax structures on income inequality. Thus, the originality of this paper is that it examines how tax instruments influence income inequality and, hence, the inclusive tax transition. This study contributes to advancing the literature on tax policy and income inequality by studying how the tax structure (the different tax instruments) affects income inequality. Indeed, different tax instruments have different returns, different tax bases and specific characteristics.

This study differs from previous studies in three respects. First, previous studies focus on the impact of direct and indirect taxation on inequality. They generally use the tax/GDP ratio as the variable of interest. In this paper, in addition to the effect of the direct and indirect tax weight, these variables are disaggregated to use individual tax instruments. Second, to our knowledge, this is the first study that empirically tests the effect of tax structure on income inequality by considering mimicry in the design of tax policies in the case of SSA. Thus, we apply a spatial econometric strategy using a weighting matrix. Indeed, the choice of this instrument is based on the importance of tax mimics and tax spillovers in

policy design in developing countries. Finally, we consider that the determinants of income inequality are multidimensional. To this end, we take into account factors that are little discussed in the literature on the case of sub-Saharan African countries, such as the shadow economy and the globalization index. Our results first indicate that only personal income taxes are effective in significantly reducing income inequality in SSA. In contrast, indirect taxes and international trade taxes increase inequality. Even if the coefficient remains negative, no effect of corporate income tax was found, as well as for excise duties on inequality. Similarly, a nonsignificant positive effect of VAT was found. Furthermore, it is shown that respect for property rights and good institutional quality reduce income inequality. Finally, through a battery of robustness tests, it is confirmed that our results are robust to any change.

The rest of the document is organized as follows. Section 2 presents the stylized facts; Section 3 discusses the different approaches found in the literature; then, the focus is on the data used and the methodology in Section 4. Section 5 presents the empirical results and robustness tests. Finally, a sixth section concludes and provides policy recommendations.

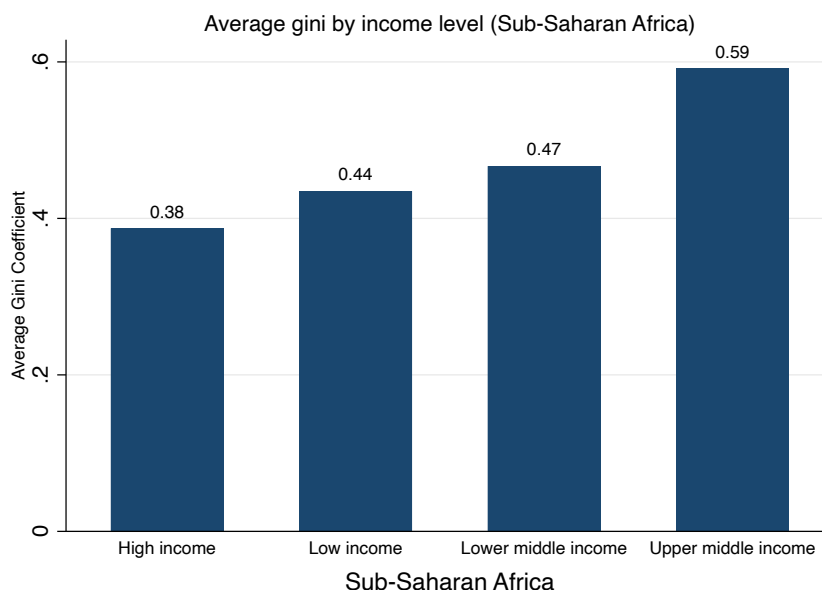
1.2 Stylized facts

In this section, some stylized facts that characterize income inequality and tax structure in Sub-Saharan African countries are presented. While it is one of the most dynamic continents in terms of economic prosperity in the last decade, Africa is second only to Latin America in terms of high inequality in the world Klasen (2016). There is a large body of literature on the relationship between inequality and growth, as measured by the level of per capita income.

Figure 1.1 shows us the average level of income inequality measured by the Gini index over the period 2000-2017 in the countries in our sample. On average, we can conclude that countries with a high level of income are the least unequal. More precisely, the Figure1 shows us that average inequalities go from 0.44 for low income countries to 0.47 for lower middle income countries, 0.59 for upper middle income countries and 0.38 for high income countries. The description in Figure 1 is in accordance with the hypothesis known as the "inverted U" introduced by the work of Kuznets (1955).

Indeed, the assumption is that at very low levels of income, inequality must be low, because virtually everyone lives at or near the subsistence level. As the growth process begins, income inequality increases as agents migrate from the low-income (traditional) agricultural sector to (modern) industrial sector. Subsequently, Kuznets process of increasing inequality refers to a secular relationship generated by long-term changes in economic structure. The shift of agents from the traditional to modern sector raises inter-sectoral inequality and within industry there is a huge disparity between wage earners which will

Figure 1.1: Author's realisation based on SWIID database



raise intra-sectoral inequality. Finally, beyond a certain threshold, the trend is reversed, the inequalities are stabilized and then decrease until they attain the lowest level that can be observed in high income economies.

The tax composition from 2000 and 2019 clearly illustrates the changes in tax structure. Overall, according to table 1.1 there is an average increase in all tax instruments. In particular, VAT revenue as a percentage of total tax revenue has improved by 9%, while the share of income tax revenue has increased by only 3% and the corporate tax by 6% on average over the same period (2000-2019) for our sample countries.

Table 1.1: Table of Tax composition in 2000 and 2019 in Sub-Saharan Africa countries

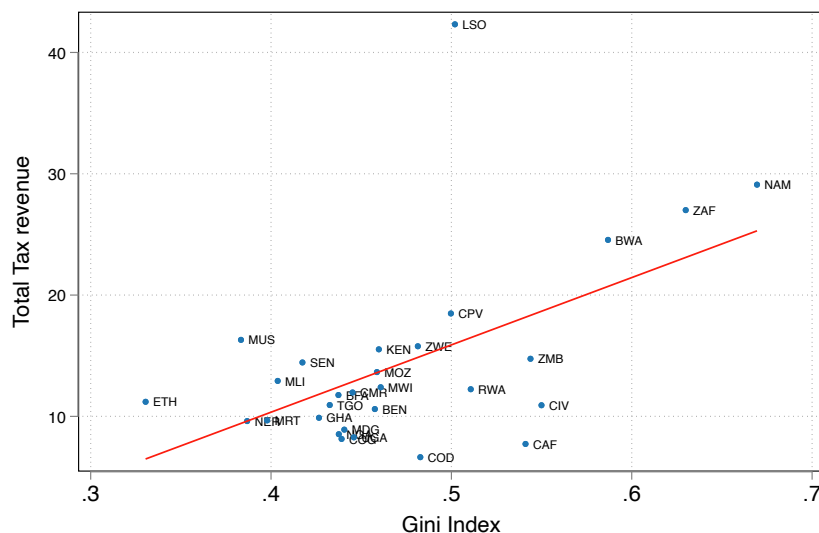
Year	VAT	Personal Income	Corporate Income
2000	22%	16%	11%
2019	31%	19%	17%
Variation 2000-2019	+9%	+3%	+6%

The changes in the composition of tax revenues since the 2000s have been driven by many factors. First, development strategies have established VAT as a tool for domestic revenue mobilisation and thus a strategic component of the tax transition. Secondly, improved economic performance has contributed to the creation of jobs and the emergence of a new middle class. However, despite its potential, personal

income tax has evolved rather marginally over the same period.

Figure 1.2 shows a positive and increasing relationship between the Gini coefficient and total tax revenue mobilization (tax revenue).

Figure 1.2: Correlation between income inequality and total tax revenue as a percentage of GDP

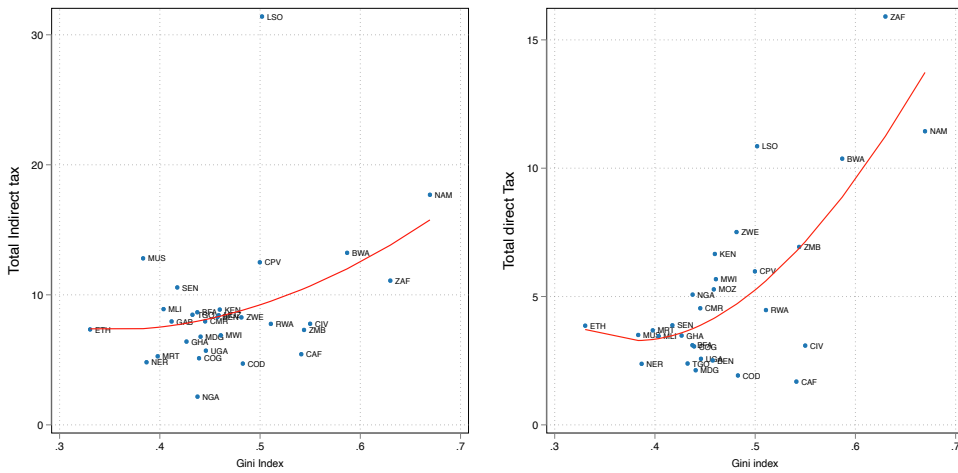


Most countries in our sample have average tax revenues around 16% of GDP. This positive relationship between inequality and tax revenue might seem counterintuitive but could be explained by the low level of revenue mobilization in these economies. This description remains consistent with the idea that only increased tax revenue mobilization could reduce income inequality (Bird and Zolt, 2005; Agnello and Sousa, 2014). Otherwise, the current level of revenue would be insufficient to provide good quality public services, transfers and public infrastructure, which are essential to address income inequality.

Figure 1.3 below describes the relationship between income inequality and indirect and direct taxes as a percentage of GDP. Indirect tax revenues are found to be positively correlated with income inequality measured by the Gini index (SWIID). This is consistent with general assumptions about the regressivity of indirect taxes. However, contrary to the idea of the progressivity of direct taxes, we find that the trend line representing the correlation indicates that inequality and direct taxes are positively related in the countries of our sample.

The trend line is correlation, not causation, suggesting that the relationship obtained from the graphical analysis may be biased by econometric issues such as reverse causality of taxes to inequality and the existence of other factors that affect the inequality-tax link (Yogo and Njie, 2018). We therefore undertake an econometric analysis to explore the impact of these tax instruments in more detail.

Figure 1.3: Relation between income inequality and Total indirect/direct tax as a percentage of GDP



1.3 Literature review

1.3.1 Theoretical approach

In this section, the theoretical link between income inequality and tax policies is developed to formalize the testable empirical implications of the relevant theoretical literature. Overall, optimal taxation theory shows that increased mobilization of certain types of taxes can distort the functioning of the economy (Mirrlees, 1971). Newbery and Stern (1988) provide some cardinal principles on the design of effective redistributive tax policies in developing countries. Indeed, direct taxes such as personal income taxes are likely to be more effective in achieving redistribution goals than policy instruments under certain conditions Atkinson and Stiglitz (1976). Tax on personal income is best equipped to tax people according to their ability to pay. Moreover, progressive PITs (usually combined with income transfers) play a major role in many countries in raising revenue while reflecting concerns about income inequality. The redistributive impact of tax policy depends not only on the volume of taxes and expenditures but also on their composition. Differences in the level and composition of taxes have shown that the potential redistributive impact of tax policies in developing countries is considerably reduced compared to advanced economies. Furthermore, studying the contribution of direct taxes in reducing inequalities in recent decades, Coady et al. (2015) confirm that direct income taxes and transfers have reduced inequality by an average of one-third in advanced economies. Therefore, income taxes are often designed to collect a larger proportion of the income of the rich than of the poor, to reduce the inequality of disposable income relative to taxable income. While taxes on capital appear to be progressive, in theory it is administratively difficult to tax capital because of its mobility, which gives rise to many opportunities for

evasion and avoidance (Clements et al., 2015). In addition, the mobility of capital also allows companies to shift much of the burden of these taxes to labor. The policy literature on the redistributive character of indirect taxes has not received sufficient attention (Prasad and Deng, 2009).

The general theoretical arguments postulate that indirect tax instruments appear regressive. In terms of its character, VAT taxes final consumption and it is recognized that poor households have a higher marginal propensity to consume than rich households. Thus, an increase in consumption taxes could negatively affect the income of poor households. Indeed, a limitation of almost all cross-country studies on this topic is that the hypothesis of VAT regressivity has not been systematically tested as put by Timmons (2010). Thus, the "paradox" so widely noted in the literature is that, despite their internal regressivity, these taxes may ultimately achieve greater redistribution.

1.3.2 Empirical approach

At the empirical level, the empirical evidence from econometric studies that have explored the subject in the past is examined. In general, empirical studies have focused on the relationship between different types of fiscal instruments and economic growth. Extensive literature on developing countries has found clear non-consensual relationships, notably (Skinner and Mundial, 1988; Easterly and Rebelo, 1994; Ocran, 2011; Canavire-Bacarreza and Hanauer, 2013). Other authors, notably (Wenli and Sarte, 2004; Arnold et al., 2011), have found a strong association between tax structure and growth.

After World War II, taxation was used as a specific tool to promote redistribution of wealth through the introduction of high-income tax rates Cornia et al. (2011). Subsequently, the different crises that have arisen have questioned the effectiveness of taxation in influencing income distribution and correcting market failures. Although it is strongly suggested and more relevant to use public spending in the search for equity Bird and Zolt (2005), there are recent studies for example, (Piketty and Saez, 2014) showing that taxation can be a powerful solution to promote more equitable income redistribution. Thus, the relationship between taxation and inequality has been widely discussed in the literature and the results remain mixed depending on the specificities of the methodology and the study sample. Although they take into account the progressivity of the tax structure, deductions and tax credits, many studies on developing countries (Goñi et al., 2011; Joumard et al., 2013; Martinez-Vazquez et al., 2012) have shown that transfers are more effective than taxation in reducing inequality. Indeed, Mirrlees (1971) suggest that tax systems dominated by indirect taxes are regressive and therefore unequal. Similarly, export taxes are regressive and generally affect small agricultural production units (which, while not poor, have relatively low incomes). Thus, the removal of these taxes, combined with the reduction of other implicit

taxes on agriculture, should have a positive impact on distribution and the poor.

However, Mirrlees warns that the progressivity of income taxes can be questioned, as it varies according to the analysis methodology used. On the basis of a partial equilibrium analysis, personal and corporate taxes are found to be regressive (Westlake, 1973) but progressive in a general equilibrium analysis (Mwega, 1986). However, indirect taxes or subsidies based on consumption do not redistribute income efficiently, as high-income households generally account for a much larger proportion of consumption than low-income households Sah (1983). In the case of African countries, Sahn and Younger (1999) found that the value added tax is progressive. Indeed, authors such as Jacquemot and Raffinot (2018) argue that in such countries, the poorest typically do not have access to formal markets because of the entry costs and the high share of informality. In this context, the overall view that VAT is regressive remains to be proven. Other studies have shown that it can be less progressive than the consumption taxes it replaced, so that these reforms may ultimately be regressive (Cho and Muñoz, 2003; Hossain, 1995). However, these studies also show that the progressivity of a value-added tax can be enhanced by adopting lower rates for commodities or by setting the tax threshold high enough to exclude most small businesses, which tend to be used intensively by low-income groups Jenkins et al. (2006). Consumption and property taxes are more conducive to economic growth than income taxes, indeed (McNabb, 2018), found that reducing the share of income taxes in the revenue mix would lead to a higher GDP growth rate.. The effectiveness of consumption taxes and their role in enhancing equity was examined in a qualitative study by Correia (2010). For efficiency purposes, a single rate is preferred to increase revenue yield, combined with a well-targeted transfer program (Engel et al., 1999).

The more consumption taxes contribute to government revenue, the greater the efficiency and welfare effects on low-income people. This view of consumption taxes contrasts with the common view that consumption taxes are regressive ². Thus, the AfDB (2010) calls for the removal of tax exemptions and incentives in the Kenyan tax system, as they undermine tax equity and lead to revenue losses. The distributional impact of value added taxes has been mixed (Bird and Zolt, 2005; Coady et al., 2015).

On the other hand, the results of (Martinez-Vazquez et al., 2012; Bastagli et al., 2015; Woo et al., 2013) show that progressive personal income tax and corporate tax reduce income inequality. However, these results need to be related because Saez (2004) shows that the choice of direct taxation is not systematically effective in reducing income inequality. According to Saez (2004), direct taxation ceases to be relevant when the taxation of labor is based solely on income and when there is imperfect substitution of

²This regressivity can be mitigated by applying differentiated rates: lower rates for basic goods and higher rates for luxury goods, although this complicates tax administration and is not optimal (Saez, 2010)

types of labor in the production function. The author therefore suggests that the choice of tax instrument should be based on short- or long-term objectives. To this end, he recommends that in the short run, the fight against income inequality should be conducted through indirect taxation. On the other hand, he suggests that in the long term, direct taxation should be used to fight income inequality. Also, [Duncan and Sabirianova Peter \(2016\)](#) research has shown that tax progressivity to reduce inequality is only effective when countries are democratic. However, an incorrectly designed redistributive tax policy can have negative consequences for efficiency, growth and even income distribution. Given the limitations of the tax structure to reduce inequality, [Martorano \(2018\)](#) in his analysis suggests that tax revenues should be mobilized to reduce income inequality. Finally, in light of its effectiveness in raising revenue in developing countries, indirect taxes can play a role in redistribution. In this respect [Kenworthy and McCall \(2008\)](#) conclude that “the chief contribution of taxes to inequality reduction is indirect. Taxes provide the money to fund the transfers that reduce inequality.”

As the literature clearly indicates, there is little consensus on the link between tax instruments and inequality. Moreover, most studies have focused on developed or developing countries and less on the Sub-Saharan countries. Through our empirical analysis, a first step is made in this direction.

1.4 Data and methodology

1.4.1 Data

The sample includes annual data for the period 2000 to 2017 for 30 sub-Saharan African countries. The choice of this sample of countries is dictated by the availability of data on both inequality and various independent variables. Table 1.2 present summary statistics. The table 1.9 and 1.10 in the appendix presents the variables used as well as their sources and definitions and complete list of countries.

Measurement of the dependent variable

The data on income inequality refer to the Gini index extracted from the Standardizing the World Income Inequality Database (SWIID)³; in our study, we use net income inequality (after taxes and transfers). The choice of Gini net is related to the fact that it measures the ability of taxation to reduce income inequality. The SWIID database is an attempt to solve the problem of data scarcity. For instance, the World Income Inequality Database (WIID) is challenged by the presence of missing data, which complicates its usefulness for research examining the relationship between taxation and

³The goal of the Standardized World Income Inequality Database (SWIID) is to meet the needs of those engaged in broadly cross-national research by maximizing the comparability of income inequality data while maintaining the widest possible coverage across countries and over time

inequality in African countries. However, some authors have been highly critical of the widespread use of imputations in general, as well as the imputations used by SWIID, and caution against using the dataset in econometric work (Jenkins, 2015; Ferreira G et al., 2015). Any costs arising from its implementation must be considered alongside the potential benefits from wider coverage. The value of SWIID depends on the plausibility of the assumptions underlying the imputation model (potential bias issues) and the correct use of the multiply imputed data (accuracy issues). Therefore, even if SWIID has some weaknesses, it is important to note that SWIID uses a transparent procedure to increase the comparability of available data on cross-national inequalities. Although it is not ideal for all research on economic inequality, its advantages over other cross-national datasets make it a prestigious research tool. Additionally, SWIID provides uncertainty estimates for the observations, which means that users can easily perform robustness tests against the chosen inequality measure.

Measurement of the variable of interest

Fundamentally, measuring the tax pressure by the different statutory tax rates does not capture the complexity of the tax system and, therefore, does not provide a clear indicator of the implicit tax policy. For instance, some authors (Bird and Zolt, 2005; Mourfou and Ouedraogo, 2021; Gemmell and Morrissey, 2005) use the ratio of revenue by tax (direct; indirect; commercial) to GDP as an indicator for measuring the tax burden that characterizes the tax structure. However, there is a criticism of the calculation of the tax ratio. Indeed, the bias in the calculation of tax rates results from the fact that GDP is expressed in purchasers' prices and the relationship between tax rates and GDP is not immediate (Lurton, 2007). Authors postulate that the average tax rate approach seems the most appropriate. It consists of taking into account the taxes actually paid, while relating them to a reduced tax base to approximate the real tax base (Lurton, 2007). However, in order to properly assess what one wishes to measure with this indicator, one would need to have microeconomic accounting data, which are difficult to obtain and to homogenize across countries. In our study, constraints on the availability of accounting data to estimate tax bases restrict us from using the revenue-to-GDP ratio. Unlike previous studies, we also disaggregate our variable of interest (taxation). For this purpose, in addition to measures, such as the percentage of direct/indirect tax revenues, individual tax instruments were also used, i.e., the ratio of (PIT, CIT, VAT, Trade Tax) to GDP. Based on the determinants of inequality in the literature, data from the Government Revenues Database was utilized (ICTD- UNUWIDER) (Prichard et al., 2014)⁴. Drawing on the recent empirical and theoretical literature on inequality and revenue mobilization, control variables were used that capture the simultaneous factors influencing income inequality and tax instruments. All these vari-

⁴Where missing, the ICTD-GRD tax revenue data was supplemented with tax revenue data as a percentage of GDP from the recent IMF Longitudinal Global Revenue Dataset (WoRLD). As well as from the Sub-Saharan Africa Tax Revenue Database Mansour (2014) if data are missing from the ICTD-GRD and IMF-WoRLD datasets.

ables are standard controls in the taxation literature ([Gupta, 2007](#); [Keen and Lockwood, 2010](#); [Morrissey et al., 2016](#)).

(i) **GDP/capita.** The level of development by GDP/capita was approximated. The growth rate of gross domestic product (GDP growth), which controls the economic cycle and fiscal conditions. It is assumed that GDP/capita growth reflects a certain economic productivity and remains a reliable indicator of economic wealth creation in a country. The coefficient on GDP per capita is expected to be positive because lower inequality and poverty are associated with a higher income level.

(ii) **Education.** Education is measured by the Penn World Table (PWT) 8.0 Dataset Human Capital Index per capita. The variable is based on the average number of years of schooling, taken from the work of [Barro and Lee \(2013\)](#), and associated with an assumed rate of return for primary, secondary, and tertiary education. Education is an important component of well-being and is generally used in the measurement of quality of life. Higher levels of education are associated with higher levels of household and individual income and could reduce income inequality.

(iii) **Trade openness.** Trade openness as a percentage of GDP. From a theoretical point of view, the Stolper-Samuelson theorem confirms that in a two-factor framework of two countries, increased trade openness (through tariff reduction) in a developing country with low-skilled labor would increase wages for low-skilled workers and reduce compensation for high-level skill workers, resulting in reduced income inequality [Stolper and Samuelson \(1941\)](#). [Edwards \(1997\)](#) argues that there is no evidence linking openness to evidence linking openness to trade liberalization to an increase in inequality. It is suspected that it will have a negative impact on inequality.

(iv) **FDI.** FDI as a percentage of GDP. The effect of FDI on income distribution is mixed in the literature. FDI can contribute to a more unequal distribution of income in less developed host countries. Indeed, [Tsai \(1995\)](#), reports that there is a positive and statistically significant correlation between FDI and income inequality. This conclusion is supported by [Basu and Guariglia \(2007\)](#). They argue that FDI flows into developing countries and can broaden the skill set of skilled workers. Thus, the wage gap between skilled and unskilled workers increases. These results indicate that FDI flows lead to labor market segmentation, with skilled labor receiving higher wages and increasing income inequality. Therefore, a positive impact of FDI on income inequality is expected.

(v) **Financial Development Index;** The Financial Development Index measures and analyses the fac-

tors that enable the development of financial systems in different economies. The index takes into account the quality of each country's financial laws and regulations, the business environment and the likelihood of a financial crisis, among other things. According to [Beck et al. \(2007\)](#), financial development can improve the poor's access to credit, mitigate extreme inequality and thus improve welfare without distorting economic efficiency. By increasing growth, financial development can participate in improving the incomes of the poor.

(vi) **Public Debt.** The links between public debt and inequality have not been widely studied in modern macroeconomics. The relationship has remained mixed since the early theories. More recently the idea that public debt could reduce inequality has been debated. Thus, due to borrowing constraints, public debt can have redistributive effects, depending on whether prices are flexible (in which case Ricardian equivalence holds globally) or rigid (in which case public debt can have redistributive effects, to the benefit of the borrowing classes, forced to borrow. In this model – with sticky prices – public debt (used to finance tax cuts) has redistributive as well as expansionary effects for the whole economy.

(vii) **Shadow economy.** The shadow economy is, by nature, difficult to measure, as agents engaged in shadow economy activities try not to be detected. The shadow economy is a major source of inequality. However, the literature indicates that the direct link between income inequality and the informal economy is not always clear. As the size of the shadow economy increases, more goods and services are produced outside the formal economy. The most consistent results indicate a positive and statistically significant relationship between the size of the shadow economy and income inequality, both in the long run and in the short run, all else being equal [Chong and Gradstein \(2007\)](#).

Table 1.2: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gini	445	.472	.076	.327	.674
Log GDP/capita	540	6.925	1.037	4.72	9.288
Log Trade Openness	504	4.145	.411	3.031	5.106
PIT	539	2.298	2.17	.025	13.38
CIT	540	2.036	1.351	.119	8.04
VAT	525	3.916	1.928	0	8.68
Tax Trade	540	3.426	4.639	.154	40.861
Direct Tax	513	5.075	3.567	.199	17.442
Indirect Tax	539	8.956	5.589	.374	48.618
Financial Development	522	.151	.121	.029	.638
Shadow Economy	480	38.07	10.024	19.23	69.08
Education	522	1.813	.448	1.069	2.885
Public Debt	522	1.546	1.649	0	19.553

1.4.2 Methodology

Identification strategy

Our objective is to analyze whether and how the tax structure affects inequality. The choice of the appropriate estimation model for this research is made on the basis of the structure of our data. Equation (1) is a model inspired by (Lee and Gordon, 2005; Adam et al., 2015; Martorano, 2018). Ordinary least squares (OLS) models are inefficient in the presence of potential endogeneity variables. Thus, in this study, the estimation technique used was the fixed-effects least squares dummy variable method (LSDV). The choice of this method was based on its simplicity and advantages. Indeed, fixed effects make it possible to correct the biases caused by the autocorrelation of errors and heteroscedasticity. Finally, this method takes heterogeneity into account in a simple way and allows for testing the uniformity of behavior. To test the sensitivity of income inequality to the tax structure, our model is formalized as follows:

$$Gini_{i,t} = \alpha + \beta Tax_{i,t} + \rho X_{i,t} + \mu_i + \epsilon_{i,t} \quad (i = 1; 2; \dots; N; t = 1; 2; \dots; T) \quad (1.1)$$

where $Gini_{i,t}$ represents the Gini inequality index of country i at time t ; α_i is a constant; $Tax_{i,t}$ is the composition of tax revenues from different taxes; $X_{i,t}$ represents the other explanatory variables, μ_i is the country-specific effect and $\epsilon_{i,t}$ is the error term. Beyond that, X identifies a set of variables included in the econometric model to control for several economic factors that may have affected the evolution of inequality in Sub-Saharan Africa over the period considered. Following (Lee and Gordon, 2005; Adam et al., 2015; Martorano, 2018) we argue that the effectiveness of fixed effects may be limited. This is because omitted fixed effects create an endogeneity bias. According to the literature, there is an inverse causal relationship between income inequality and taxes (Meltzer and Richard, 1981; Pickering and Rajput, 2018). Drawing on the results of econometric estimations by (Bird and Zolt, 2005; Agnello and Sousa, 2014), high levels of inequality increase incentives to mobilize revenue and conversely increased revenue mobilization reduces income inequality. Similarly, a high existence of income inequality reduces the opportunities for a good institutional environment and conversely a good quality of institutions favors the reduction of inequality (Martinez-Vazquez et al., 2012). Thus, a potential existence of endogeneity due to reverse causality is suspected. To address this issue, the robustness of our results is developed by the instrumental variables method, more precisely, the double ordinary least squares (2SLS). We use two instruments in this paper. The first one is inspired by the literature, namely the lagged endogenous variable, and the second one is based on the distance matrix. The choice of this technique is justified, as endogeneity is suspected between some variables.

Implementation of the instrumental variable

To overcome these biases, [Lee and Gordon \(2005\)](#) instrument personal and corporate tax rates using the weighted average of personal and corporate tax rates in other countries by considering the inverse of the distance between the two countries. Recently, [Duncan and Sabirianova Peter \(2016\)](#) exploited the spatial correlation of tax rates between neighboring countries to instrument their measure of structural tax progressivity. In this article, a spatial econometric model was used. To estimate spatial autocorrelation, how countries are connected to each other needs to be defined. The reasoning behind the use of the geographical distance weighting matrix is related to the fact that geographically close countries are more relevant tax competitors - countries compete for the tax base - since productive capital is highly mobile between geographically close countries due to relatively lower transport and information costs. This is in line with the first law of geography: "Everything is related to everything else, but things close together are more related than things far apart" [Tobler \(1970\)](#), which explains the wide use of inverse geographical distance in spatial econometrics to measure connectivity. Algebraically, after normalization, the weights $w_{i,j}$ of the geographical distance weighting matrix are given as follows:

$$w_{i,j} = \begin{cases} \frac{1/d_{ij}}{\sum_j 1/d_{ij}}, & \text{for } i \neq j \\ 0, & \text{for } i = j \end{cases} \quad (1.2)$$

where d_{ij} is the Euclidean distance between the capital of country i and that of country j for $i \neq j$. The choice of this instrument is also explained by the importance of tax spillover effects in policy design across developing countries [Cornia et al. \(2011\)](#). Indeed, governments are more likely to reform their tax system if neighboring countries and countries with a similar economic and institutional framework do the same. As an example, the recent double taxation reform implemented in Uruguay influences the design of taxation in other Latin American countries.

1.5 Empirical results and robustness check

1.5.1 Empirical results

Baseline results

Here, the basic results with the fixed effect model (LSDV) are presented. While the Gini index data from SWIID contains some missing values, these do not affect the consistency of the estimation results. However, it is worth noting that the missing values may result in a reduction in the number of observa-

tions available for analysis. The results in Table 3 highlight the effect of each tax instrument on income inequality. As expected, the results confirm that personal income tax is negatively associated with income inequality. Moreover, the associated coefficient is strongly negative and significant (Column 1). Then, increasing the level of personal income tax (PIT) collection reduces inequality. In other words, a 1% increase in personal income tax (PIT) leads to a decrease in income inequality of 0.17 percent. This finding confirms the progressivity of the PIT, suggesting that the PIT may be the best tool to affect income distribution. This result is in accordance with past work of (Martinez-Vazquez et al., 2012), which shows the redistributive impact of a progressive tax structure. However, this conclusion contrasts with Bird and Zolt (2005), who reported that PIT would have a very limited, if any, effect on reducing income inequality in developing countries. They argue that the tax system is less progressive, the costs are excessive, and the gains are too small. For corporate taxes, in Column (2), a nonsignificant negative impact on inequality was found. This result suggests that corporate taxes have no effect on inequality in sub-Saharan African countries. Indeed, given the importance of the informal sector and tax evasion in these countries, governments are not able to raise sufficient revenues from large (especially international) firms to address the equity issue. In addition, the effectiveness of corporate income tax is eroded by many exemptions and favors granted to companies. Thus, no significance was observed for the CIT. This result is consistent with the analysis of the IMF (2014), which shows that international tax competition will pose increasing problems for developing countries in protecting corporate tax revenues. Moreover, the increasing international mobility of capital and the associated opportunities for tax evasion, fraud, and avoidance present increasing administrative challenges.

Column 3 of Table (1.3) suggests that the VAT increases inequalities, but the coefficient is not significant. In fact, the VAT taxes final consumption, whereas it is accepted that the poorest households devote a larger share of their income to consumption. Therefore, they are likely to pay a higher average tax compared to higher income groups. However, few empirical works have tested this general conjecture. In view of the result, we postulate that the effect of VAT on inequalities remains mixed. In Column (4), we found that trade taxes accentuate inequality, which can be explained simply by the fact that the existence of barriers to entry is likely to create monopolies within the country, reducing competition favorable to consumption, especially by the poor. This result is consistent with Siddique (2021), who found that trade taxes and tariffs have a negative impact on income distribution. Direct taxes in general seem to be negative, but we did not reach a significant score (Column 5). Indeed, revenues from direct taxes clearly suffer from tax evasion and the prevalence of a large informal sector. In Column 6, indirect taxes positively and significantly affect inequality. It is clearly observed that a 1% increase in indirect tax revenues as a percentage of GDP increases income inequality by 0.029%. This is because of the regressive nature of

this tax and the dependence on trade tax revenues in most countries. On the other hand, (Column 7) excise taxes that could increase the progressivity of these various taxes have remained on the sidelines of the tax transition and remain an unexploited potential ([Mansour and Rota-Graziosi, 2012](#)). Assessing the impacts of the control variables on income inequality in sub-Saharan countries, we found that most of the control variables are statistically significant and have the predicted sign, as discussed in the literature. The focus is more on the interpretation of the coefficient and sign of Model 1 with the PIT in Table 3.

The results of the impact of trade openness on inequality support the hypothesis that the Stolper-Samuelson theorem (1941) does not describe the only channel through which trade can influence income inequality. It is observed that increasing trade openness improves equity. In other words, a 1 percent improvement in trade openness leads to a 0.70 percent decrease in inequality. This result is consistent with the literature supported by ([Rodrik, 1997](#)) trade makes it easier for developing country firms to replace unskilled labor with inexpensive imports, weakening the bargaining power of workers. Thus, trade intensifies economic competition, leading to lower prices for basic consumer goods. This benefits the poor more than the rich because the poor spend relatively larger shares of their income on basic consumer goods. In addition, competition also reduces the monopoly position enjoyed by the upper class as well as income inequality. Another argument is that trade increases labor productivity, which leads to higher wages and reduced inequality. Although trade openness may reduce the wages of unskilled labor, it provides incentives for workers to acquire training and for firms to employ more unskilled labor, again reducing inequality.

We observed that the increase in GDP increases inequalities significantly. Economic growth is not systematically associated with lower income inequality. Specifically, a one percent increase in GDP increases inequality in the margin by 0.09 to 0.07 percent depending on the fiscal instrument. These results are opposed to Kuznet's inverted curve theory. However, they are consistent with the idea of ([Piketty and Saez, 2014](#); [Myles, 2014](#)) who challenged Kuznet's work. Regarding financial development, there is a positive and significant effect on income inequality, which could be explained by the idea that in the early stages of financial development, loans are targeted at a minority of wealthy households, who can benefit from these credits.

Otherwise, poorer segments of the population will find it difficult to access credit from financial institutions due to lack of collateral and financial literacy ([Beck et al., 2004](#); [Claessens and Perotti, 2007](#)). Furthermore, the results of [Tan and Law \(2012\)](#) support the existence of a U-shaped relationship between financial deepening and inequality for developing economies. Fundamentally, financial markets are inefficient in improving income distribution in these countries.

Foreign direct investment positively and significantly affects inequality. This result is explained by the fact that FDI to these countries is generally invested in capital-intensive sectors (extractive sector). This result is consistent with (Basu and Guariglia, 2007; Gopinath and Chen, 2003) who argue that FDI flows to developing countries can broaden the skill set of skilled workers. Thus, the wage gap between skilled and unskilled workers increases. This result confirms the fact that sub-Saharan African countries have made loans in the expansionary policy choice, which explains the redistributive effect of debt. On the side of the informal economy, a strong positive and significant relationship with inequality was observed. In other words, as the size of the informal sector increases, the more distortions related to evasion, fraud and activities that escape the government perpetuate inequality. An important component of well-being, it is generally used in the measurement of quality of life; education, instead of reducing inequality, increases it. Indeed, our measure of inequality is characterized by considering the number of years of education. There is a large gap between the performance of higher education and that of primary and secondary education, which in most countries is virtually free and therefore accessible. For the rest of the document, the estimation with PIT will be considered because of its importance in reducing inequalities.

Table 1.3: Baseline result, tax structure and inequality in Sub-Saharan Africa Countries

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PIT	-0.170** (0.0693)						
CIT		-0.0207 (0.0486)					
VAT			0.00886 (0.0507)				
Tax Trade				0.0312*** (0.00961)			
Direct Tax					-0.00898 (0.0405)		
Indirect Tax						0.0298** (0.0150)	
Excises Tax							-0.0469 (0.0505)
Log GDP_capita	0.0985*** (0.0347)	0.0990*** (0.0358)	0.0918** (0.0355)	0.0937*** (0.0359)	0.0849** (0.0362)	0.0921*** (0.0354)	0.0709** (0.0355)
FDI	0.0381*** (0.00789)	0.0349*** (0.00731)	0.0322*** (0.00802)	0.0344*** (0.00724)	0.0347*** (0.00806)	0.0317*** (0.00707)	0.0276*** (0.00998)
Log Trade_Openess	-0.702** (0.282)	-0.719** (0.280)	-0.739*** (0.277)	-0.764*** (0.280)	-0.764*** (0.283)	-0.773*** (0.277)	-0.743** (0.298)
Financial Dev	3.178* (1.784)	3.129* (1.748)	3.278* (1.885)	3.402* (1.785)	2.987* (1.783)	3.173* (1.770)	2.045 (2.072)
Public Debt	-0.0354* (0.0189)	-0.0506*** (0.0191)	-0.0470** (0.0199)	-0.0580*** (0.0189)	-0.0522** (0.0207)	-0.0503** (0.0194)	-0.0648*** (0.0199)
Shadow Eco	0.0429*** (0.0152)	0.0409** (0.0172)	0.0453*** (0.0162)	0.0424** (0.0164)	0.0442** (0.0171)	0.0439*** (0.0164)	0.0424** (0.0177)
Education	1.707*** (0.467)	1.331*** (0.484)	1.269*** (0.484)	1.224*** (0.459)	1.310*** (0.488)	1.245*** (0.474)	1.356*** (0.488)
Constant	43.26*** (1.671)	43.88*** (1.839)	43.75*** (1.839)	44.00*** (1.763)	43.84*** (1.816)	43.79*** (1.769)	43.89*** (1.827)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	279	280	278	280	270	279	249
R-squared	0.996	0.996	0.996	0.996	0.995	0.996	0.996

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Endogenous treatment

It is possible that the above results are still ineffective due to endogeneity. To address this issue, an ordinary double least square model with fixed effects (2SLS FE) was applied using the instrument we have constructed. The results of this model indicate that the effect of PIT on inequality is negative and significant at the 1% level, rising from -0.17 to -0.40%. Otherwise, this result confirms that the progressivity of this tax is the best tool to act on income distribution. Moreover, the p values of the associated F tests are lower than 1%, and the p values of the Kleibergen and Paap (2006) under-identification test prove that the instruments are correlated with the endogenous variables. Finally, the null hypothesis of the Sargan-Hansen test is not rejected, which confirms the validity of the instruments. In addition, the first-stage results ⁵ show that the instruments are valid because they explain the endogenous variables at conventional thresholds. The results appear as follows.

Table 1.4: Result of PIT and income inequality

VARIABLES	2SLS FE Result
PIT	-0.400*** (0.108)
Log GDP_capita	0.0967*** (0.0363)
FDI	0.0431*** (0.00837)
Log Trade_Openess	-0.575** (0.293)
Financial Development	5.738*** (1.856)
Public Debt	-0.00365 (0.0220)
Shadow Economy	0.0517*** (0.0145)
Education	2.154*** (0.542)
Country dummies	Yes
Observations	253
Number of countries	26
Endogeneity test	0.0015
Sargan-Hasen(p-value)	0.678
Kleibergen-Paap rk LM statistic (p value)	0.0000
Cragg-Donald Wald F statistic	72.222
R-squared	0.182
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1

1.5.2 Sensitivity analysis

Some indicators of the policies that a country can implement to achieve inclusive development are considered here. For example, countries may decide to increase final government consumption expendi-

⁵The result of the first-stage regression presented in Table A3 in the Appendix A

tures to provide services and goods (including road and infrastructure repair, national defense, schools, health care and including employee salaries). In addition, SSA countries currently face a strong resurgence of conflict, ethnic tensions, and military presence in politics. We then introduce an interaction variable, considering the presence of PIT*ethnic tensions and PIT*military as political leader. In fact, the existence of these factors determines the effectiveness of progressive taxation. To this end, using ICRG and the PRM Dataset, we estimate the sensitivity of our findings in the presence of these social scourges.

Table 1.5: Testing for sensitivity analysis

VARIABLES	(1)	(2)	(3)
PIT	-0.307** (0.122)	-0.263** (0.120)	-0.596*** (0.187)
Gov_consumption	0.0460*** (0.0158)		
PIT*Military in politics		0.0522** (0.0226)	
PIT*EthnicTensions			0.125*** (0.0379)
Log GDP_capita	0.0899** (0.0355)	0.0651 (0.0451)	0.0285 (0.0423)
FDI	0.0375*** (0.00809)	0.0456*** (0.00869)	0.0405*** (0.00786)
Log Trade_Openess	-0.622** (0.295)	-0.907*** (0.324)	-0.971*** (0.313)
Financial Development	4.196** (1.914)	6.326*** (2.129)	4.273* (2.438)
Public Debt	-0.0106 (0.0250)	-0.0371 (0.0279)	-0.0205 (0.0323)
Shadow Economy	0.0632*** (0.0200)	0.0441** (0.0198)	0.0128 (0.0199)
Education	2.209*** (0.508)	1.350* (0.780)	0.112 (0.629)
Country dummies	Yes	Yes	Yes
Observations	237	203	194
Number of countries	25	21	20
Endogeneity test	0.0249	0.0190	0.0697
Sargan-Hasen(p-value)	0.0584	0.6656	0.3656
Kleibergen-Paap rk LM statistic (p value)	0.0000	0.0000	0.0007
Cragg-Donald Wald F statistic	52.408	78.463	60.629
R-squared	0.259	0.198	0.188
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1		

It is generally agreed that the relationship between government expenditure and inequality is complex. Our results in Table (1.5) Column 1 show that final government consumption expenditures, which do not include transfers or indirect subsidies, have a positive effect on inequality, even if the coefficient is quite low. This finding is consistent with the idea that a large part of the benefits of government spending on health and education and including employee salaries in developing countries are received by middle-income groups in urban areas (Tanzi, 1974; Alesina et al., 1998). Particularly in low- and middle-income countries, much doubt has been raised about the effectiveness of public expenditure as a redistributive policy. This effect, which seems counterintuitive, is readily explained by the fact that for reasons of political economy, such spending often disproportionately benefits higher income groups. The occurrence of conflict and political instability (the presence of the military in politics) positively affects income inequality. This is because tensions and instabilities discourage investment and increase perceived inequality. Furthermore, the literature admits a correlation between tensions and the absence of real socioeconomic opportunities (Collier, 2000). As a reminder, inequalities between groups defined by religion, ethnicity or regional identities are linked to a significantly higher risk of armed conflict (World Bank, 2018). Therefore, in the presence of etchnical and military tensions in politics, progressive taxation is found to have a positive effect on income inequality. In view of the strong link between citizens and the state, this finding is explained by citizens' noncompliance and distrust. Furthermore, based on the political economy literature, this could be due to the bias of the tax system in a military and therefore autocratic regime.

1.5.3 Robustness checks

Additional controls on baseline specification

Further controls were added in the baseline specification to take into account other variables likely to affect income inequality. These additional controls are the Globalization KOF Index, Natural Rent and Exclusion/Socio-Economic Group.

The results are reported in Table 5. In the context of global integration, notably globalization, the increased international mobility of national resources could affect the relationship between taxation and inequality. Furthermore, it is argued that integration into the global economy promotes economic growth, which helps to address problems of poverty, inequality and the lack of democracy. To address this issue, the KOF index was used, which measures the economic, social, and political dimensions of globalization. The regression results in Table (1.5), especially in Column (1), show that global integration leads to a reduction in income inequality. Indeed, political and social globalization may lead countries

to set common minimum standards and thus increase equality within countries (Dreher, 2006). Regarding the relationship between inequality and natural rents, there is no consensus in the economic literature.

The results of our estimations show that natural rents have a significant negative impact on income inequality. Otherwise, an increase in rent helps to reduce inequality. This result is consistent with the work of Kim and Lin (2018). The authors' analysis showed that in the long run, oil abundance and dependence mitigate income inequality, implying that the poor benefit more from oil booms. The index of socioeconomic exclusion captures the social and economic relegation or marginalization of individuals and is a relevant indicator of equal access to public services ⁶. We observe a positive and significant relationship on income inequality. Indeed, the increase in social exclusion accentuates poverty and thus increases inequalities.

Table 1.6: Results of additional controls on baseline specification

VARIABLES	Baseline Result	(1)	(2)	(3)
PIT	-0.400*** (0.108)	-0.333*** (0.110)	-0.404*** (0.120)	-0.350*** (0.123)
Log GDP_capita	0.0967*** (0.0363)	0.0942*** (0.0365)	0.0848** (0.0378)	0.0891** (0.0371)
FDI	0.0431*** (0.00837)	0.0453*** (0.00849)	0.0486*** (0.00883)	0.0474*** (0.00880)
Log Trade_Openess	-0.575** (0.293)	-0.452* (0.274)	-0.284 (0.279)	-0.265 (0.273)
Financial Development	5.738*** (1.856)	6.326*** (1.894)	6.664*** (1.865)	6.925*** (1.840)
Public Debt	-0.00365 (0.0220)	-0.0135 (0.0218)	-0.00434 (0.0218)	-0.0109 (0.0212)
Shadow Economy	0.0517*** (0.0145)	0.0444*** (0.0147)	0.0403*** (0.0139)	0.0448*** (0.0139)
Education	2.154*** (0.542)	2.365*** (0.549)	2.177*** (0.543)	2.100*** (0.526)
Globalisation_KOF Index		-0.0270* (0.0149)	-0.0259* (0.0148)	-0.0272* (0.0143)
Log Natural_Rent			-0.255*** (0.0820)	-0.225*** (0.0795)
Exclusion/Socio-Economic Group				4.905*** (1.856)
Country dummies	Yes	Yes	Yes	Yes
Observations	253	253	253	253
Number of countries	26	26	26	26
Endogeneity test	0.0015	0.0032	0.0017	0.0036
Sargan-Hasen(p-value)	0.678	0.7143	0.7366	0.7440
Kleibergen-Paap rk LM statistic (p value)	0.0000	0.0000	0.0000	0.0000
Cragg-Donald Wald F statistic	52.408	61.679	56.432	51.394
R-squared	0.182	0.214	0.217	0.249

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

⁶To see more: Pemstein et al. (2021, V-Dem Working Paper Series 2021:21)

The role of institutional quality and property rights

Since we know from previous studies ([Vergara, 2022](#)), that institutions affect pre-tax inequality as well, it is absolutely important to analyze the role of institutions on post-tax inequality, as measured by the gini index. The reduction in income inequality also depends on governance in terms of the quality of the rule of law index and the enforcement of property rights. Indeed, the rule of law index is derived from the V-dem project (Varieties of Democracy) and is formed by taking point estimates from a Bayesian factor analysis of the indicators. This variable reflects the extent to which "laws [are] applied transparently, independently, predictably, impartially, and equally, and the extent to which the actions of government officials comply with the law", and it consists of 15 indicators⁷.

Regarding the role of institutions in the effect of tax policy on inequality, Table (1.6) shows the negative sign of the rule of law and property rights index on income inequality. This result implies that in a rule of law with less corrupt governments, rules and laws respected, personal income tax is collected efficiently and better redistributed by financing for example pro-poor expenditures. Thus, high-quality institutions help the government control corruption and thus eliminate tax evasion. As a result, governments with better institutions are likely to have better policies to rebalance the incomes of the richest and poorest citizens, which of course reduces income inequality. In conclusion, good institutional quality enhances the principle of impartiality by keeping democratic procedures accountable and prevents bureaucrats from pursuing their own interests more effectively, which in turn leads to downward pressure on income inequality.

⁷(Respect for the high court and the judiciary; independence of the high court and lower courts; respect for the constitution by the executive; rigorous and impartial public administration; transparent laws and predictable enforcement; and the quality of governance; access to justice for men and women, judicial accountability, judicial corruption decisions, public sector corruption, public sector theft, executive corruption and corrupt exchanges, embezzlement, and executive theft).

Table 1.7: Effects of institutional variables

VARIABLES	Baseline Result	(1)	(2)
PIT	-0.400*** (0.108)	-0.346*** (0.104)	-0.420*** (0.105)
Log GDP_capita	0.0967*** (0.0363)	0.111*** (0.0378)	0.0956*** (0.0359)
FDI	0.0431*** (0.00837)	0.0414*** (0.00812)	0.0461*** (0.00866)
Log Trade_Openess	-0.575** (0.293)	-0.590** (0.285)	-0.614** (0.295)
Financial Development	5.738*** (1.856)	5.781*** (1.813)	6.418*** (1.852)
Public Debt	-0.00365 (0.0220)	-0.0116 (0.0224)	0.00715 (0.0235)
Shadow Economy	0.0517*** (0.0145)	0.0496*** (0.0141)	0.0574*** (0.0144)
Education	2.154*** (0.542)	2.125*** (0.545)	2.457*** (0.553)
Rule of law Index		-1.571** (0.673)	
Property Righth			-2.221*** (0.758)
Country dummies	Yes	Yes	Yes
Observations	253	253	253
Number of countries	26	26	26
Endogeneity test	0.0015	0.0039	0.0006
Sargan-Hasen(p-value)	0.678	0.7745	0.566
Kleibergen-Paap rk LM statistic (p value)	0.0000	0.0000	0.0000
Cragg-Donald Wald F statistic	72.222	71.573	71.945
R-squared	0.182	0.216	0.194
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1		

Alternative main dependent variable

Thus far, the Gini index from SWIID ([Solt, 2020](#)) was used as the dependent variable. Here, a new measure of income inequality, namely, the Gini index from the World Development Indicator, is considered (WDI, 2021). This index is calculated from primary household survey data and is used to determine the extent to which the distribution of income between households or individuals within a country deviates from a situation of perfect equality. Statistically, the Gini index refers to the area between the Lorenz curve and a hypothetical line of perfect equality, expressed as a percentage of the maximum area under that line. The result of the estimation using the Gini index from the World Bank database is presented in Table 1.7, Column (2). As seen, our baseline results remain broadly consistent.

The coefficient associated with personal income tax remains negative and statistically significant. Evidence that increasing personal income taxes reduces income inequality in sub-Saharan African countries.

Table 1.8: Alternative data source for income inequality

VARIABLES	Gini (SWIID) (1)	Gini (World_Bank) (2)
PIT	-0.400*** (0.108)	-2.086*** (0.536)
Log GDP_capita	0.0967*** (0.0363)	0.0791 (0.254)
FDI	0.0431*** (0.00837)	0.209*** (0.0415)
Log Trade_Openess	-0.575** (0.293)	-0.631 (1.359)
Financial Development	5.738*** (1.856)	10.19 (11.88)
Public Debt	-0.00365 (0.0220)	0.0103 (0.214)
Shadow Economy	0.0517*** (0.0145)	0.328*** (0.0774)
Education	2.154*** (0.542)	5.517** (2.691)
Country dummies	Yes	Yes
Observations	253	271
Number of countries	26	25
Endogeneity test	0.0015	0.0035
Sargan-Hasen(p-value)	0.678	0.222
Kleibergen-Paap rk LM statistic (p value)	0.0000	0.0000
Cragg-Donald Wald F statistic	72.222	81.526
R-squared	0.182	0.139
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1	

Alternative empirical strategy

In this section, we include lagged income inequality to account for the persistence of income inequality. To achieve this, we applied a dynamic model. Our regression equation is as follows:

$$Gini_{i,t} = \alpha + \sigma Gini_{i,t-1} + \beta Tax_{i,t} + \rho X_{i,t} + \epsilon_{i,t} \quad (i = 1; 2; \dots; N; t = 1; 2; \dots; T) \quad (1.3)$$

To solve the endogeneity problem and to conclude on good estimates, we retain the GMM estimators (Generalized Moment Method). The GMM estimator is more suitable for dynamic panel data and especially when the time dimension is small compared to the individual dimension. The estimator of [Blundell and Bond \(1998\)](#) combines two equations, one in level and one in first difference. The level equation uses lagged first differences as instruments for the endogenous variables while the first difference equation uses lagged levels as instruments. To check the validity of the instruments, we use the standard Hansen test for over-identifying restrictions and the Arellano and Bond test which checks for second order serial correlation. Second-order serial correlation in the residuals in first difference. The result of the estimation using the GMM is presented in the following table. These results remain broadly consistent

with our baseline findings (Table 1.12)⁸.

1.6 Conclusion and policy implications

In this article, the role of tax policy is explored, particularly its effectiveness in influencing income inequality in sub-Saharan African countries. This paper confirms that tax instruments, given their returns, different tax bases and specific characteristics, affect the evolution of income inequality differently. Our research contributes to the debate on the relationship between taxation and income inequality that guides public policy in achieving the objective of sustainable development 10. A sample of 30 countries for the period 2000 to 2017, focusing on fiscal instruments, were considered. Fixed-effect estimation techniques (LSDV) were used, then the method of double ordinary least squares with instrumental variable (2SLS) and finally robustness in the GMM (generalized method of moments). First, our results indicate that only personal income taxes are effective in significantly reducing income inequality in SSA. On the other hand, indirect taxes and taxes on international trade increase inequality. Even if the coefficient remains negative, no effect of corporate taxes and excise duties on inequality were found. Similarly, a nonsignificant positive effect of VAT was found. In addition, these results were further developed by some analyses of heterogeneity. Thus, presenting some evidence confirming that respect for property rights and good institutional quality reduce income inequality. Finally, our results reveal that progressive taxation is ineffective in military political regimes and in the presence of ethnic conflicts. Based on a battery of robustness tests, our results are robust to any change.

Overall, it is clear that the effectiveness of taxes in promoting equity in sub-Saharan Africa is limited by several factors. In particular, the structure of tax rates, the narrowness of the tax base, the high level of informality and tax evasion limit the impact of taxation on reducing inequality. In a post-COVID-19 world marked by the uncertainties of a fragile recovery— fuelled by climate shocks and conflicts between the world’s largest food producers—the design of inclusive fiscal policies is crucial to ensure sustainable economic recovery. Thus, the practice of progressive taxation must be pursued to identify appropriate tax measures to improve revenues in an inclusive and growth-friendly manner. In this sense, personal income tax can still be important for inclusive development if it is well designed and revenues are well used. Despite its modest role in the composition of tax revenues, our results show that this tax is an essential fiscal instrument in the economic recovery of African countries undermined by the effects of the COVID-19 crisis. Moreover, the history of taxation in advanced economies shows that as countries develop, personal income taxes should become a more important source of revenue.

From a policy recommendation perspective, the main conclusion is that sub-Saharan African countries

⁸see in appendix

could reduce income inequality on the one hand by improving the progressivity of personal income taxes; on the other hand, many taxpayers are partially or totally exempt from this tax. It is crucial to broaden the personal income tax base to give it a greater place in the composition/design of taxes. Finally, we introduce and enforce rules that improve institutional quality. Although we were able to highlight some novelties in our analysis, there is still room for improvement. Indeed, future research could focus on improving the design of personal income tax. Given that a high marginal tax rate distorts incentives to produce/work and encourages tax avoidance and evasion, the optimal level of progressivity must be a fair balance between fairness and efficiency. Additionally, given the possible distortions, it is important to examine the effectiveness of exemption policies and reduced rates (of certain primary goods) in tackling inequality and extreme poverty to establish a better trade-off and/or a beneficial mix for inclusive growth. To achieve the 2030 Agenda for Sustainable Development, tackling inequalities is not only crucial for political stability and social cohesion, but it is also a sound economic practice and imperative for sustainable development.

Appendix

Table 1.9: Definition and sources of variables

Variables	Descriptions	Sources
Gini index (SWIID)	Estimate of Gini index of inequality in equivalized (square root scale) household disposable (post-tax, post-transfer) income, using Luxembourg Income Study data as the standard.	(SWIID)
Indirect Tax	Indirect taxes comprise the sum of taxes on goods and services, international trade and transactions, and other taxes.	ICTD Government Revenue Dataset (GRD)
Direct Tax	Direct taxes include taxes on income, profits and capital gains, taxes on payroll and workforce as well as taxes on property.	
Individual Tax	Individual Income Tax Revenue as a % of GDP	
Corporate Tax	Corporate Income Tax Revenue as a % of GDP	GRD & IMF World Revenue Longitudinal Data (WoLRD)
VAT Revenue	VAT Revenue as a % of GDP	
Excises Tax	Excise Tax Revenue as a % of GDP	
Tax trade	Trade Tax Revenue as a % of GDP	
Financial Development	Financial development is defined as a combination of depth, access, and efficiency to provide financial services	Global Financial Development Database (GFDD)
Government Consumption	General government final consumption expenditure	WDI
Trade Openness	Sum of exports and imports of goods and services, % of GDP.	
Natural resources rents	Total natural resources rents (% of GDP)	
GDP per capita	GDP per capita is gross domestic product divided by midyear population. (Annual %)	
FDI	Net inflows (new investment inflows less disinvestment) in a given economy from foreign investors, divided by GDP.	
Gini (World Bank)	Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution	
GDP/Capita Growth	Annual percentage growth rate of GDP per capita based on constant local currency.	
Rule of law index	The extent to which laws are applied transparently, independently predictably, impartially and equally and also the extent to which the actions of government officials comply with the law.	V-Dem Database
Property right	measures the respect of property rights	
Exclusion/Socio-Economic Group	Index of (political) exclusion by socio-economic group	Penn World Table (PWT) 8.0 Dataset
Education	The variable is based on the average number of years of schooling. Human Capital Index per capita.	
Globalisation_KOF Index	The KOF Globalization Index measures the economic, social, and political dimensions of globalization.	2020 KOF Globalisation Index
Military leader in politics	Yearly measure on the regime leader's connection to the armed forces.	PRM Dataset
Shadow Economy	The shadow economy is an unobserved phenomenon (latent variable) that is estimated using the causes of illicit behavior, and indicators reflecting illicit activities.	Leandro Medina and Friedrich Schneider (IMF, 2017)
Ethnic tension	This component is an assessment of the degree of tension within a country attributable to racial, nationality, or language divisions.	ICRG

Table 1.10: List of countries

List of countries		
Benin	Kenya	Senegal
Botswana	Lesotho	South Africa
Burkina Faso	Madagascar	Togo
Cameroon	Malawi	Uganda
Cape Verde	Mali	Zambia
Central African Republic	Mauritania	Zimbabwe
Congo, Dem. Rep.	Mauritius	
Congo, Rep.	Mozambique	
Cote d'Ivoire	Namibia	
Ethiopia	Niger	
Gabon	Nigeria	
Ghana	Rwanda	

Table 1.11: First stage regression results

VARIABLES	First stage PIT
log GDP_capita	0.048 (1.78)
FDI_Net	0.0126* (2.52)
logTrade_Openess	0.351* (2.13)
FD	2.58 (1.93)
Public_debt	0.0667* (2.31)
shad_Eco	0.00 (0.29)
hc	1.039* (2.39)
Instrument_PIT	0.340** (2.81)
Lag.tax_indiv	0.507*** (7.01)
Observations	253
Number of id	26
R-squared	0.18

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Instrument_PIT represents the instrument created
using the geographic distance weighting matrix

Table 1.12: Alternative empirical strategy

VARIABLES	(1)
Lag gini_disp	0.917*** (0.0101)
PIT	-0.0666* (0.0359)
Log GDP_capita	0.0688* (0.0354)
FDI	0.0131** (0.00606)
Log Trade_Openess	-0.0226 (0.195)
Financial Development	0.0677 (0.522)
Public Debt	0.0912*** (0.0274)
Shadow Economy	0.00889 (0.00731)
Education	0.421*** (0.123)
Constant	-1.903*** (0.717)
AR1:P-value	0.006
AR2:P-value	0.236
Hansen	0.884
Observations	266
Number of id	26
Number of Instrument	23
Robust standard errors in parentheses	*** p<0.01, ** p<0.05, * p<0.1

Chapter 2

Chapter 2

Armed Conflict and Fiscal Capacity in the Sahel: An Empirical Approach

A slightly different french version of this chapter is accepted for publication in *Revue Française d'Economie* with Arnaud Zahonogo & Gervasio Semedo.

“In the crucible of conflict, the state must find its strength—not through force, but through its ability to mobilize resources and build institutions that serve its people.”

— Charles Tilly, *Coercion, Capital, and European States* (1992)

2.1 Introduction

The Addis Ababa action agenda of July 2015 has pointed out the importance of domestic revenue mobilization in the achievement of Sustainable Development Goals (SDGs). Domestic revenue mobilization is essential and a key source of financing for sustainable development ([Junquera-Varela et al., 2017](#)). These resources help to build functional institutions for sustainable development, improve government accountability to communities and reduce dependence on foreign aid ([Isak, 2018](#)). Given the fact that external financing cannot cover the need for the achievements of Sustainable Development Goals, the more reliable source of government’s revenues are taxes. Tax mobilization should then be a key objective in developing countries. The Organisation for Economic Co-operation and Development (OECD) recently assessed the fiscal landscape in Sub-Saharan Africa (SSA), revealing that the unweighted average tax-to-GDP ratio in 33 countries was 15.6% in 2021, unchanged since 2020. This figure lags behind the

Asia-Pacific (19.8%), Latin America and the Caribbean (21.7%), and the OECD area (34.1%). While Africa's average tax-to-GDP ratio rose by 1.5 percentage points from 2010 to 2021, this increase is largely attributed to per capita income growth and the expanding middle class rather than significant reforms in tax administration. Achieving the Sustainable Development Goals (SDGs) requires over 1 trillion dollars annually—one-third of the continent's gross national income. Fiscal transition in SSA focuses on modernizing tax administrations to reduce dependence on customs revenues, shifting toward indirect taxation, particularly Value Added Tax (VAT). However, the implementation of these reforms is hindered by weak institutions and challenges in modernizing tax administration, including digitization and capacity-building efforts.

The Sahel region, which includes countries such as Mali, Burkina Faso, Mauritania, Niger, Chad, and others, has been marred by recurring armed conflicts for several years. The definition of the Sahel can vary, but the broader scope includes parts of western and north-central Africa, extending to countries like Cameroon, The Gambia, Guinea, Nigeria, and Senegal [IEP \(2023\)](#). These conflicts, characterized by complex political, social, and economic dynamics, have severely impacted the region's stability. Factors such as fragile state institutions, internal power struggles fueled by multinational corporations' extractive activities, increased militarization, geopolitical interests, demographic pressures, and widespread insecurity have contributed to the endemic nature of conflicts in the region.

Armed conflict, as defined by [\(Kreutz, 2010\)](#), refers to situations where at least 25 battle-related deaths occur within a calendar year due to the use of armed force between two parties, with one typically being the state government. The Sahel has been plagued by recurrent conflicts with devastating human, political, economic and social effects. But what does the term 'conflict' refer to? In Africa, these conflicts have involved firstly wars of national liberation with a view to the independence of the countries concerned. Secondly, followed by battles between rival formerly federated parties to remove the coloniser, it being understood that everywhere in Africa, independence did not follow a peaceful process of transfer of power. A third type of internal conflict is of a secessionist and identity-based nature, with regional and ethnic discord as the primary reasons; the temptation is to found ephemeral states, real or potential (Ethiopia, Senegal, Comoros, Sudan, etc.). Religious conflicts can be superimposed on this third type and become internationalised; the example is that of West African countries (Nigeria, Mali, etc.) with jihadist incursions. Finally, conflicts of power specific to all so-called cash economies can be triggered, such as coups d'état, especially in partisan states governed on the basis of identity or deep inequalities, poor governance or weak institutions [Hugon \(2003\)](#). The region is facing the effects of political instability and geographical tensions.

Historical precedents show that conflicts have significant fiscal dimensions [Addison et al. \(2002\)](#). For example, [Tilly et al. \(1992\)](#) demonstrates that the fiscal demands created by expansionary wars in Europe

are at the basis of the formation of nation-states. There was a development of institutions that could levy taxes and the tax revenue was used to finance armies. Historically, conflicts have been at the basis of taxation. It's the case of several countries. For instance, the Sri Lanka government that has implemented reforms in term of tax mobilization during conflicts with Tamils rebels and was reaching more than US\$ 1 billion per year [IMF \(1999\)](#). Also the case for Ethiopia and Eritrea which have mobilized more revenue during the 1998 - 2000 war.

Today, SSA countries are particularly challenged in moving away from external financing and customs revenues due to their outward-oriented economies. This dependency is often attributed to colonial legacies that resulted in ineffective tax institutions. ([Acemoglu et al., 2001](#); [Acemoglu and Robinson, 2000](#)) provide a deeper understanding, distinguishing between extractive and settler colonies. The latter benefited from more inclusive institutions, leading to greater development and better structural transformation, as demonstrated by [Keneck-Massil et al. \(2021\)](#) The varying levels of economic diversification in former colonies can be traced to factors such as settler mortality rates and settlement patterns. Despite these insights, significant barriers to effective tax collection persist, including the prevalence of the informal sector, regional population mobility, porous borders, and transparency issues in land management.

Thus, it is essential to recognize the role of states in driving the structural transformation necessary to reduce dependency on external resources like aid and customs revenues. Sustainable economic development hinges on a strong state capable of directing public resources into high-impact investments in infrastructure, education, health, and research. Such investments are crucial for enhancing the capacities and opportunities for households, youth, and businesses, while also strengthening the human capital of state officials. [Geloso and Salter \(2020\)](#) emphasize that "societies that grow rich in the absence of a strong state invite predation by societies that develop such well-structured states." This highlights the critical need for investments in state capacity to deter external threats and ensure economic prosperity. We interpret state capacity not merely as a condition for achieving economic prosperity but as essential for the survival and stability required to enjoy such prosperity. This observation raises important questions regarding the ability of SSA states to reform in order to protect citizens from both internal and external conflicts, while ensuring economic, social, and political stability through the provision of essential public services such as infrastructure, security, justice, education, and health—key foundations for growth and development. The relation between conflicts and tax revenue mobilization is a topic of great interest and has been debated in the literature with some divergent findings. On the one hand, we have a longstanding literature suggesting that conflicts may lead to an increase of tax collection. Indeed, conflicts will increase the desire of governments to raise revenues for military expenditures ([Downing, 1992](#); [Tilly et al., 1992](#);

[Ertman, 1997](#)). On the other hand some empirical studies support the idea that conflicts could reduce tax collection. Tax revenues could decrease during conflicts because of the adverse effects on tax collection or economic activity. Conflicts could harm the tax collection of countries by deteriorating the tax base and administration capacity. Conflicts also harm economic activity and institutions and then making taxes compliance and tax collection difficult ([Nkurunziza, 2004](#)). The impact of conflicts on economic activities such as international trade may also decline the taxes revenue. For [Gupta et al. \(2004\)](#) armed conflict has adverse effects on tax revenues. [Van Den Boogaard et al. \(2018\)](#) and [Chowdhury \(2004\)](#) also found empirically that the degradation of economic activities and infrastructures due to conflicts have a negative impact on tax collection. [Addison et al. \(2002\)](#) also conclude that conflict can also affect the regulation of the financial system and then negatively impact tax collection. However, despite a worrying security situation, the Sahel remain a region full of opportunities. In fact, the region is well endowed in term of natural resources, renewable energy and is one of the world's most youthful regions. Thus, investments in these different areas can contribute to the economic development of these countries and the achievement of Sustainable Development Goals (SGDs). And these investments would be possible through the revenues collected from taxation. Therefore, the countries of the Sahel region provide a good framework for analysis.

To our knowledge, there is no empirical studies that analyze the link between tax revenue mobilization and conflict in the Sahel region. Our study contributes to the literature by providing an empirical analysis of tax revenue mobilization in the Sahel given the state of conflict in the region by using data from 2000 to 2021 for 10 Sahel countries. Our assumptions as in [Gupta et al. \(2004\)](#) suggest that armed conflicts negatively and significantly affect tax revenue mobilization in Sahel countries. Armed conflict were found to be harmful to tax collection as suggested earlier by [Gupta et al. \(2004\)](#). This result is robust to several robustness tests, specifically changing the definitions of tax revenue, adding additional control variables, and exploring heterogeneity. Property rights and information and communication technology appear to improve tax revenue mobilization. A further analysis highlight that, institutional quality, socio-economic conditions and foreign aid play a crucial role in mitigating the negative effects of conflict on tax revenues.

The reminder of the paper is organized as follows. The section 2 present the theoretical framework showing the channels through which conflicts affect tax revenue mobilization. Section 3 presents the data, some stylized facts and the empirical strategy used. Section 4 discusses the main results and robustness check. Section 5 presents some heterogeneity tests. Section 6 concludes the paper.

2.2 Background and transmission channels

This section explores the theoretical link and the various channels through which conflict affects tax revenue mobilization to formalize the testable empirical implication. The political economy literature on conflict and economic development has demonstrated that conflicts tend to have adverse impacts on development outcomes (Gates et al., 2012; Gupta et al., 2004). In the Sahel region conflict may significantly impact on tax revenue through the following mechanisms (i) conflict frequently results in the disruption of economic activities, including trade, agriculture, and mining (Polachek and Sevastianova, 2012). This can lead to a reduction in taxable economic transactions and a decline in tax revenue mobilization. (ii) Armed conflict can result in the destruction of crucial infrastructure, such as roads, bridges, and communication networks. They can impede the ability of tax officials to access certain areas and communicate with taxpayers, thereby hindering tax collection efforts (Pedersen, 2002). (iii) Armed conflict can displace skilled professionals and entrepreneurs and result in loss of human capital due to fatalities. This reduction in skilled labor can ultimately diminish the capacity of tax authorities to enforce tax laws and collect taxes. (iv) Conflict can create an environment of corruption and informality, as people may resort to illegal means to survive, resulting in reduced tax compliance and lower tax revenue mobilization. While this presents significant challenges, there are also opportunities for tax revenue mobilization in the Sahel region, including (i) The Sahel region possesses abundant natural resources such as oil, gas, and minerals. Taxing these resources has the potential to generate significant government revenue, even in the duration of conflicts. (ii) Foreign aid can play a crucial role in tax revenue mobilization in conflict-affected regions (Addison and McGillivray, 2004; Diakite et al., 2019). Donor's programs can assist in building tax capacity, strengthening tax compliance, and supporting tax administration, thus supporting the mobilization of tax revenue. (iii) While informality can hinder compliance with tax obligations, it can also provide an opportunity to tax economic activities that were not previously taxed. As conflicts increase informality, it provides an opportunity for tax authorities to adopt innovative approaches to reach out to informal sector actors and encourage them to contribute to tax revenue mobilization.

2.3 Data and methodology

2.3.1 Data

The sample includes annual data for the period 2000 to 2021 for 10 Sahel countries. The choice of this sample of countries is dictated by the availability of data on both Tax revenue and various independent variables. The Table 2.1: present our summary statistics.

Measurement of the dependent variable

Following the literature on domestic revenue mobilization (Gupta, 2007; Brun et al., 2015; Morrissey et al., 2016; Prichard et al., 2018; Apeti and Edoh, 2023), we use tax revenue in percentage of GDP as proxy for tax capacity. Tax revenue excluding resource taxes and social contributions, is drawn from the UNU-WIDER Government Revenue Dataset (GRD). Unlike the World Revenue Longitudinal Database (WoRLD) or the Organisation for Economic Co-operation and Development (OECD), this database has advantages in distinguishing between resource and non-resource sector revenues based on disaggregated data from IMF Article IV reports (Prichard, 2016).

Measurement of the variable of interest

We used the UCPD/PRIO armed conflict dataset version 22.1 (Gleditsch et al., 2002; Themnér and Wallensteen, 2011) to obtain information on conflicts. This dataset captures conflicts that involve states, are characterized by the use of force between two sides, and result in a death toll of at least 25 people in a calendar year. An armed conflict is then defined as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a calendar year."¹. Our analysis focused on the period from 2000 to 2021. In light of this variable and the way conflict is defined in our context, the study focuses on the effect of internal conflict. Drawing on the recent empirical and theoretical literature on conflict and revenue mobilization, control variables were used that to capture the simultaneous factors influencing tax revenue and armed conflicts. All these variables are standard controls in the taxation literature.

(i) **GDP/capita.** GDP per capita represent the per capita income of a given country and is an indicator of the country's level of development. Higher per capita income is expected to positively affect tax revenue mobilization. A higher GDP per capita means a more developed economy which lead to higher incomes and profits. Then taxes also increase which increase the tax revenue mobilization of a country. A greater economic activity could contribute to the increase of tax revenue. As mentioned by Crivelli and Gupta (2014) higher per capita income could positively affect public revenue as an increase in per capita income would reflect a growing demand for public services and a higher degree of economic and institutional sophistication. GDP per capita is collected from the World Development Indicators (WDI) database.

(ii) **Kof informational index.** The KOF informational index² measure the depth of the use, adoption of

¹UCDP/PRIO Armed Conflict Dataset Codebook

²It comes from the 2020 KOF Globalisation Index and is composed of two dimensions which are the Informational Globalisation de facto and the Informational Globalisation de jure and includes several variables (internet bandwidth, international patents, high technology exports, television access, internet access and press freedom).

information and communication technology and includes several variables such as internet access and press freedom that may affect tax revenue mobilization. Indeed, internet on one hand could positively impact tax mobilization through some online tax payments that would reduce costs and time in the processing of taxes collection. This could lead to higher tax revenue mobilization. Also internet bandwidth and internet access can enable e-commerce and other online transactions, which can lead to higher revenue from sales taxes and value-added taxes (VAT). [Gnangnon and Brun \(2018\)](#) for instance analyzed the impact of the internet gap on public revenue mobilization in sub-Saharan Africa and found that better access to internet would effectively influence the tax and customs administration in the direct mobilisation of public revenues. The internet access is proxied by the share of the individuals using internet. On the other hand, press freedom can also play a significant role in tax revenue mobilization. Press freedom can in fact impact political stability which have direct implications on tax revenue mobilization. Also press freedom could influence people perception and trust in the government which improve tax compliance and tax morale ([Benno \(2003\)](#) [Torgler \(2003\)](#) [Torgler et al. \(2011\)](#)).

(iii) **Agriculture.** Agriculture is measured by the value added of the agricultural sector as share of total value added. We expect a negative correlation. High share of agriculture value added is expected to impact negatively tax revenue due to the difficulty of taxing the agricultural sector [Brun et al. \(2011\)](#), [Brun et al. \(2015\)](#), [Gnangnon and Brun \(2018\)](#). Indeed, the agricultural sector may be full of informal small-scale farmers making it difficult for the governments to collect taxes. Also, the agricultural sector could be exempted from taxes, leading to lower tax revenue. Agriculture is collected from the World Development Indicators (WDI) database.

(iv) **Property right.** Property rights are very important when it comes to tax revenue mobilization. The restriction of property rights or their concentration can lead to a smaller tax base. Strong enforcement of property rights provides greater security for property owners, which can be an incentive to invest in property, encourage economic growth, and increase tax revenue for the government. Also, if property rights are not well defined or are poorly enforced, this can lead to conflicts over who has the right to use or control certain resources We expect a positive correlation. They are important in the determination of the tax base and facilitate compliance with tax laws ([Norregaard \(2013\)](#); [Fjeldstad and Heggstad \(2012\)](#); [Fjeldstad \(2004\)](#)). Property right is collected from the Varieties of Democracy (V-DEM) database.//

Table 2.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Armed conflict	220	.314	.465	0	1
Tax revenue	204	9.691	3.289	3.133	17.65
KOF Informational	200	46.367	13.146	18.012	69.49
Property Right	210	.691	.143	.362	.859
log GDP per capita	220	6.775	.497	5.938	7.893
Agriculture	220	26.278	10.302	12.246	55.772

2.3.2 Methodology

3.2.1 Identification strategy

Our objective is to analyze whether and how conflict affects domestic revenue mobilization in Sahel. The choice of the appropriate estimation model for this research is made on the basis of the structure of our data. Equation (1,2, and 3) is a model inspired by (Van Den Boogaard et al., 2018; Fang et al., 2020; Boly and Kere, 2022; Leepipatpiboon et al., 2023). At first, we use Driscoll-Kraay, 1998 (Ordinary Least Square) to estimate (1). This provides an average effect of conflict, assuming that the effects are homogeneous over time and across country. The choice of this method was based on its simplicity and advantages. Indeed, Driscoll-Kraay standard errors is relevant to deal with heteroskedasticity, autocorrelation and also temporal and cross-sectional dependence. Further, we also employ fixed effects regression. The results remain substantially similar and are reported in table (5) in the appendix. To test the sensitivity of conflict to the tax revenue, our model is formalized as follows:

$$Tax_{i,t} = \alpha + \beta C_{i,t} + \rho X_{i,t} + \epsilon_{i,t} \quad (i = 1; 2; \dots; N; t = 1; 2; \dots; T) \quad (2.1)$$

where $Tax_{i,t}$ represents the tax revenue of country i at time t ; α_i is a constant; $C_{i,t}$ is the conflict variable ; $X_{i,t}$ represents the other explanatory variables and $\epsilon_{i,t}$ is the error term. Beyond that, X identifies a set of variables included in the econometric model to control for several economic factors that may have affected the evolution of tax revenue in Sahel region over the period considered.

However, Driscoll-Kraay standard errors (OLS) models are inefficient in the presence of potential endogeneity variables. Although conflict affects tax revenue collection, it is possible that increased tax revenue could lead to a decrease in armed conflict. Indeed, increased government revenues can be used to fund social programs, improve economic opportunities, and provide security. Thus, a potential existence

of endogeneity due to reverse causality is suspected. To address this issue, the robustness of our results is developed by the instrumental variables method, more precisely, the double ordinary least squares (2SLS).

3.2.2 Implementation of the instrumental variables

To overcome these biases, [Buhaug and Gleditsch \(2008\)](#) document that the eruption of civil war in the Democratic Republic of Congo (then Zaire) was influenced by events in neighboring countries. Recently, [Alassani et al. \(2022\)](#) exploited spatial autocorrelation using geographical distance weighting matrix to test the effect of tax structure on income inequality by considering the importance of tax spillover effects in policy design across developing countries. Also, [Leepipatpiboon et al. \(2023\)](#) exploited a distance-weighted index of other countries' commodity countries to instrument their measure of Commodity Terms of Trade. In this article, a spatial econometric model is used. To estimate spatial autocorrelation, how countries are connected to each other needs to be defined. The reasoning behind the use of the geographical distance weighting matrix is related to the fact that geographic distance between countries may influence the likelihood or severity of armed conflict in country. For example, if terrorist groups have links to similar groups in countries neighboring country, they may be better equipped and organized to carry out attacks in the nearest country, which may increase the likelihood and severity of conflict. This is in line with the first law of geography: "Everything is related to everything else, but things close together are more related than things far apart" [Tobler \(1970\)](#), which explains the wide use of inverse geographical distance in spatial econometrics to measure connectivity ³

Where d_{ij} is the Euclidean distance between the capital of country i and that of country j for $i \neq j$. The choice of this instrument is also explained by the importance of armed conflict spillover effects across developing countries [Boly and Kere \(2022\)](#). Indeed, there is a positive and significant effect of the military spending of neighboring countries on the military spending of the country concerned. Thus, the idea of [Boly and Kere \(2022\)](#) is that the complementarity in military spending is consistent with "yardstick" competition between countries, given the relatively high level of political instability in Africa. It can be assumed that in an environment marked by the rise of terrorism and access to information on attacks, incumbent politicians, in order to increase their chances of remaining in power, will look at the level of military spending in neighboring countries and seek to emulate it, in order to ensure or maintain an acceptable level of security in the country they govern. Terrorism may also give rise to yardstick competition due to the anticipation that a tougher stance against terrorism in neighboring countries,

³Algebraically, after normalization, the weights $w_{i,j}$ of the geographical distance weighting matrix are given as follows:

$$w_{i,j} = \begin{cases} \frac{1/d_{ij}}{\sum_j 1/d_{ij}}, & \text{for } i \neq j \\ 0, & \text{for } i = j \end{cases} \quad (2.2)$$

through higher military spending, may push terrorism back to the home country, hence the need to increase national military spending. Such an increase would also be fundamentally motivated by the desire to ensure an acceptable level of security in the home country and to retain power, in line with yardstick competition. We use 'military spending' as our second instrument, building on previous studies. In order to maintain coherence with our theoretical approach, we will lag it in the model. Our third instrument is commonly used in the literature, notably the lagged endogenous variable. We recognize that this instrument is at best imperfect and do not necessary resolve the issue of identification totally, but in absence of a clearly better alternatives, its use has become standard (Bose et al., 2012)

2.3.3 Stylized facts

In those countries, it is often difficult to get some statistics on deaths, incidences, hostages and injuries due to armed conflicts. However, the Institute for Economics & Peace through its annual report gives us interesting information. As a percentage of global terrorism⁴ deaths, the Sahel produce 43% in 2022 (1% in 2007)⁵. Across the Sahel, 22,074 people were killed in 6,408 terror attacks between 2007 and 2022 IEP (2023). We also note a change in the dynamics with an intensification of deaths in the tri-border regions of Mali, Niger and Burkina Faso. Since 2012, Mali, Niger and Burkina Faso are the epicenter of Sahel terrorism. At country level, 4 of the 10 countries in the Sahelian zone were among the countries most affected by terrorism in 2023 according to the Global Terrorism Index (GTI): Burkina Faso is ranked 2nd with a GTI score of 8.564 and is the second most affected country by terrorism in 2022 just behind Afghanistan. According to the Global Terrorism Index report, there were 310 terrorism incidents in Burkina Faso in 2022. The country also recorded the highest number of deaths of any country in 2022. Civilian were the most targeted with 642 deaths which represent 57 per cent of terrorism related deaths in the country. Burkina Faso also faces political instability characterized by two coup d'état in 2022. Mali is ranked 4th with a GTI score of 8.412. In 2022 the country has recorded its higher number of deaths despite the decrease of terrorist's attacks. Most of them were directed towards military and civilians with 607 civilian deaths and 188 military deaths in 2022. The country has also experienced a political instability with a coup d'état in May 2021 and also the failure of Operation Barkhane with the departure of French military forces.

Nigeria is ranked 8th with a GTI score of 8.065. Despite this high ranking, terrorism continues to decline in the country with total deaths decreasing from 497 in 2021 to 385 in 2022. We also have a decrease in terrorist attacks (214 incidents in 2021 to 120 incidents in 2022). Civilians are also the most

⁴Terrorism being one of the manifestations of armed conflicts

⁵"The Sahel is increasingly representing more terrorism deaths than any other region globally".Institute for Economics & Peace. Global Terrorism Index 2023: Measuring the Impact of Terrorism, Sydney, March 2023.

affected with 196 deaths recorded in 2022.

Niger is ranked 10th with a GTI score of 7.616. The country has experienced a decline in the impact of terrorism between 2021 and 2022. Niger has recorded 198 deaths from terrorism in 2022 which represent a 67% decrease compared to 2021 (595 deaths recorded). However, despite this decline, Niger is the country with the sixth highest civilian death toll in 2022.

In terms of number of conflicts, the Sahel region records on average 115 conflict events per million inhabitants from 2015 to 2020 according to the ACLED⁶. A breakdown by country allows us to see which country is the most affected by armed conflicts in the region. As shown in the figure 3, Mali is the Sahel country the most affected by conflicts in term of number followed by Burkina Faso and Niger. This joins the ranking of the Global Terrorism Index on the epicenter of Sahel terrorism.⁷

2.4 Empirical results and robustness check

2.4.1 Empirical results

4.1.1 Baseline

In our baseline result, two estimations are made using the Driscoll-Kraay method (See Table 2.2 below) and an Instrumental Variable method (See Table 2.3 below). In the two estimations, our variable of interest is statistically significant and negative at 1% level. This result shows that armed conflict is harmful to tax revenue mobilization in the Sahel region. This finding is in line with authors like (Gupta et al., 2004; Addison and McGillivray, 2004; Diakite et al., 2019) and can be explained by the ensuing chaos. Indeed, the destruction of infrastructures, the decrease of the economic activity and the increase of corruption that can occur during a period of conflict make it difficult for the governments to collect taxes. This can then result in the reduction of tax revenue.

Concerning the control variables, GDP per capita exerts a significant and negative impact on tax revenue mobilization in the two models. This unexpected finding is in line with (Gnangnon and Brun, 2018) and may reflect an income inequality across the population that could limit the tax base. A high level of corruption and the weakness of the tax administration explains also the negative impact of GDP per capita. And of course, the significant presence of the informal economy which is not subject to taxation limit the tax base. We also note that value added of the agricultural sector affects negatively and

⁶The Armed Conflict Location & Event Data Project

⁷According to the Global Terrorism Index 2023, the tri-border region including Burkina Faso, Mali and Niger experienced the most attacks accounting for 81% of all terrorism deaths across those states in 2022.

significantly tax revenue mobilization. This finding is consistent with a large body of literature (Gnangnon and Brun, 2018; Brun et al., 2011; Khattry and Rao, 2002; Agbeyegbe et al., 2006; Mallick, 2021; Bahl, 2004; Mawejje and Francis Munyambonera, 2016; Brun et al., 2015). This confirm our expectations on the difficulty of collection taxes in the agricultural sector especially for developing countries. As expected, tax revenue mobilization is positively and significantly affected by property right and reflects the importance of property rights when it comes to facilitate compliance with tax laws. This finding is in line with (Kelly, 2012; Norregaard, 2013). Indeed, enforcement of property rights provides greater security for property owners, which can be an incentive to invest in property, encourage economic growth, and increase tax revenue. The KOF informational index which measure the depth of the use, adoption of information and communication technology is also positive and significant meaning that variables such as internet access and press freedom have a positive impact on tax revenue mobilization as expected. Indeed, the growth of e-commerce and online marketplaces can increase the volume of sales transactions, which can lead to higher tax revenue from sales taxes and value-added taxes (VAT). This finding is in line with (Gnangnon and Brun, 2018; Adegboye et al., 2022; Brun et al., 2020; Mallick, 2021) and confirms our predictions that communication technology such as internet usage is relevant for tax revenue mobilization.

Table 2.2: Armed conflict and Tax revenue (Driscoll-Kraay standard errors OLS)

VARIABLES	Dependable variable: Tax revenue				
	[1]	[2]	[3]	[4]	[5]
Armed_conflict	-1.025** (0.428)	-0.982** (0.397)	-1.362** (0.532)	-1.689*** (0.349)	-0.573** (0.273)
logGDP/capita		-0.583 (0.390)	-0.632 (0.384)	-2.384*** (0.314)	-3.692*** (0.404)
Property Right			6.262*** (1.674)	6.214*** (1.093)	7.853*** (1.650)
KOF_Infomrtional				0.182*** (0.0195)	0.151*** (0.0169)
Agriculture					-0.152*** (0.0214)
Constant	9.972*** (0.482)	13.90*** (2.963)	10.02*** (3.267)	13.53*** (1.565)	26.36*** (2.518)
Observations	204	204	202	198	198
Number of groups	10	10	10	10	10
R-squared	0.019	0.027	0.098	0.555	0.677

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.1.2 Endogenous treatment

It is possible that the above results are still ineffective due to endogeneity. To address this issue, an ordinary double least square model (2SLS) was applied using our instruments. The results of this model indicate that the effect of effect of conflicts on tax revenue is negative and significant at the 1% level, rising from -0.57 to -2.39%. Otherwise, this result confirms that the armed conflict is a threat to resource mobilization in Sahel. Moreover, the p values of the associated F tests are lower than 1%, and the p values of the Kleibergen and Paap (2006) under-identification test prove that the instruments are correlated with the endogenous variables. Finally, the null hypothesis of the Sargan-Hansen test is not rejected, which confirms the validity of the instruments. In addition, the first-stage results⁸ show that the instruments are valid because they explain the endogenous variables at conventional thresholds. It's important to note that, the robustness of the results is not affected even though the number of observations is reduced due to missing values in the "military expenditure" data used as an instrument. The results appear as follows:

Table 2.3: Impact of conflicts on tax revenues using instrumental variables.

VARIABLES	FIRST Stage	Tax revenue (IV estimates)
Armed Conflicts		-2.395***
		-0.843
Lag Conflicts Armed	0.400***	
	-0.0721	
Geographical distance	0.366**	
	-0.154	
Lag military expenditure	-0.107***	
	-0.0255	
log GDP per capita	0.151**	-3.728***
	-0.0682	-0.458
Property rights	0.194	8.143***
	-0.223	-1.313
KOF Information	0.00575**	0.184***
	-0.00286	-0.0169
Agricultural value added	0.0198***	-0.108***
	-0.00378	-0.0286
Constant	-1.698***	24.13***
	-0.533	-3.749
Endogeneity test		0.0006
Sargan-Hasen(p-value)		0.148
Kleibergen-Paap rk LM statistic (p value)		0.0000
Cragg-Donald Wald F statistic		26.204
Observations	151	151
R-squared		0.657
Number of id	10	10
Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1		

⁸see appendix for the first-stage result

2.4.2 Sensitivity: The role of institutional quality

Since we know from previous studies [Fang et al. \(2020\)](#) that institutional quality can play a crucial role in mitigating the impact of conflict on tax revenue. We introduce variables that are related to institutional quality to test the sensitivity of the magnitude and coefficient of armed conflict on tax revenues. To be precise, data such as, Control of corruption, Government effectiveness, Political Stability are used. We have a large body of literature showing that institutional quality is crucial in the the improvement of tax revenue mobilization ([Ndikumana and Abderrahim, 2010](#); [Tapsoba et al., 2017](#); [Bird et al., 2008](#); [Mawejje, 2019](#)). Our result (Table 2.4) is in line with these findings. Control of corruption, Government effectiveness and Political Stability were found to be significantly and positively associated with tax revenue mobilization. Also, when the different variables of institutional quality are introduced consecutively in our regression, the negative effects of armed conflicts are slightly mitigated. This is consistent with [Fang et al. \(2020\)](#) showing that the institutional quality can contribute to mitigate the impact of conflict on tax revenue mobilization.

Table 2.4: Sensitivity: The Role of Institutional Quality

VARIABLES	Dependent Variable: Tax Revenue			
	(1)	(2)	(3)	(4)
Armed Conflict	-2.395*** (0.843)	-2.100** (0.831)	-2.297*** (0.778)	-1.649* (0.995)
log GDP/capita	-3.728*** (0.458)	-3.114*** (0.496)	-3.088*** (0.447)	-3.295*** (0.440)
Property Rights	8.143*** (1.313)	7.565*** (1.359)	7.362*** (1.389)	7.210*** (1.387)
KOF Informational	0.184*** (0.0169)	0.163*** (0.0188)	0.171*** (0.0171)	0.181*** (0.0159)
Agriculture	-0.108*** (0.0286)	-0.0879*** (0.0260)	-0.0633** (0.0256)	-0.0945*** (0.0234)
Control of Corruption		1.412** (0.608)		
Government Effectiveness			2.379*** (0.773)	
Political Stability				0.689* (0.397)
Constant	24.13*** (3.749)	21.84*** (3.447)	21.77*** (3.299)	21.96*** (3.262)
Endogeneity Test	0.0006	0.0003	0.0000	0.0038
Sargan-Hansen (p-value)	0.148	0.164	0.051	0.111
Kleibergen-Paap rk LM Statistic (p-value)	0.0000	0.0000	0.0001	0.0003
Cragg-Donald Wald F Statistic	26.204	22.709	24.843	14.045
Observations	151	151	151	151
R-squared	0.657	0.682	0.680	0.696

Unreported first step, significant for all instruments

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

2.4.3 Robustness checks

4.3.1 Additional controls on baseline specification

Further controls were added in the baseline specification including other variables likely to affect conflict and tax revenue. These additional controls are Inflation, Access to electricity, Trade, Credit to private Sector, and Population Growth. Inflation is often considered as an important criterion for assessing macroeconomic stability. We observe that inflation measured by the consumer price index has a significant negative impact on tax revenues. This result suggests that inflation can impact economic activity, as it can create uncertainty, distort resource allocation, and reduce investment and consumption (De Gregorio, 1993; Ryngaert, 2022). On the other hand, inflation affects taxes through potential channels such as real income and tax bracket creep. Concerning Access to electricity, we have a positive and significant effect on tax revenue. Indeed, infrastructure investment, particularly in improving access to electricity, impact tax revenue by stimulating economic growth, attracting foreign investment, formalizing the economy, and improving tax administration and compliance. Concerning trade, we found that, Trade openness are positively related to tax revenue. This result is in line with previous studies (Gnangnon and Brun, 2019). Also Credit to private Sector boost tax revenue Gnangnon (2021). Usually the literature suggests that credit to private sector can potentially boost tax revenue by stimulating business expansion, promoting entrepreneurship and fostering innovation and technological advancement.

Table 2.5: Testing for additional controls on baseline specification

VARIABLES	Dependant variable: Tax revenue				
	(1)	(2)	(3)	(4)	(5)
Armed_conflict	-2.464*** (0.853)	-2.721*** (0.834)	-2.113** (1.030)	-1.650* (0.857)	-1.433** (0.726)
Inflation	-0.115** (0.0472)	-0.114** (0.0477)	-0.110** (0.0464)	-0.0844** (0.0343)	-0.107*** (0.0324)
Acces_electricity		0.0246 (0.0187)	0.0362* (0.0192)	0.0579*** (0.0140)	0.0556*** (0.0138)
Trade			0.0237* (0.0133)	0.0215* (0.0112)	0.0208** (0.0102)
Credit to Private Sector				0.226*** (0.0371)	0.211*** (0.0399)
Population Growth					-0.931 (0.843)
Main controls	YES	YES	YES	YES	YES
Constant	23.49*** (4.110)	25.08*** (4.327)	26.74*** (4.688)	32.43*** (3.712)	36.72*** (4.668)
Endogeneity test	0.0001	0.0000	0.013	0.035	0.0128
Sargan-Hasen(p-value)	0.126	0.142	0.322	0.452	0.478
Kleibergen-Paap rk LM statistic (p value)	0.000	0.000	0.000	0.001	0.0002
Cragg-Donald Wald F statistic	24.639	23.932	17.907	15.883	13.782
Observations	149	149	149	144	144
R-squared	0.672	0.664	0.706	0.806	0.817

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3.2 Alternative main dependent variable

Thus far, total tax revenue was used as the dependent variable. Here we use the Total Revenue of the country measured as total revenue, including non-resource taxes and social contributions. Our results show that there is also a significant negative effect regardless of the definition of tax revenue used.

Table 2.6: Alternative main dependent variable: Total Revenue

VARIABLES	(1) Tax revenue	(2) Total revenue
Armed_conflict	-2.395*** (0.843)	-3.776*** (1.130)
log GDP/capita	-3.728*** (0.458)	-3.640*** (0.642)
Property Right	8.143*** (1.313)	5.196*** (1.630)
KOF Informational	0.184*** (0.0169)	0.227*** (0.0264)
Agriculture	-0.108*** (0.0286)	-0.0832** (0.0374)
Constant	24.13*** (3.749)	23.90*** (5.022)
Endogeneity test	0.0006	0.0084
Sargan-Hasen(p-value)	0.148	0.148
Kleibergen-Paap rk LM statistic (p value)	0.0000	0.0000
Cragg-Donald Wald F statistic	26.204	36.617
Observations	151	104
R-squared	0.657	0.598
Robust standard errors in parentheses		
unreported first step, significant for all instruments		
*** p<0.01, ** p<0.05, * p<0.1		

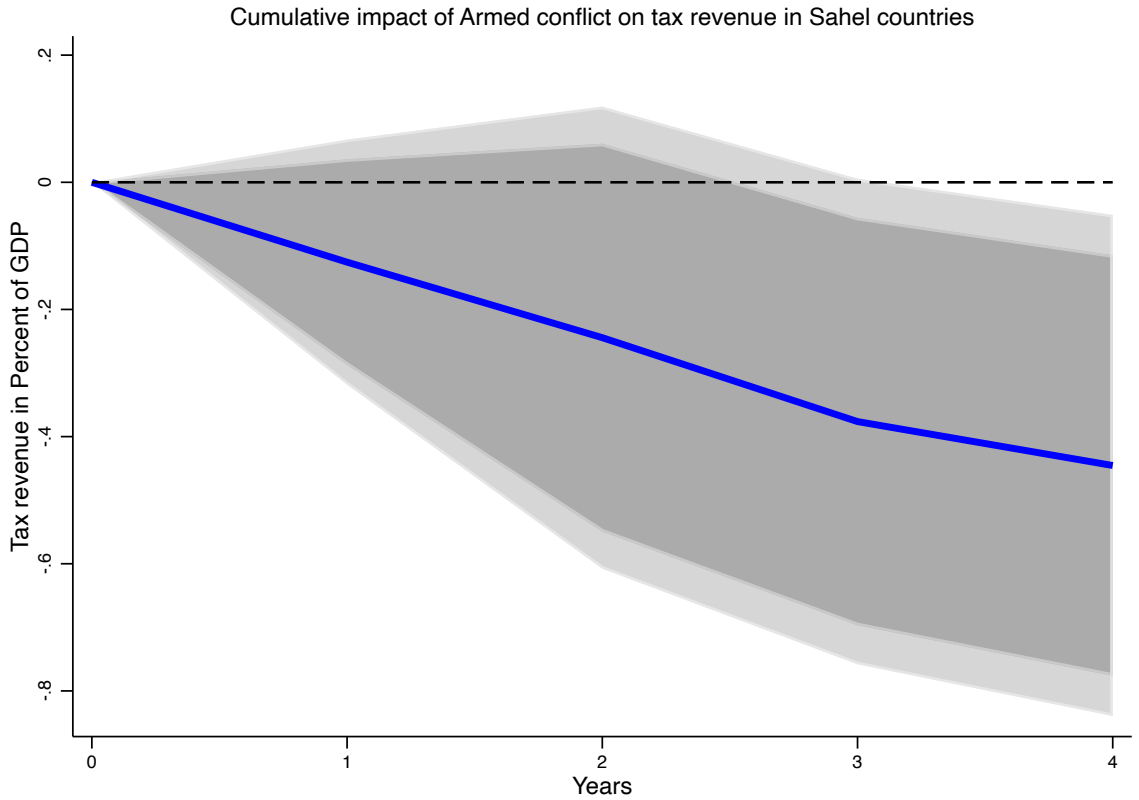
4.3.3 Alternative empirical strategy

We intend to capture the effect of conflict over a longer time horizon on tax revenues. To do this, we rely on the local impulse model. This model captures the direct effects of conflict, and is also applicable to the identification of indirect effects. The key concept of this approach is to estimate the local projections for each time horizon, rather than extrapolating from a model that is based on a distant horizon, as is the case with VAR models. The Local Projections (LP) framework is flexible enough to accommodate a panel structure and does not constrain the shape of the impulse response functions and is thus less sensitive to misspecification. [Auerbach and Gorodnichenko \(2013\)](#); [Jordà and Taylor \(2016\)](#); [Ramey and Zubairy \(2018\)](#) as well as [Born et al. \(2019\)](#) among others, also rely on local projections while analyzing fiscal policy. This method has been recommended by [Stock and Watson \(2007\)](#) and others, as it offers a flexible alternative that avoids imposing the dynamic restrictions inherent in vector autoregressions or distributed autoregressive lags, making it particularly suitable for detecting nonlinearities in the dynamic response. Additionally, this method has several benefits: (i) it can be easily estimated using classical

models like ordinary least squares, generalized linear models, or instrumental variables estimators; (ii) it is more robust to a poorly specified model; (iii) it allows for point or joint inference more readily; (iv) and finally, it is more convenient for strongly nonlinear models and is flexible when specifying multivariate models. In the identification strategy, we consider the conflict as an external shock. The equations to be estimated are:

$$Tax_{i,t+h} = \alpha + \beta C_{i,t+h} + \rho X_{i,t+h} + \epsilon_{i,t+h} \quad (h = 0; 1; \dots; 5) \quad (2.3)$$

Figure 2.1: Cumulative impact of Armed conflict on tax revenue in Sahel countries



Source: Author's construction

This result suggests that conflicts tend to take time to deteriorate the tax base. Specifically, conflict shocks decrease revenues between the 2nd and 3rd year. This impact is negative and significant at 5% and then at 1% (Light Ash Bar). It is possible that armed conflicts are slow to affect tax revenues. Indeed, even in times of war, the government can still control the tax revenue mobilization system. However, conflict can have an indirect impact on the economy and the state's ability to mobilize tax revenues. For

example, fighting can disrupt agricultural or industrial production, which can lead to lower revenues and a reduced tax base. In addition, conflict can lead to population displacement and the effects of conflict on tax revenue may be cumulative, meaning that the impact grows over time as the conflict continues (McLoughlin et al., 2017). Ultimately, the impact of conflict on tax revenues will depend on numerous factors, including the duration and intensity of the fighting, the ability of the state to maintain control of its territory and tax system, and the extent of indirect economic disruption caused by the conflict.

2.5 Heterogeneity

2.5.1 Conflict and tax revenue: The role of foreign aid

Foreign aid can play a role in mitigating the negative effects of conflict on tax revenue by providing resources to support economic recovery and reconstruction efforts (Table 2.7). Following Maïmouna et al. (2019), we generate an intersection variable to analyze the relationship between conflict and official development assistance. Our findings reveal that even during armed conflicts, a 1% increase in official aid can mobilize revenues. This suggests that foreign aid can play a crucial role in mitigating the adverse effects of conflict on fiscal revenues by providing resources to support economic recovery and reconstruction efforts, such as rebuilding damaged infrastructure, providing essential services like healthcare and education, and promoting the development of new industries. Overall, our results indicate that aid granted during periods of conflict positively impacts revenue collection.

2.5.2 Conflict and tax revenue: The role of Socio-economic Conditions

Socio-economic Conditions variable come from (Howell, 2011) and represent an assessment of the socioeconomic pressures at work in society that could constrain government action or fuel social dissatisfaction. The subcomponents of the index are unemployment, consumer confidence, and poverty. Our findings lead us to conclude that socioeconomic conditions play a significant role in shaping the relationship between conflict and tax revenue. During times of conflict, these socioeconomic factors can have a notable impact on the ability of individuals and firms to generate taxable income, influence consumer spending and investment patterns, and affect the government's ability to collect taxes. Therefore, understanding and addressing socioeconomic conditions during periods of conflict are crucial for policymakers aiming to effectively manage tax revenue collection in challenging circumstances.

Table 2.7: The role of foreign aid and socio-economic Conditions

VARIABLES	Dependant variable: Tax revenue	
	(1)	(2)
Armed_conflict	-3.473*** (0.861)	-3.993** (1.849)
Armed_conflict*Aid	0.448*** (0.138)	
Aid	0.0511 (0.0529)	
Armed_conflict*Socio_eco_Conditions		1.167** (0.524)
Socio economic Conditions		0.748** (0.278)
Main controls	YES	YES
Constant	17.19*** (2.358)	16.63*** (4.852)
Observations	198	152
R-squared	0.733	0.790
Number of groups	10	8
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

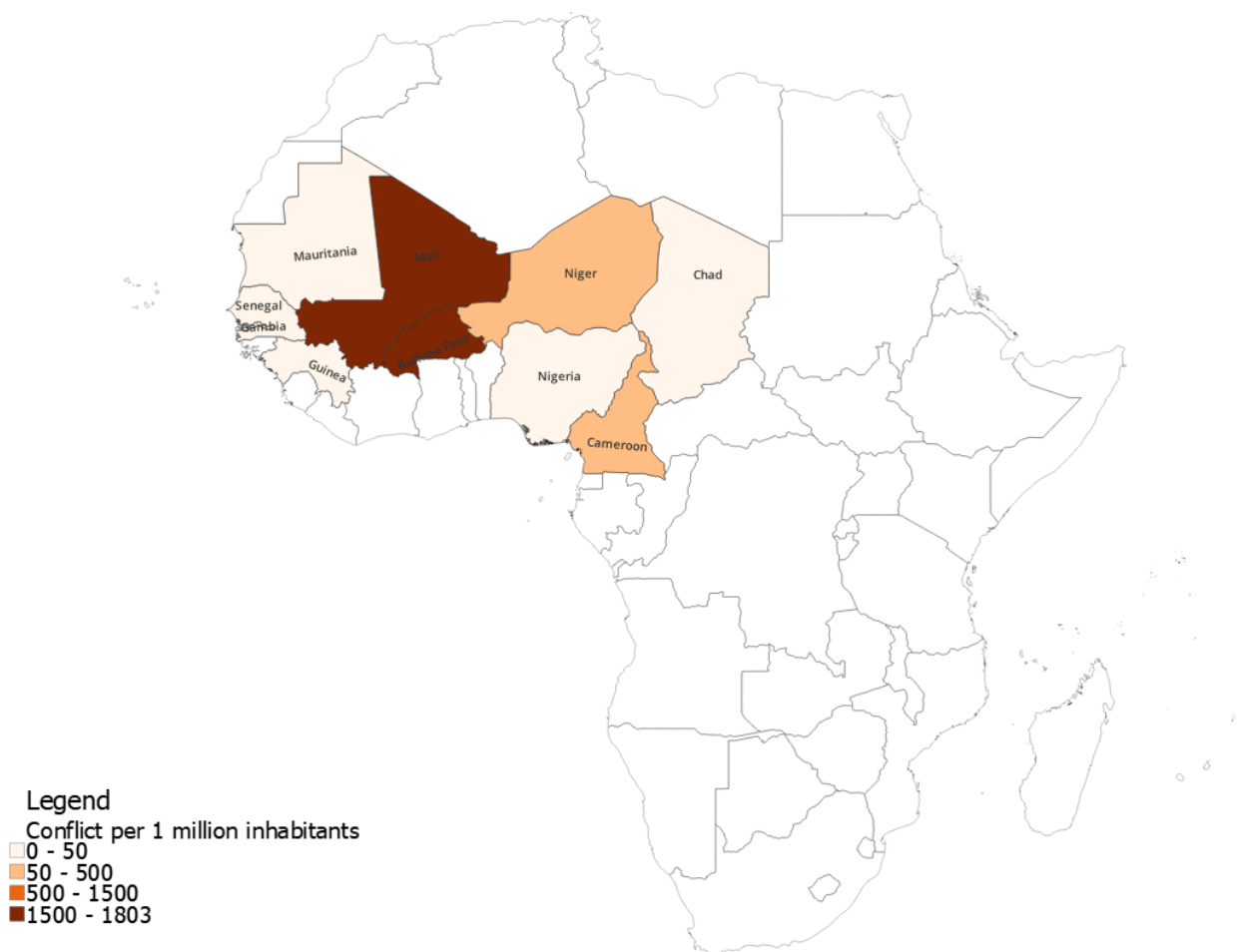
2.6 Conclusion and policy implications

In this article, we attempt to explore the performance of tax revenue mobilization in the Sahel region given the security environment. We seek to assess the impact of recurrent armed conflicts in this region on tax revenue mobilization using data on 10 Sahelian countries from 2000 to 2021. We find that armed conflicts have a significant negative effect on tax revenue mobilization. When these results are subjected to sensitivity testing, the negative association remains robust. However, the results suggest that institutional quality positively affects revenue and reduces the magnitude and the effect of conflict on revenue. From this finding, the improvement of institutional quality is crucial. A key finding is that Sahelian countries do not perform well in terms of tax revenue mobilization in times of conflict. This could be due to several factors such as firstly the deterioration of the tax base and the administration capacity due to the conflicts. A second factor can be the deterioration of the economic activity which make tax collection very difficult. A third reason could be the degradation of institutions. Policy implications from this finding is that Sahelian countries should first strengthen their tax administration which is weak in times of conflict by investing in technology and infrastructure in order to improve capacity to collect taxes. We also found that property right and information and communication technology are positively correlated with tax revenue mobilization. However, agriculture sector have a negative impact on tax revenue mobilization. From our finding, governments need to more use technology to improve tax mobilisation, tax filing and also to discourage tax evaders. Governments should reinforce institutions

in order to ensure transparency in tax collection and spending. An effective control of corruption and rule of law is also important for the governments to propose some tax incentives in order to encourage investments.

2.7 Appendix

Figure 2.2: Map of Number of Conflicts Events per one Million inhabitants in Sahel from January 2015 to September 2021



Source: Author's construction using data from the Armed Conflict Location and Event Data project (ACLED) and QGIS software

Table 2.8: First stage regression results

VARIABLES	First stage Armed_conflict
logGDP/capita	0.151* (0.0777)
Property Right	0.194 (0.185)
KOF Informational	0.00575** (0.00273)
Agriculture	0.0198*** (0.00402)
Lag (Armed_conflict)	0.400*** (0.0841)
IV of Armed_conflict	0.366** (0.162)
Lag of military expenditure	-0.107*** (0.0257)
Constant	-1.698*** (0.585)
Observations	153
R-squared	0.480
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	
Note: IV of Armed_conflict represents the instrument created using the geographic distance weighting matrix	

Table 2.9: Armed conflict and Tax revenue (fixed effect)

VARIABLES	Fixed effect OLS	Drisc/Kraay std. err.
Armed conflict	-0.671*** (0.207)	-0.573** (0.273)
log(GDP/capita)	-3.839*** (1.038)	-3.692*** (0.404)
Property Right	-1.492 (1.536)	7.853*** (1.650)
KOF Informational	0.0797*** (0.0238)	0.151*** (0.0169)
Agriculture	-0.0343* (0.0207)	-0.152*** (0.0214)
Constant	33.10*** (6.820)	26.36*** (2.518)
Observations	198	198
Number of id	10	10
R-squared	0.631	0.677
Country fixed effect	YES	NO
Year fixed effect	YES	NO
Standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 2.10: List of countries (10)

Burkina Faso	Mali
Cameroon	Mauritania
Chad	Niger
Gambia	Nigeria
Guinea	Senegal

Table 2.11: Source of Data

Variables	Source
Tax revenue (%GDP)	UNU-WIDER Government Revenue Dataset
Total revenue	UNU-WIDER Government Revenue Dataset
Armed conflict	UCDP/PRIO Armed conflict Dataset
KOF Informational	KOF Globalisation Index
Property Right	Varieties of Democracy (V-DEM) database
GDP per capita	World Bank WDI
Agriculture	World Bank WDI
Control of Corruption	ICRG
Government Effectiveness	ICRG
Political Stability	ICRG
Trade	World Bank WDI
Rule of Law	World Bank WGI
Credit to private Sector	World Bank WDI
Foreign Aid	World Bank WDI
Socio-economic Conditions	Howell (2011)

Chapter 3

Chapter 3

Fiscal Efficiency Amid Climate Shocks: How does climate shocks affect public spending efficiency in Developing Countries?

“Climate change will affect the basic elements of life for people around the world—access to water, food production, health, and the environment. The costs of inaction are far greater than the costs of mitigation.”

—Nicholas Stern, *The Economics of Climate Change* (2007)

3.1 Introduction

Sustainable development agenda has emerged as strategic policy priority in the scientific debate on the political economy of development. Devastating economic and social impact of climate change has affected the world, especially developing countries ([Marto et al., 2018](#)). In addition, sudden emergence of the COVID-19 pandemic and the conflict in Ukraine pose a significant risk of reversing years of progress

and jeopardising the achievement of the Sustainable Development Goals (SDGs). Financing the recovery will require mobilising and effectively allocating significant resources. This means that taxpayers and policymakers (should) care about how public resources can be transformed efficiently into deliverables in terms of public goods and services. Public spending is recognized as an important tool in a government's continuous efforts to improve public sector performance, achieve growth objectives and fight poverty and inequality (d'Agostino et al., 2016; Devarajan et al., 1996; Landau, 1983; Fan, 2008). Developing countries often face constraints in mobilizing resources and in expanding their fiscal space (Besley and Persson, 2014). However, efficient public spending remains a reliable means of achieving development goals despite limited fiscal space Combes et al. (2023). The economic literature has extensively demonstrated that public expenditure efficiency, not only optimises the allocation of resources to projects and programmes with the greatest social benefits, but also promotes economic growth (Chan et al., 2017), reduces poverty (Walle, 1999) and improves income distribution (Afonso et al., 2010a; Doumbia and Kinda, 2019). In addition, it serves as an incentive to improve revenue collection. The concept of "collect more, spend better" encapsulates the virtuous cycle of public spending efficiency. However, this process encounters several obstacles, such as corruption, bureaucratic inefficiencies, and restricted transparency in managing public finances.

Today, climate change effects pose a major threat to growth, economic activities, and sustainable development (Raddatz, 2009; Dafermos et al., 2018; Acevedo et al., 2020; Ortiz-Bobea et al., 2021). According to the World Meteorological Organization, temperatures are expected to rise by more than 1.5 degrees Celsius above preindustrial levels within the next five years. Additionally, the Intergovernmental Panel on Climate Change warns that if current trends continue, temperatures could increase by 3°C or more above preindustrial levels by 2100¹. The consequences for humanity are both direct and indirect.

Overall, extensive economic literature have proven that weather shocks and disasters have a negative impact on the economic growth of countries in both the short and long term (Dell et al., 2012; Acevedo et al., 2020). The literature identifies two measures to reduce the impact of shocks and disasters, notably prevention and mitigation (Laframboise and Loko, 2012; Noy, 2009). Risk prevention aims to reduce the likelihood of a disaster occurring, whereas mitigation measures focus on reducing the damage associated with a disaster after it has occurred.

Developing countries are challenged to formulate effective adaptation and mitigation strategies to combat the adverse effects of climate change. This undertaking has significant implications for these countries'

¹The Panel's central estimates under the "SSP2-4.5" scenario indicate a range of 2.1-3.5°C.

fiscal frameworks, as previous studies have emphasised (Jones et al., 2013; Bachner and Bednar-Friedl, 2019; Aligishiev et al., 2022). Jones et al. (2013) provide compelling evidence of climate change's impact on public finances, highlighting its potential to exacerbate wider challenges. Climate change affects government tax revenues (Mohan and Strobl, 2021; Tsopmo et al., 2022), especially for countries that are heavily dependent on sources of income such as tourism, the sale of fishing rights and agriculture. According to (Jones et al., 2013), this decline in revenue could substantially affect efficiency of public expenditure and allocation in these countries. Overall, the susceptibility of these crucial sectors to the effects of climate change could cause knock-on effects throughout the entire fiscal landscape, altering budgetary priorities and presenting obstacles to the efficient allocation of resources.

While previous research has established a significant interconnection between public finances and endeavours to combat climate change, limited attention has been given to the effect of climate change on public spending efficiency. Given the increasing probability of more frequent and severe climate-related incidents in the future, it is imperative for countries to proactively prepare for and adapt to these changes. Theoretical impact of climate change on public spending is somewhat unclear. Climate change may affect public expenditure efficiency in developing countries, particularly for countries with low absorption capacity, through the following mechanisms: (i) Climate shocks may change priorities for resource allocation (Amir Imam and Kpodar, 2023; Afonso et al., 2023). Governments may have to allocate a larger share of their budgets to disaster preparedness, relief and recovery. However, this may divert funds away from other essential sectors such as education or healthcare, potentially affecting the efficiency of public expenditure and the delivery of crucial services. (ii) climate change can lead to physical damage to infrastructure, assets (De la Fuente et al., 2007) and therefore increase the need to invest in infrastructure upgrades and resilience-building projects to mitigate the impacts of climate change. These investments have the potential to put public budgets under strain and may require borrowing from other development projects, which could affect overall efficiency. (iii) Climate change can exacerbate economic instability in developing countries, affecting their fiscal capacity (Amir Imam and Kpodar, 2023). Sudden shocks, such as crop failures or infrastructure damage, can disrupt economic growth (Stern and Stiglitz, 2023) and lead to fiscal deficits, affecting public expenditure efficiency. It is thus necessary to estimate the empirical impact of climate shocks on the efficiency of public expenditures. This will inform policy and economic responses to adaptation and mitigation (Leppänen et al., 2017).

So far, the literature has focused on the effects of climate change on economic growth (Berlemann and Wenzel, 2018); financial stability (Dafermos et al., 2018); poverty and inequality (Leichenko and Silva, 2014; Baarsch et al., 2020; Paglialunga et al., 2022; Cevik and Jalles, 2023b). It is also well documented

that increasing frequency and severity of climate-related natural disasters affect economic development (Loayza et al., 2012; Noy, 2009; Skidmore and Taya, 2002; Gilmore et al., 2004), reduce the accumulation of human capital Cuaresma (2010) and worsen external balances Gassebner et al. (2010). More recently, Cevik and Jalles (2023b, 2022) show that climate change vulnerability has significant effects on government bond yields and spreads, the probability of sovereign debt default and sovereign credit ratings. Although recent studies such as , Gu and Hale (2023) examines the relationship between climate risks and foreign direct investment. The paper explores whether multinational react to such risks by altering their presence in countries that are more affected. However, the literature has so far ignored the effect of climate shocks on public expenditure efficiency.

This paper attempts to bridge this gap in the literature by investigating how climate challenge may affect government spending efficiency. Considering that climate action is a central component of the current sustainable development trajectory, it becomes crucial to analyze how it influences public spending efficiency. To offer practical and insightful policy responses, the study addresses the following key questions: How do climate shocks impact government spending efficiency? What are the transmission channels, and does the effect of climate change on efficiency depend on absorption capacity? The impact of climate change on public budgets is a multifaceted issue with far-reaching implications. Our study contributes to several strands of literature. First, it examines the intersection of climate change and public finance, particularly focusing on how climate shocks influence public spending efficiency in developing countries. We provide additional evidence that these shocks, especially those related to rainfall and temperature, significantly undermine fiscal efficiency. Moreover, we highlight the mediating role of macroeconomic instability and GDP growth disruptions, offering new insights into the mechanisms through which climate change exacerbates fiscal challenges and emphasizing the need for climate resilience in public finance management.

The remainder of the work is organized as follows. The following section presents some stylised facts. section 3 describes the methodology and data used. Next, section 4 presents the empirical results, while section 5 analyses sensitivity and the possible heterogeneity of our results. Finally, Section 6 concludes the study and presents the main policy recommendations derived from the results

3.2 Literature and Conceptual Framework

3.2.1 Climate change and public finances

Research on the macroeconomic impacts of climate change has become increasingly significant. Numerous studies have underlined the need for both mitigation and adaptation policies and highlight that climate-induced negative supply shocks contribute to a global economic downturn (Stern, 2007; Jones et al., 2007; Corugedo et al., 2023). Globally, climate change is fundamentally an externality issue—especially in developing countries. The fiscal consequences of climate change arise from the allocation function, which includes mitigation, adaptation, redistribution and stabilization. Each aspect leads directly to an increase in public spending while simultaneously reducing tax revenues. The indirect implications of climate change, resulting from the behaviour of greenhouse gas emitters who fail to realise that their cumulative impact exceeds the socially optimal level, have a significant impact on public finances (Corugedo et al., 2023; Kunawotor et al., 2022). In the realm of public finances, climate change exerts a notable impact on key aggregates, encompassing tax revenue, public spending, public debt, and the budget balance. For example, it is possible that, countries heavily reliant on industries like tourism, fishing, or agriculture may witness significant reductions in government revenue due to climate-related disruptions. Climate change significantly increases the cost of disaster relief and rebuilding infrastructure - including urban amenities, roads and bridges - straining government budgets.

The UN's IPCC predicted an annual investment of \$1.6 to \$3.8 trillion until 2050 to meet Paris Agreement targets ², emphasizing the substantial financial impact of mitigation policies. Additionally, climate change leads to economic consequences, shrinking tax bases due to reduced activity in sectors like tourism and agriculture. These economic impacts worsen fiscal imbalances, reducing funds for crucial public services like healthcare and education.

Climate vulnerability hampers the ability of developing countries to raise revenues (Corugedo et al., 2023; Tsopmo et al., 2022). Direct taxes, which include income taxes and corporate taxes, appear to be particularly compromised in terms of their magnitude in the face of climate vulnerability (Tsopmo et al., 2022). This can be attributed to several factors. The impact arises from climate change's direct influence on critical economic sectors like agriculture and manufacturing, resulting in reduced incomes for individuals and diminished corporate profits. This, in turn, shrinks the tax base for direct taxes, limiting overall revenue. Additionally, the financial strain caused by climate-related disasters often leads to governments implementing tax relief measures, crucial for immediate challenges but exacerbating fiscal

²<https://www.ipcc.ch/sr15/chapter/chapter-2/>

pressures and impeding the sustainability or growth of revenue collected through direct taxes.

Climate shocks are worsening the budget deficit and total public debt (Amir Imam and Kpodar, 2023; Lis and Nickel, 2010; Kunawotor et al., 2022; Giovanis and Ozdamar, 2022), while growth and macroeconomic performance are significantly influenced by public debt. Thus, climate change can have long-term effects on economic growth (Cevik and Jalles, 2023a; Kahn et al., 2021; Ciccarelli and Marotta, 2024), particularly in vulnerable sectors. For example, slower economic growth can hinder the government's ability to generate sufficient revenue, making it challenging to service existing debt and potentially leading to a cycle of increased borrowing (Clements et al. (2023)). Moreover in economies characterized by constrained fiscal space, notably observed in developing countries, augmenting debt poses a challenge. This challenge arises from existing high debt levels, escalating interest costs, and substantial demands for adaptation, all within the context of aspiring to achieve the Sustainable Development Goals.

Through various direct and indirect channels, climate shocks can affect the efficiency of public spending in developing countries. Such channels can influence government spending, resource allocation and overall economic stability (Karim and Noy, 2020; Barr et al., 2010). We assume that frequent climate shocks might increase the recurring maintenance costs of infrastructure, leaving fewer resources for other public spending priorities. Exploring the vulnerability to climate change effects, (Nordhaus and Boyer, 2000; Strömberg, 2007) emphasise that it varies across countries, with developing countries being particularly vulnerable due to warmer climates, less favourable initial macroeconomic conditions, higher income inequality and lower government effectiveness.

Support for climate change-related innovation will place a burden on government budgets through expenditure on research and development subsidies and/or tax breaks. These tax expenditures can be considered as tax losses, especially if they are not properly assessed. Overall, the fiscal consequences of climate change require a strategic coordination of tax and expenditure tools, emphasizing measures that bolster public funds rather than diminish them.

3.2.2 Efficiency analysis : non-parametric and parametric approaches

Efficiency score estimation literature utilizes both parametric and nonparametric approaches. Assessing the efficiency of public spending, (Wang and Alvi, 2011; Hauner and Kyobe, 2010; Afonso et al., 2022) employed the Data Envelopment Analysis (DEA) method. Their approach primarily gauged public expenditure efficiency by examining how effectively inputs generated outputs. In contrast, (Gupta and Verhoeven, 2001; Afonso et al., 2005) made significant contributions to the field by evaluating public sector efficiency through the correlation between public expenditure and its intended socio-economic outcomes.

Nonparametric techniques, like Free Disposal Hull (FDH) analysis and Data Envelopment Analysis (DEA), provide flexibility since they do not impose constraints on inefficiency distribution or behavioral assumptions. In general, non-parametric models rely on linear optimization programs to construct the efficiency curve [Afonso and Aubyn \(2005\)](#). These traditional approaches fail to account for measurement errors, stochastic influences, or distinguish between public sector mismanagement and exogenous factors affecting inefficiency [Kumbhakar and Lovell \(2003\)](#). Moreover, the scores acquired after estimation are deterministic, meaning they are still vulnerable to measurement error and random variation in the data ([Aigner et al., 1977](#); [Bauer, 1990](#))³.

Nonparametric models are known to depend on outliers for establishing the production frontier [Fiorentino et al. \(2006\)](#). These models exhibit high sensitivity when dealing with diverse units. This makes Stochastic Frontier Analysis (SFA) a more suitable choice for assessing the effectiveness of public spending in developing countries, which often display substantial discrepancies in per capita income levels and other variables that influence expenditure and affect efficiency scores. Parametric techniques, particularly SFA, address the limitations of nonparametric approaches by utilizing a stochastic production function. This allows the error term to include both inefficiency and idiosyncratic shocks ([Aigner et al., 1977](#); [Meeusen and van Den Broeck, 1977](#)), providing better control over random events. Although parametric methods require strong assumptions about data distribution, they can effectively handle noise and advanced specifications, especially in panel data [Grigoli and Kapsoli \(2018\)](#).

The stochastic frontier model is chosen in this study for its potential to manage the random nature of climate change as well as segregate the error term into country-specific inefficiencies and measurement inaccuracies. SFA accounts for deviations from the deterministic frontier due to measurement inaccuracies and stochastic fluctuations. Public spending and its determinants can vary widely across countries, and SFA allows for a regression-based approach to handle these variations. These methods imply robust assumptions about data distribution, with semi-normal, exponential, and truncated normal distributions being commonly used in the literature.

³for a more in-depth discussion see [Gupta and Verhoeven \(2001\)](#)

3.3 Measuring efficiency scores

3.3.1 Parametric analysis of efficiency

We estimate public spending efficiency scores following the methodology of [Kumbhakar et al. \(2015\)](#). The model we use is as follows:

$$y_{it} = \alpha_0 + \beta x_{it} + \alpha_i + v_{it} - u_{it}^+ - \eta_i^+$$

Where, y_{it} represents the logarithm of the output variable. x_{it} denotes the vector of input variables, which have been transformed using the logarithm. While i and t refer to the specific country and time period, respectively. The superscript (+) indicates that the components discussed are non-negative values. Breaking down the components of the error term e_{it} : α_i captures the unique effects associated with each country, reflecting the differences between countries (country heterogeneity). v_{it} accounts for the pure noise term, representing random variations that are independent and distributed identically. u_{it}^+ characterizes the transitory (short-term) technical inefficiency component. η_i^+ represents the persistent (long-term) inefficiency component. Finally, α_0 denotes a constant term.

[Kumbhakar et al. \(2015\)](#) model is used for a particular reason, which is important for this analysis. This model stands out for its ability to handle unobserved heterogeneity between decision units, a feature absent in most commonly used panel models, such as those proposed by ([Battese and Coelli, 1992](#); [Kumbhakar et al., 1991](#); [Lee and Schmidt, 1993](#)). Controlling for unobserved heterogeneity is crucial as it enables the separation of heterogeneity from inefficiency, improving the analysis's accuracy.

We focus on countries with significant differences in economic development, political situations and other relevant factors. Such variables can exert substantial influence over public spending efficiency. Therefore [Kumbhakar et al. \(2015\)](#) model is highly suitable for cross-national panel analysis, effectively considering the heterogeneity.

A notable feature of [Kumbhakar et al. \(2015\)](#) approach is its advanced decomposition of aggregate inefficiency u_{it} into two unique components: short-run inefficiency (time-varying, marked as u_{it}^+) and long-run inefficiency (time-invariant, marked as η_i^+). This approach provides a more comprehensive and adaptable framework on inefficiency, enhancing our comprehension of the elements that lead to inefficiency and its evolution over time. None of the previous models capable of disentangling the uniform effects of heterogeneity (whether fixed or random) and inefficiency can make this fine distinction between short-run and long-run inefficiency. This differentiation proves vital in conducting a thorough examination of public expenditure and the efficiency of governmental strategies.

3.3.2 Public Spending Efficiency indices

In this section, sectoral performance indices for public spending are calculated from a series of social indicators. In fact, increasing the values of the selected socio-economic indicators depends on improving the efficiency of public spending. The performance of indicators used in this study are primarily based on the work of (Afonso et al., 2005; Combes et al., 2023). We distinguish two categories of performance indicators: sectoral indicators, covering education, health, infrastructure, and public administration, and "Musgravian" indicators, which include the traditional functions of government such as allocation, distribution, and stabilization.

The selection of result indicators in this study is guided by both data availability and the insights provided by prior research ⁴. For the education sector, the performance index is composed of three key sub-indicators: the net primary school enrollment rate, the net secondary school enrollment rate, and the expected years of schooling, providing a comprehensive view of educational outcomes. In the health sector, life expectancy at birth and the infant mortality rate (per 1,000 live births) are used as critical indicators of health system performance. Drawing on the methodology of Donaubauer et al. (2016), we construct a performance index for the infrastructure sector by aggregating sub-indices that reflect three crucial dimensions: electricity consumption, access to electricity, and telephone subscriptions.

For public administration, we utilize the framework established by Afonso et al. (2005), constructing a performance index based on three sub-indicators: the quality of property rights, the rule of law index, and the extent of the shadow economy.

In terms of inputs, the study considers sector-specific expenditures: public expenditure on education (as a percentage of GDP) for the education sector, public expenditure on health (as a percentage of GDP) for the health sector, public capital stock (as a percentage of GDP) and public-private partnership stock (as a percentage of GDP) for infrastructure, and final consumption expenditure of public administrations (as a percentage of GDP) for public administration. Additionally, we incorporate Musgravian indicators, which are divided into three critical categories: distribution, stability, and economic performance. Distribution is assessed through the Gini index, providing insight into income inequality. Stability is measured by the standard deviation of the three-year moving average of GDP growth and inflation, reflecting the economic environment's volatility. Economic performance is gauged through GDP per capita, the ten-year average GDP growth rate, and the ten-year average unemployment rate, offering a long-term perspective on economic health. To capture the inputs for these dimensions, total public expenditure (as

⁴(see, for example, Afonso et al., 2005; Herrera and Pang, 2005; Hauner and Kyobe, 2010)

a percentage of GDP) is used for stability and economic performance, while social protection expenditure (as a percentage of GDP) is employed for assessing distribution.

We combine different performance indicators to create a composite performance index for each sector using the method proposed by [Anderson \(2008\)](#), applying generalized least squares estimators. This approach has two major advantages: highly correlated indicators are given less weight, while uncorrelated indicators, which may provide new information, are given more weight. Additionally, the method accounts for variables with missing data by assigning them less weight compared to complete cases, thus maximizing the use of available data.

3.4 Data and Methodology

3.4.1 Data

Our sample includes annual data for the period 2000 to 2019 for 35 developing countries. The choice of this sample of countries is dictated by the availability of data on both dependant and various independent variables. The data used are collected from various sources, mainly from the World Bank: World Development Indicators (WDI), World Governance Indicators (WGI), and set of Varieties of Democracy (V-Dem) Version 10 data. The table 3.7 in the appendix presents the descriptive statistics of the all variables used as well as their sources and definitions and complete list of countries.

4.1.1 Measurement of dependant variable

Following the literature on government spending efficiency ([Gupta and Verhoeven, 2001](#); [Afonso et al., 2005](#); [Hauner and Kyobe, 2010](#); [Combes et al., 2023](#); [Apeti et al., 2024](#)) we use our indice namely Public Spending Efficiency (PSE), for the full sample. This variable is computed using series of social indicators.⁵

4.1.2 Measurement of independant variable

Temperature and rainfall data are collected from the Climatic Research Unit, University of East Anglia (CRU). The CRU compiles comprehensive datasets on temperature and rainfall, drawing from a wide range of sources such as global meteorological stations, satellite observations, and historical climate records ([Osborn et al., 2021](#); [Ashcroft et al., 2018](#); [Osborn et al., 2017](#)). To our knowledge, this is the most complete and longest database for all countries than any other available data source on temperature and rainfall. Temperature is measured in (°C) while rainfall in (mm). After computing the temperature and precipitation variables and creating the climate change index using Stata commands and procedures

⁵(see section 3.3.2 for the detail on PSE indices)

suggested by Schwab et al. (2020).⁶

Following Diallo (2023), we proceed to calculate the 'climate shock' variable, which is determined using a Z-score indicator defined as follows:

$$Z_{ij} = \frac{Climate_{ij} - \overline{Climate_{last5years}}}{SD_{Climate_{last5years}}} \quad (3.1)$$

where: Z_{ij} represents the Z score for country i and year j , $Climate_{ij}$ represents the climate index for country i and year j , $\overline{Climate_{last5years}}$ is the average climate index over the last five years for country i , $SD_{Climate_{last5years}}$ is the standard deviation of climate index over the last five years for country i .

The table 3.7 in the appendix presents the descriptive statistics of variables used.

3.4.2 Methodology

Our objective is to examine the impact of climate change on public spending efficiency and the implications of this impact for countries' fiscal policy.

Climate change has budgetary implications that make its inclusion in national plans and annual budgets necessary within the framework of public climate expenditure.

Our study builds upon current literature in measuring public spending efficiency, while extending this literature through a comprehensive output-based efficiency measure. To estimate the causal impact of climate shocks on public spending efficiency we use a fractional regression model proposed by Papke and Wooldridge (1996). Further, Papke and Wooldridge (1996) argue that their model effectively addresses the limitations inherent in using linear and Tobit models, particularly when dealing with dependent variables defined within the unit interval, irrespective of whether thresholds are observed. They emphasize that this model was specifically developed to handle such variables. Despite this, many studies still employ the Tobit model in the second stage after score estimation using methods like DEA or SFA, which is often inappropriate and has known limitations, as highlighted by Ramalho et al. (2011).

Indeed, as highlighted by Ramalho et al. (2011), Ramalho et al. (2010), and Papke and Wooldridge (1996), the unique characteristics of efficiency scores—specifically their bounded nature and the potential for significant probability mass at the boundaries—make fractional regression models particularly suitable for analysis. These models, estimated using the quasi maximum likelihood (QML) estimator proposed by Papke and Wooldridge (1996), are designed to respect the unit interval constraint of the dependent

⁶This technique involves creating a synthetic index by taking a weighted average of several standardized outcomes. The process begins by standardizing the indicator variables, followed by constructing the inverse covariance matrix for use in the generalized least squares (GLS) weighting procedure. The efficiency of GLS lies in assigning less weight to highly correlated indicators and more weight to uncorrelated ones, which may introduce new information. Additionally, this method allows for index construction even when some indicators have missing data, by setting missing values to zero after normalization.(more detail in the annex.)

variable, thereby addressing the limitations of standard OLS regressions, which fail to constrain predictions within the required bounds.

Indeed, their application relies on a crucial assumption regarding the functional form, which constrains the conditional mean of the dependent variable within the unit interval. This is expressed as:

$$E(y|x) = G(x\omega) \quad (3.2)$$

where $G(\cdot)$ is some nonlinear function satisfying $0 \leq G(\cdot) \leq 1$.

The literature indicates that Equation (2) can be estimated with nonlinear least squares or maximum likelihood estimation (Papke and Wooldridge (1996)). However, neither is more robust than QML because nonlinear least squares is less efficient and maximum likelihood imposes a specification of the conditional distribution of y at x . According to Papke and Wooldridge (1996), the estimation of the FRM is done by QML using the Bernoulli model (log-likelihood function). The equation is as follows:

$$LL_i(\omega) = y_i \log[G(x_i\omega)] + (1 - y_i) \log[1 - G(x_i\omega)] \quad (3.3)$$

where $G(\cdot)$ is a nonlinear function, typically the logistic or probit link, ensuring that $0 \leq G(x_i\omega) \leq 1$.

The QML estimator is obtained by maximizing the log-likelihood function:

$$\hat{\omega} = \arg \max_{\omega} \sum_{i=1}^N LL_i(\omega) \quad (3.4)$$

This estimator is consistent and asymptotically normal, as long as the conditional mean is correctly specified. The asymptotic variance of the QML estimator is given by:

$$\sqrt{N}(\hat{\omega} - \omega_0) \xrightarrow{d} N(0, \xi) \quad (3.5)$$

where $\xi = A^{-1}BA^{-1}$, with $A = E[-\nabla_{\omega\omega'} LL(\omega)]$ and $B = E[\nabla_{\omega} LL(\omega) \nabla_{\omega'} LL(\omega)]$. These expectations are estimated using the observed data, ensuring robust inference even under model misspecifications. This methodology allows for efficient and robust estimation of the impact of climate shocks on public spending efficiency while maintaining the appropriate bounds on predicted values.

3.5 Main results

The estimation results, presented in (Table 3.1), highlight the effects of climate shocks and various economic controls on Public Spending Efficiency (PSE) using both Probit and Logit fractional models. Our findings reveals a consistent and statistically significant negative impact of climate shocks on PSE,

with coefficients of -0.091 in the Probit model and -0.152 in the Logit model, significant at the 1% level. This result aligns with existing literature that examines the impact of climate change on public finances (Melecky and Raddatz, 2011; Lis and Nickel, 2010). It suggests that as climate shocks intensify, public spending efficiency declines, likely due to shifts in economic structure, weather-induced fiscal pressures, and the strain placed on government resources. Limited budgetary capacity during such shocks may force governments to reallocate funds inefficiently, prioritizing immediate needs over long-term investment, thereby reducing overall efficiency.

Regarding control variables, GDP per capita shows a positive and significant effect on PSE, indicating that wealthier countries manage public resources more effectively, consistent with existing literature (Afonso et al., 2010b; Wong, 2020). The negative impact of agricultural value-added on PSE suggests that economies heavily dependent on agriculture are more susceptible to climate shocks, leading to frequent reallocations of resources and inefficiencies in public spending (Imam and Kpodar, 2022). Public aid, while positive, is not statistically significant, implying that external funding alone does not necessarily improve PSE. This may be attributed to issues such as corruption and mismanagement, particularly in developing countries, as noted by Niyonkuru (2016). Conversely, Foreign Direct Investment (FDI) positively influences PSE, supporting findings by Borensztein et al. (1998) that FDI enhances efficiency by introducing capital, technology, and expertise. The positive effects of trade openness suggest that greater integration into the global economy strengthens economic growth, a view supported by Singh (2010).

Overall, countries with strong economic structures and external investments are better positioned to manage public resources efficiently, even amidst climate-related challenges.

Table 3.1: Baseline result of Climate shocks impact on Public Spending Efficiency

Panel A (PSE) without controls	Fractional Model	
	Probit	Logit
Lag Climate shocks (log)	-0.091*** (0.0136)	-0.152*** (0.0230)
Constant	0.0822 (0.117)	0.122 (0.188)
Time fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observations	665	665
Panel B with controls	PSE	PSE
Lag Climate shocks (log)	-0.0652*** (0.0154)	-0.108*** (0.0260)
log GDP per capita	0.877*** (0.193)	1.431*** (0.320)
Agriculture	-0.0211*** (0.00631)	-0.0352*** (0.0104)
log Public Aid	0.0278 (0.0250)	0.0461 (0.0410)
Foreign Direct Investment	0.0113*** (0.00328)	0.0187*** (0.00540)
Lag Trade Openness	0.00313** (0.00146)	0.00504** (0.00243)
Constant	-7.813*** (1.783)	-12.75*** (2.953)
Time fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observations	605	605
This table reports estimates of the impact of Climate shocks on PSE. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

3.6 Robustness checks

In this section, we undertake a series of robustness checks including, an alternative estimation employing Beta regression approach, adding more control variables, and exploring heterogeneity across countries, using rainfall and temperature shocks.

3.6.1 Alternative estimation

The table 3.2 presents the results of the Beta Regression model used to examine the impact of climate shocks on Public Spending Efficiency (PSE). Beta regression, introduced by [Ferrari and Cribari-Neto \(2004\)](#), is specifically designed to model dependent variables that are continuous and constrained within the standard unit interval (0,1). This model is particularly advantageous when dealing with variables that violate the normality assumption, offering a flexible and robust alternative. The beta distribution, denoted $B(\mu, \phi)$, allows the shape of the distribution to vary based on the mean (μ) and the precision parameter (ϕ), effectively accommodating asymmetry. In beta regression, various link functions, such as

logit, probit, and log-log, map the linear predictor to the unit interval, with the logit link being the most commonly used. This approach is highly suitable for scenarios where traditional regression models may fall short, particularly when dealing with bounded data.

Table 3.2: Climate shocks impact on PSE using Beta regression

Dependent Variables (PSE)	Fractional logit regression	Beta regression model
	PSE	PSE
Lag Climate shocks (log)	-0.108*** (0.0260)	-0.108*** (0.0195)
log GDP per capita	1.431*** (0.320)	1.430*** (0.235)
Agriculture	-0.0352*** (0.0104)	-0.0354*** (0.00771)
log Public Aid	0.0461 (0.0410)	0.0456 (0.0376)
Foreign Direct Investment	0.0187*** (0.00540)	0.0179*** (0.00566)
Lag Trade Openness	0.00504** (0.00243)	0.00509** (0.00211)
Constant	-12.75*** (2.953)	-12.71*** (2.138)
Time fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observations	605	605
Standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

3.6.2 Additional controls

The table (3.3) presents the results of additional controls incorporated into the analysis of the impact of climate shocks on Public Spending Efficiency (PSE). Panel A introduces variables such as age dependency, natural rent, and public debt, showing that climate shocks consistently exert a significant negative impact on PSE across all models. In Panel B, institutional variables like government effectiveness and control of corruption are included, both of which positively impact PSE. This suggests that stronger institutions can help mitigate some of the negative effects of climate shocks on public spending efficiency. The amplitude of the coefficients indicates the varying strength of these relationships across different models, with institutional factors showing a notable ability to counterbalance adverse climate impacts ([Javaid et al., 2022](#); [Danish and Ulucak, 2020](#)).

Table 3.3: Results of additional controls and Institutional variables

	(1)	(2)	(3)
Panel A (PSE)	Adding Variables		
Lag Climate shocks (log)	-0.102*** (0.0263)	-0.0973*** (0.0261)	-0.0934*** (0.0267)
Age dependency	-0.0959*** (0.0271)	-0.107*** (0.0267)	-0.121*** (0.0273)
Natural Rent		0.0157** (0.00751)	0.0202*** (0.00781)
Public Debt			-0.0457** (0.0204)
Constant	-13.46*** (2.973)	-12.97*** (3.033)	-10.32*** (3.232)
Observations	606	606	546
	Institutional variables		
Panel B	Government Effectiveness		Control of Corruption
Lag Climate shocks (log)	-0.0780*** (0.0274)		-0.0806*** (0.0277)
Government Effectiveness	0.367*** (0.138)		
Control of Corruption			0.336** (0.138)
Constant	-9.504*** (3.588)		-10.07*** (3.661)
Observations	518		518

All Specifications include the variables of the baseline model. Robust Standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.6.3 Heterogeneity

We investigate whether the impact of climate shocks on public spending efficiency is different across countries and income groups as climate challenges may be also different across these groups. The table (3.4) presents the heterogeneous effects of climate shocks on Public Spending Efficiency (PSE) by separating the impacts of rainfall shocks and temperature shocks. The results indicate that both types of shocks have a significant negative effect on PSE.

Table 3.4: Heterogeneity impacts of rainfall and temperature shocks on PSE

	Rainfall shocks	Temperature shocks
Public Spending Efficiency (PSE)		
lag rainfall shocks	-0.000191** (9.70e-05)	
lag temperature shocks		-0.178** (0.0873)
Constant	-15.27*** (2.661)	-13.37*** (2.803)
Baseline Control	Yes	Yes
Time fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observations	605	605

All Specifications include the variables of the baseline model and Robust Standard errors in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The table (3.5) provides an analysis of the impact of climate shocks on PSE across two regions: Sub-Saharan Africa; Latin America and the Caribbean. The results indicate that climate shocks significantly reduce PSE in both regions, with coefficients of -0.0990 for Sub-Saharan Africa and -0.117 for Latin America and the Caribbean, both significant at the 1% level. The negative impact suggests that climate shocks substantially undermine public spending efficiency, likely due to the region's vulnerability to environmental changes and weaker institutional frameworks.

The findings underscore the need for region-specific strategies to enhance resilience against climate-related disruptions. While both regions are significantly affected, the slightly larger impact in Latin America and the Caribbean suggests a need for more robust policies to manage the fiscal challenges posed by climate variability. This region is increasingly facing severe climate events ⁷ such as hurricanes, floods, and droughts, which profoundly impact public infrastructure and economic activities.

Table 3.5: Climate shocks and PSE - Heterogeneity across region

	Sub-Saharan Africa	Latin America and Caribbean
Public Spending Efficiency (PSE)	PSE	PSE
Lag Climate shocks (log)	-0.0990*** (0.0298)	-0.117*** (0.0409)
Baseline Control	Yes	Yes
Time fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observations	391	214

Note: This table reports estimates of the impact of Climate shocks on Public Spending Efficiency. All specifications include the variables of the baseline and Robust Standard errors in parentheses. All regressions include the constant, not reported. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

⁷The UNDP (2022) report highlights that the region has experienced a significant increase in extreme weather events over recent decades, with 10 LAC countries being among the 25 most vulnerable globally to climate risks

3.6.4 Transmission channels

The objective of this subsection is to identify and assess the transmission channels linking climate change and public spending efficiency (PSE). We adopt a simultaneous equation modeling approach, drawing from methodologies employed by (Ekoula et al., 2023; Alassani, 2023). The modeling process is depicted in Figure 1. This approach involves estimating regression as follows:

$$\text{Med}_{it} = \alpha_1 + b_1 \text{CCI}_{it} + c'_1 X_{it} + u_{it} \quad (3.6)$$

$$\text{PSE}_{it} = \alpha_2 + b_2 \text{CCI}_{it} + b_3 \text{Med}_{it} + c'_1 X_{it} + u_{it} \quad (3.7)$$

Where, Med_{it} represents the mediation variables, specifically inflation and GDP growth. CCI_{it} is the climate change index; X_{it} are control variables; b_1 , b_2 , and b_3 are coefficients to be estimated; and u_{it} is the error term.

Our analysis identifies three effects: (i) Direct Effect: Captured by b_2 . (ii) Indirect Effect: Calculated as $b_1 \times b_3$. (iii) Total Effect: The sum of the direct and indirect effects, $b_2 + (b_1 \times b_3)$.

Climate shocks can lead to higher inflation, as observed by Iliyasu et al. (2023). This inflation erodes the real value of public spending, forcing governments to either cut spending or reallocate funds inefficiently. Additionally, high inflation creates economic uncertainty, complicating government planning and reducing public spending efficiency (PSE). These shocks also significantly hinder GDP growth. Gallup et al. (1999) and Nordhaus (2006) find that higher temperatures result in notable reductions in economic growth in developing countries. Burke et al. (2015) demonstrate that countries in hotter climates suffer greater damage from rising temperatures, leading to infrastructure damage, reduced agricultural productivity, and discouraged investment. Slower GDP growth reduces government revenue while increasing demand for public services, further straining public finances and reducing PSE.

The results, presented in Table 3.6, show the estimates for Model (1) using inflation and GDP growth as mediators (Columns [1a]-[2a]), and for Model (2) using these mediators as controls (Columns [1b]-[2b]). We find that, Climate Shocks significantly affects both mediators, with effects statistically significant at the 1% level (Columns [1a]-[2a]). Both mediators significantly impact PSE (Columns [1b]-[2b]). Climate Shocks has a significant effect on PSE even in the absence of mediators (Column [3]). The coefficient of the Climate Shocks on PSE decreases when a mediator is included in the model (Columns [1b]-[2b] compared to Column [4]). Finally, mediation effects are confirmed through several tests, showing that the

indirect effect of Climate Shocks on PSE through inflation and GDP growth is statistically significant. For instance, mediation through inflation accounts for a substantial portion of the total effect of climate change on PSE, highlighting the role of economic instability and price fluctuations as critical pathways through which climate change influences public spending efficiency.

Figure 3.1: Transmission Mechanisms Linking Climate shocks and Public Spending Efficiency

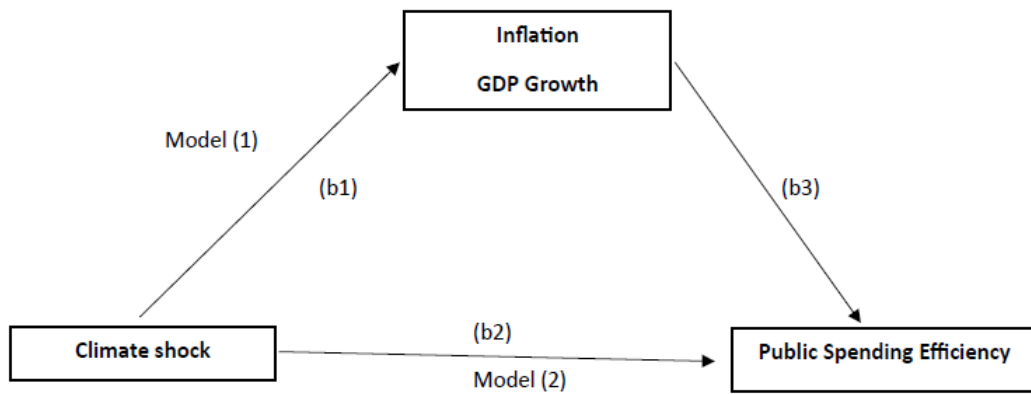


Table 3.6: Results of transmission mechanisms analysis

VARIABLES	(i) Mediator: Inflation			(ii) Mediator: GDP Growth		
	(1a) Inflation	(1b) PSE		(2a) GDP Growth	(2b) PSE	
Lag Climate shocks (log)	0.290*** (0.0967)	-0.00667*** (0.000947)		-0.144* (0.0830)	-0.0104*** (0.00180)	
Inflation		-0.0107*** (0.00221)				
GDP Growth					0.0177*** (0.000878)	
Constant	13.53*** (3.680)	0.882*** (0.0844)		2.359 (3.128)	0.687*** (0.0675)	
Baseline control variables	Yes	Yes		Yes	Yes	
Bootstrap replications	500	500		500	500	
Observations	573	573		605	605	
	Mediating the effect of Inflation			Mediating the effect of GDP Growth		
	Coeff	Std. error	P-value	Coeff	Std. error	P-value
(A) Mediation tests						
Delta	-0.034	0.012	0.005	-0.044	0.025	0.080
Sobel	-0.034	0.012	0.005	-0.044	0.025	0.082
Monte Carlo	-0.034	0.012	0.005	-0.045	0.025	0.072
(A) Composition of the effect						
Indirect effect (Sobel)	0.034			0.044		
Direct effect	0.190			0.179		
Total effect	0.225			0.223		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.7 Conclusion

Climate change is undeniably the defining challenge of our era, particularly for developing countries already grappling with resource constraints. Our paper investigates the causal impact of climate shocks on Public Spending Efficiency (PSE) in a sample of 35 developing countries over the period 2000-2019. Our findings reveal a significant negative impact of climate shocks on PSE. This result remains robust across alternative methods and when exploring heterogeneity. Importantly, this impact is mitigated by strong institutional frameworks. We also identify two transmission channels of this impact as inflation and GDP growth. Inflation erodes the real value of public spending, leading to inefficient resource allocation, while slower GDP growth strains government revenues and increases demand for public services.

To ensure the long-term sustainability of development efforts, it is crucial to: (i) Strengthen Economic Resilience: Governments should prioritize building economic resilience to climate shocks by diversifying their economies and investing in climate-resilient infrastructure. (ii) Implement Inflation Control Mechanisms: Effective monetary policies and price controls are essential to stabilize inflation, protect the real value of public spending, and prevent inefficient resource allocation. (iii) Enhance Climate Adaptation Strategies: Developing countries must bolster their capacity for climate adaptation and mitigation through improved governance and public sector efficiency. Given the disproportionate impact of climate shocks on developing countries, there is an urgent need to incorporate climate resilience into public finance management strategies, supported by increased international cooperation and assistance.

3.8 Appendix

Table 3.7: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Public Spending Efficiency	700	0.658	0.119	0.125	0.913
Climate Shocks	700	1.324	1.938	0	26.074
GDP per Capita	700	4186.547	4533.984	255.1	18729.59
Agriculture	691	16.752	13.369	1.183	60.61
Aid	687	5.461	6.766	-0.251	40.41
Foreign Direct Investment	700	3.628	3.987	-4.846	46.275
Trade Openness	668	63.734	27.78	20.964	206.767
Temperature	700	23.673	4.574	8.86	29.75
Rainfall	700	1262.097	745.795	148.05	3614.63
Government Effectiveness	665	-0.358	0.706	-1.849	1.572
Control of Corruption	665	-0.308	0.73	-1.523	1.725

Table 3.8: Sources of variables for the calculation of efficiency scores

Variables	Sources	Nature
1. Public expenditure (inputs)		
Education expenditure (% GDP)	World Development Indicators (WDI)	Continuous
Health expenditure (% GDP)	World Development Indicators (WDI)	Continuous
Infrastructure expenditure (% GDP)	World Development Indicators (WDI)	Continuous
Government final consumption (% GDP)	World Economic Outlook (WEO)	Continuous
2. Sectoral performance indices (outcomes)		
Health index		
Mortality rate	World Development Indicators (WDI)	Continuous
Life expectancy at birth	World Development Indicators (WDI)	Continuous
Education index		
Expected years of schooling	World Development Indicators (WDI)	Continuous
Net enrollment rate in primary education	World Development Indicators (WDI)	Continuous
Net enrollment rate in secondary education	World Development Indicators (WDI)	Continuous
Infrastructure index		
Electricity consumption per capita	World Development Indicators (WDI)	Continuous
Access to electricity	World Development Indicators (WDI)	Continuous
Telecommunications subscriptions	World Development Indicators (WDI)	Continuous
Public administration index		
Property rights	V-Dem Database	Continuous
Rule of law	V-Dem Database	Continuous
Informal sector	Elgin, C., et al. (2021)	Continuous
Stability		
Moving average of inflation (3-year)	Authors' calculations from WDI	Continuous
Moving average of GDP growth rate (3-year)	Authors' calculations from WDI	Continuous
Distribution		
Gini index	Standardized World Income Inequality Database (SWIID)	Continuous
Economic performance		
GDP per capita	World Development Indicators (WDI)	Continuous
GDP growth rate	World Development Indicators (WDI)	Continuous
Unemployment rate	World Development Indicators (WDI)	Continuous

Table 3.9: Climate shocks and public expenditure efficiency : sources of variables

Variables	Sources	Nature
Public Sector Efficiency	Authors, from data in Table 3.8	Scores ranging from 0 to 1
climate data	Authors calcul from CRU University of East Anglia	Continuous
Temperature	CRU University of East Anglia	Continuous
Rainfaill	CRU University of East Anglia	Continuous
Log of GDP per capita	WDI	Continuous
Agriculture Value Added	WDI	Continuous
International Aid	WDI	Continuous
Foreign direct investment (FDI)	WDI	Continuous
Trade openness	WDI	Continuous
Dependency ratio	WDI	Continuous
Natural resource rents	WDI	Continuous
Public debt	WDI	Continuous
Inflation	WDI	Continuous
Control of corruption	World Government Indicators	Continuous
Government effectiveness	World Government Indicators	Continuous

Chapter 4

Chapter 4

Fiscal Discipline and Development Outcomes: Empirical Evidence from Fiscal Rules

Co-written with Kodjovi M. Eklou

“Fiscal discipline is not just about keeping budgets balanced; it’s about laying the groundwork for sustainable development and ensuring that future generations inherit a stable and prosperous society.”

— International Monetary Fund, Fiscal Rules at a Glance (2017)

4.1 Introduction

Over the past few decades, fiscal policy has been recognized as a powerful tool to finance long-term development. However, the ability to finance priority social and infrastructure spending, critical for development is often significantly constrained by challenges to raise domestic revenues in many developing countries ¹. In addition, low revenues are often compensated by large debt accumulation, which can limit fiscal space and further constrain the ability to finance development spending. Further, political economy forces, notably public spending for the purpose of reelection ([Schuknecht, 2004](#); [Block, 2002](#)) could divert limited resources from critical development needs in these developing countries.

¹Tax effort is still low in developing countries compared to its potential [Gaspar et al. \(2016\)](#); [Mullins et al. \(2020\)](#)

In this paper we explore whether fiscal rules, by strengthening fiscal discipline (Tapsoba, 2012; Eklou and Joanis, 2019) could improve development outcomes in developing countries. We focus on key areas such as infrastructures, education, and health. Indeed, in developing countries, challenges remain in achieving key development outcomes such as infant mortality, school enrollment, and access to electricity. According to UNICEF (2023), the global under-five mortality rate has decreased by 51 percent since 2000, yet millions of children still die each year before their fifth birthday². Regarding school enrollment rates, significant disparities exist. While there has been progress, many developing countries still struggle to provide universal access to education³. Infrastructure gaps also remain large as the World Bank highlights that nearly 770 million people worldwide lacked access to electricity in 2019, with the majority residing in sub-Saharan Africa. This lack of access to reliable electricity, critical for education and healthcare services, hampers economic growth (Chen et al., 2023; Best and Burke, 2018).

We investigate the causal impact of fiscal rules on development outcomes in a sample of 110 countries over the period 1990-2019. Our empirical strategy relies on entropy balancing Hainmueller (2012) and instrumental variable approaches to identify the causal impact of fiscal rules. Indeed, estimating the causal impact of fiscal rules is challenging given endogeneity issues related to selection bias or reverse causality and omission of potential unobserved confounding factors. In our instrumental variable strategy, we exploit the spatial correlation in fiscal rules adoption as an instrument based on an argument of geographic diffusion of fiscal reforms (Cornia et al., 2011; Eklou and Joanis, 2019). We find that developing countries with fiscal rules have better development outcomes in education, health and infrastructure as measured by school enrollment, infant mortality, and access to electricity, respectively. Further, we uncover two dimensions of heterogeneity regarding the impact of fiscal rules on development outcomes. First, this impact is larger for low-income countries where the potential for improvement is also greater compared to emerging market economies. Second, we show that expenditure rules have larger impact on development outcomes compared to debt rules (DR) and balanced budget rules (BBR). In addition, DR and DBR seem to be relevant mainly for long-term outcomes such as infant mortality and access to electricity (infrastructure) which could reflect the fact that these rules may be more binding in the longer-term compared to ER. Finally, we provide evidence suggesting that fiscal rules contribute to improve development outcomes by enhancing public expenditure efficiency and fostering macroeconomic stability.

This paper is the first to the best of our knowledge to investigate the impact of fiscal discipline

²In 2022, approximately 4.9 million children under the age of five died, with sub-Saharan Africa and Southern Asia bearing the highest burden (UNICEF, 2023). Specifically, sub-Saharan Africa had a neonatal mortality rate of 27 deaths per 1,000 live births, the highest in the world (WHO, 2023).

³For instance, UNESCO reports that as of 2020, over 258 million children, adolescents, and youth were out of school globally, with the majority in sub-Saharan Africa and South Asia.

through the adoption of fiscal rules on development outcomes. Our findings suggest that while domestic resource mobilization is a centerpiece to finance sustainable development, fiscal discipline in managing these often-limited resources could be critical. Indeed, as discussed earlier, in many developing countries, a sizeable part of discretionary fiscal policy is driven by political economy considerations such as reelections [Schuknecht \(2000\)](#) and [Block \(2002\)](#) which signals a divergence between political incentives and social welfare maximization. More specifically, our findings suggest that expenditure rules, when well enforced could enhance better allocation of resources to finance critical development needs in infrastructures, health and education. This finding is consistent with previous evidence showing that expenditure rules have high compliance rate, enhance fiscal discipline and, improve both spending control and public investment efficiency ([Cordes et al. \(2015\)](#)).

The paper is related to different strands of literature on the impact of fiscal rules. First, the literature on the the role of fiscal rules in shifting public spending towards productive areas such as infrastructure, thereby crowding in private investment ([Chauvet and Ferry, 2021](#); [Ardanaz et al., 2021](#); [Vinturis, 2022](#)). Second, the literature showing that fiscal rules can enhance public expenditure and public investment efficiency ([Cordes et al., 2015](#); [Apeti et al., 2023](#)) and the role of fiscal rules in mitigating macroeconomic volatility and fostering economic growth ([Fatás and Mihov, 2003, 2006](#); [Combes et al., 2018](#)).

The rest of the paper is organized as follows. Section II presents the data and provides an overview of stylized facts and the trends in fiscal rules adoption across countries. Section III is dedicated to our empirical strategy to test the potential causal impact of fiscal rules on development outcomes. Section IV is focused on presenting the various results including sensitivity checks and heterogeneity analyses. Section V presents discussions on channels of transmission. Finally, Section VI concludes and draws some policy implications.

4.2 Data and Stylized Fact

4.2.1 Data

Our sample includes annual data for the period 1990 to 2019 for 110 developing countries, of which 51 have implemented fiscal rules. The choice of this sample of countries is dictated by the availability of data on both dependent and various independent variables. The data used are collected from various sources mainly the IMF, World Bank (World Development Indicators) and from the Worldwide Governance Indicators database [Kaufmann et al. \(2011\)](#).

Fiscal rules

Our treatment variable, fiscal rules (FR), is measured by a dummy variable that takes the value 1 in

the year a country has adopted a fiscal rule, and zero otherwise. This variable is from the IMF's Fiscal Rules Dataset. Fiscal rules in our database include Balanced Budget Rules (BBR), Debt Rules (DR), Expenditure Rules (ER), and Revenue Rules (RR). As of 2019, the database shows that balanced budget and debt rules are the most adopted (about 42 countries). expenditure rules are present in 16 countries, and revenue rules in 10 countries. Figure 1 below details the evolution and typology of fiscal rules across the sample. Table xx in the appendix presents the descriptive statistics of variables used as well as their sources and definitions along with a complete list of countries.

Development Outcomes

Our measures of development outcomes cover key sectors such as infrastructure, health and education. We use variables such as infant mortality rate (per 1,000 live births), school enrollment secondary (gross enrollment ratio), and access to electricity (% of population) as indicators of development outcomes. There is a large literature showing that access to electricity is a critical determinant of economic development and quality of life [Calderon and Servén \(2004\)](#) and [World Bank, 2019](#). Similarly, school enrollment rate, particularly at the secondary level, is a key measure of educational attainment and has been found to foster long-term economic growth ([Hanushek and Woessmann \(2012\)](#)). Additionally, [Gupta et al. \(2002\)](#) highlight that infant mortality rates are direct measures of public health outcomes and key indicators of child health. Our focus on these key measures allows us to investigate the long-term effect of fiscal institutions such as fiscal rules.

Other control variables

Following the existing literature ([Afonso and Jalles, 2019](#); [Eklou and Joanis, 2019](#); [Apeti et al., 2023](#); [Combes et al., 2024](#)), we include a set of economic and institutional covariates considered as determinants of fiscal rule adoption and potentially correlated to the outcome variable, such as GDP per capita growth, total expenditure, financial openness, inflation, Debt ratio, and the quality of institutions (captured by democratic accountability and law and order) to control for potential confounders .Indeed, better economic performance, as proxied by GDP per capita growth and inflation, could influence the likelihood of fiscal rule (FR) adoption ([Debrun and Kumar, 2009](#)). Further, some countries adopt fiscal rules as part of broader economic reforms that include financial liberalization [Tapsoba \(2012\)](#) and thus, financial openness is included among controls. Next, we control for indicators of fiscal policy and fiscal position for potential reverse causality by including public expenditure and debt level.

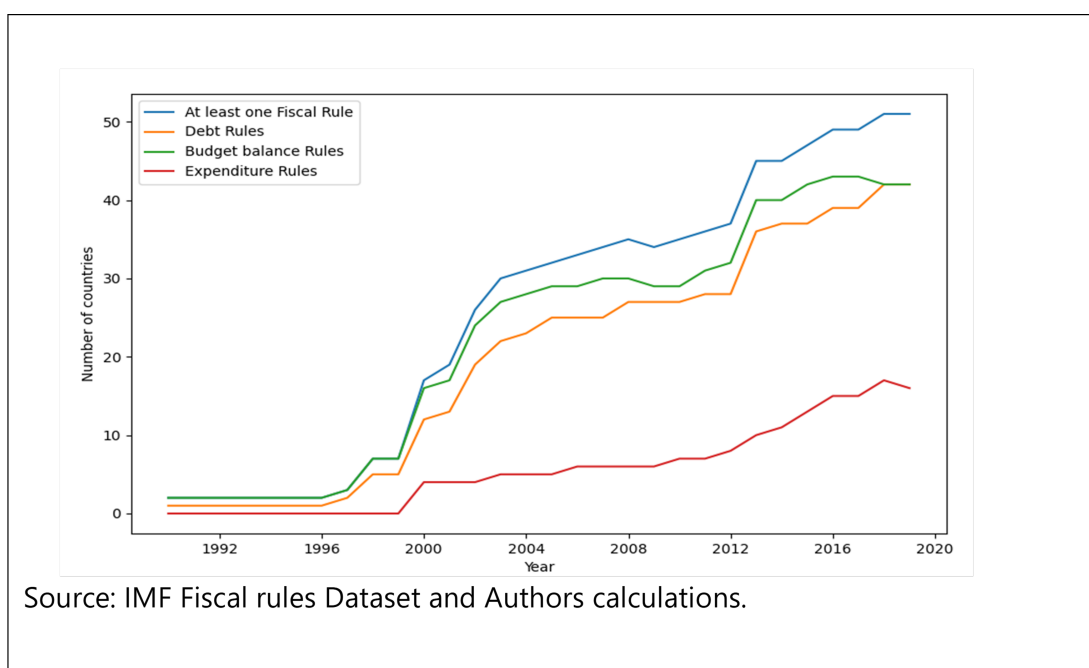
The overall institutional context in which fiscal rules are implemented could be important for these rules to deliver the desired outcomes, while at the same time the quality of institutions could be an

important determinant of long-term development outcomes. For instance, the quality of the institutional framework could enhance transparency in the budgetary process and shape the effectiveness of fiscal rules by promoting effective allocation of resources and better-targeted public spending. To control for the institutional framework, we include democratic accountability and control of corruption. Democratic accountability refers to the degree to which a government is responsive to its citizens and accountable for its actions while control of corruption captures whether public resources are managed transparently and responsibly.

4.3 Stylized Facts

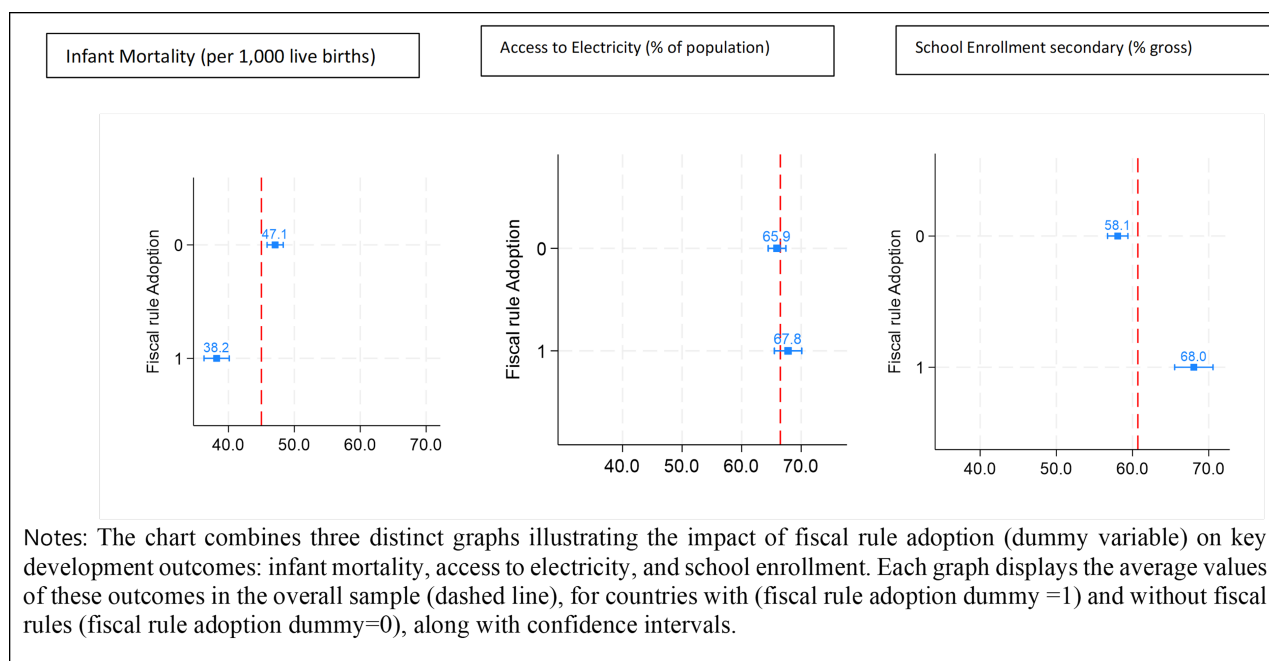
Figure 4.1 below shows the number of countries implementing various types of fiscal rules over nearly three decades in the sample. There has been a notable rise in the number of countries that have adopted fiscal rules. Beginning with fewer than 10 countries in 1990, the number increased significantly, reaching over 51 by 2019. Balanced Budget Rules, designed to ensure that governments do not spend more than they collect in revenue over a specific period, have seen the most significant adoption. The adoption of debt rules, which set limits on the public debt, helping to ensure fiscal sustainability has also increased. Expenditure rules, which limit the growth of government spending, have been adopted largely by 2019.

Figure 4.1: Trend in Fiscal Rules Adoption in the Sample



Next, we illustrate the average effect of adopting fiscal rules (FR) on key development outcomes, such as infant mortality rates, access to electricity, and school enrollment rates in Figure 4.2 below⁴. It reveals that the average infant mortality rate is lower by 8.9 percentage points in countries with fiscal rules compared to countries with no rules. Regarding the access to electricity, while it is slightly higher in countries with fiscal rules, the difference is not statistically significant. Finally, the average school enrollment rate is markedly higher in countries with fiscal rules, with a statistically significant mean difference, indicating a positive correlation of fiscal rules adoption with school enrollment rates.

Figure 4.2: Average Effect of Fiscal Rules on Development Outcomes



Overall, the adoption of fiscal rules appears to be associated with positive development outcomes in key areas such as health, infrastructure, and education. However, it is worth noting that these findings represent correlations rather than causations. The observed relationships from the graphical analysis could be driven by potential omitted variables, reverse causality between fiscal rules and development outcomes. To address these potential biases and further explore the causal impact of fiscal rules, we will conduct a detailed econometric analysis in the next section.

⁴Figure 4.4 in Appendix shows similar pattern for a different measure of education, capturing the quality of education (learning adjusted years of education).

4.4 Empirical Strategy

To investigate the potential role of fiscal rules in improving development outcomes, we use two empirical strategies including entropy balancing approach, instrumental variables, and synthetic control approach. The identification of the impact of fiscal rules adoption is challenging because of potential reverse causality from development outcomes. Indeed, it is plausible that countries with better development outcomes may be more likely to adopt fiscal rules, rather than fiscal rules directly causing these improved outcomes. Additionally, other (unobserved or omitted) factors that influence development outcomes and potentially correlated with fiscal rules could lead to biased estimates. The adoption of fiscal rules is influenced by both economic conditions and institutional frameworks and therefore is not an exogenous process. Consistently, the potential endogeneity of fiscal rules — given the interdependencies between the latter and fiscal policy — must be seriously considered, otherwise estimates would be biased [Heinemann et al. \(2018\)](#).

4.4.1 Entropy Balancing Approach

Our first empirical approach to deal with the endogeneity of the adoption of fiscal rules is the entropy balancing, developed by [Hainmueller \(2012\)](#). This program evaluation methodology which consists in estimating the average treatment effect on the treated (ATT), defined as follows:

$$ATT = \mathbb{E}[Y_{c1} | FR_c = 1] - \mathbb{E}[Y_{c0} | FR_c = 1] \quad (1)$$

Where FR_c is the fiscal rule dummy, which takes the value 1 if a country c has adopted a fiscal rule in year t , and zero otherwise. Y_{c0} represents the outcome for the untreated unit (country without fiscal rules or $FR_c = 0$) and Y_{c1} is the outcome associated with $FR_c = 1$ (treated observation). The treatment effect is therefore the difference in development outcomes (access to electricity, school enrollment, and infant mortality) between the situation due to the adoption of a fiscal rule and the situation without adoption.

This approach, however, suffers from a counterfactual problem since, for a country that adopted fiscal rules, a given development outcome in a scenario without the adoption of rules cannot be observed. To address this issue, we adopt a counterfactual framework exploiting untreated observations, which represent a potential good control group for countries that adopted fiscal rules (treated units). Since the treatment assignment is not random, a simple difference in the outcome between the treated units and the control group would pollute the estimates owing to potential selection bias discussed above.

We use the matching approach, which consists of reproducing a situation close to a context where units are randomly assigned to the treatment, which is the adoption of fiscal rules. More specifically, countries with fiscal rules are matched with countries without fiscal rules based on similar pre-fiscal rule adoption observable characteristics. The new ATT resulting from the matching process can be formalized as follows:

$$ATT(\chi) = \mathbb{E}[Y_{c1} \mid FR_c = 1, X = \chi] - \mathbb{E}[Y_{c0} \mid FR_c = 0, X = \chi] \quad (2)$$

Where χ is a set of pre-fiscal rules adoption covariates, correlated with the adoption of fiscal rules and potentially with the outcome variable (access to electricity, school enrollment, and infant mortality). $\mathbb{E}[Y_{c1} \mid FR_c = 1, X = \chi]$ is the expected outcome for countries with fiscal rules, and $\mathbb{E}[Y_{c0} \mid FR_c = 0, X = \chi]$ is the expected outcome for their best counterfactuals.

Entropy Balancing Approach

The entropy balancing approach consists of a two-step estimation. In the first step, we calculate and apply weights to untreated units (countries with no fiscal rules) so that the mean of the pre-treatment variables in the control group is not statistically different from their mean in the treated group [Neuenkirch and Neumeier \(2016\)](#). This step creates a synthetic control group, unexposed to treatment, but with observable pre-treatment characteristics close to the treated group. In the second step, we run a regression of development outcomes on the fiscal rule dummy, where observations are weighted based on the weights derived from the entropy balancing. These weights ensure that the control group (countries with no fiscal rules), after weighting, closely resembles the treatment group (countries with fiscal rules) in terms of their characteristics before the adoption of fiscal rules.

The entropy balancing approach has several advantages. First, unlike propensity score matching or difference-in-difference estimators, entropy balancing is a non-parametric approach, thus requiring no specification of the functional form of the empirical model or of the treatment assignment procedure, making the approach robust to misspecifications. Second, the weight system orthogonalizes the covariates with respect to the treatment, which limits multicollinearity issues. Third, the method ensures a suitable balance of pre-treatment characteristics between the treatment and control groups, even in the presence of a small sample or a limited number of untreated units. This allows the construction of an appropriate control group, representing a near-perfect counterfactual of the treated one. Finally, in the second step, the estimator exploits the panel structure of data by including individual and time effects to control for unobserved heterogeneity. [Tübbicke \(2022\)](#) and [Zhao and Percival \(2017\)](#) demonstrate

that entropy balancing offers a doubly robust approach in causal inference. Specifically, they highlight that when both the outcome model (linear regression) and the propensity score model (logistic regression) are correctly specified, entropy balancing achieves the asymptotic semi-parametric variance bound, making it an efficient estimator. This means that even if one of these models is misspecified, entropy balancing can still yield unbiased estimates. Consequently, they argue that entropy balancing provides a compelling alternative to traditional weighting estimators, which typically estimate the propensity score using maximum likelihood.

4.4.2 Instrumental Variable Approach

To estimate causal effects of fiscal rules, [Debrun and Kumar \(2007\)](#) and [Gootjes et al. \(2021\)](#) used lagged fiscal rules as instruments. However, the use of lagged variables as instruments is subject to several limitations and criticisms, including weak identification. Other approaches consist of using the geographical pattern in the adoption of fiscal rules, using the number of other countries in a given sub-region that have fiscal rules in place to predict the probability of adopting rules in other countries (see [Eklou and Joanis \(2019\)](#)). Recently, [Duncan and Sabirianova Peter \(2016\)](#) used the spatial correlation based on the contiguity matrix of tax rates across neighboring countries to instrument their measure of structural tax progressivity.

We follow the approach in [Duncan and Sabirianova Peter \(2016\)](#) and exploit the spatial correlation in fiscal rules as an instrument in our identification strategy. While the contiguity matrix is useful for analyzing specific geographical contexts, we use the geographic distance weighting matrix, which provides a continuous measure of the geographical separation between units and allows us to capture spatial relationships more precisely. This also enables the inclusion of fine variations in economic or social interactions. The rationale for using a geographic distance weighting matrix lies in the observation that proximity between countries may influence the adoption of domestic reforms, including fiscal rules (see for instance [Eklou and Joanis \(2019\)](#)). Peer pressure ([Caselli and Reynaud, 2020](#); [Buera et al., 2011](#); [Giuliano et al., 2013](#); [Ardanaz et al., 2021](#)) or imitation of neighboring countries to signal credibility to international markets [Balvir \(2024\)](#) are plausible mechanisms through which reforms in neighboring countries can influence domestic policy decisions. Further, [Cornia et al. \(2011\)](#) highlight the importance of fiscal policy design spillovers across countries. This is consistent with the first law of geography: “Everything is related to everything else, but things close together are more related than things far apart” [Tobler \(1970\)](#), which explains the wide use of inverse geographical distance in spatial econometrics to measure connectivity.

We estimate spatial correlation in fiscal rules, employing standard spatial econometrics techniques. Algebraically, after normalization, the weights w_{ij} of the geographical distance weighting matrix are given

as follows:

$$w_{i,j} = \begin{cases} \frac{1/d_{ij}}{\sum_j 1/d_{ij}}, & \text{for } i \neq j \\ 0, & \text{for } i = j \end{cases} \quad (4.1)$$

Where d_{ij} is the Euclidean distance between the capital of country i and that of country j . The spatial correlation obtained is used as an instrument given that it captures the influence of neighboring countries' adoption of fiscal rules, assuming that the closer countries are to each other, the stronger this influence⁵. We therefore exploit an exogenous source of variation in fiscal rule adoption based on geographical proximity. That is, while fiscal rule adoption at the country level is endogenous, neighboring countries' adoption should be plausibly exogenous from a given country's perspective⁶.

4.5 Results

4.5.1 Baseline Findings: Entropy Balancing Approach

Table 4.1 reports Descriptive statistics and covariate balancing related to the first step of entropy balancing discussed above. Panel A presents a comparison of the pre-weighting sample means for matching covariates between units with fiscal rules (column [2]) and control units (column [1]). Column [5] indicates statistically significant differences between fiscal rules and control units, as some p-values are below the 10 percent threshold. These differences could lead to selection bias in the adoption of fiscal rules, resulting in spurious estimates if endogeneity is not properly addressed. To address potential selection bias, the control units are reweighted to make the pretreatment covariates of the control group as comparable as possible to those of the treated units. The means of the covariates for the synthetic group are reported in column [1] of Panel B. Column [5] reveals that the reweighting eliminated any statistically significant pre-treatment differences between the means of the treated and synthetic covariates. Thus, the synthetic group can be viewed as a "near perfect" counterfactual of the treated group, thereby eliminating potential selection problems due to the adoption of fiscal rules. With this result, we then run equation 1 using the weights obtained by the entropy balancing procedure. As discussed by [Ogrokhina and Rodriguez \(2019\)](#), this method ensures that once the weights are generated, the treatment and control groups follow the same trend in the pretreatment period (that is before the adoption of fiscal rules).

⁵For more details, see ([Boly et al., 2020](#); [Alassani et al., 2022](#))

⁶This approach hinges however on the assumption that neighboring countries' fiscal rule adoption is correlated with a country's own adoption of fiscal rules but is uncorrelated with the error term in the outcome equation, thus satisfying the exclusion restriction assumption.

Table 4.1: Descriptive Statistics and Covariate Balancing

Before: without weighting	[1]	[2]	[3]=[1]-[2]	[4]	[5]
Panel A : Descriptive statistics	Non-Treated FR	Treated FR	Difference	t-Test	p-Val
lag GDPper capita Growth	2.570	2.632	-0.062	-0.299	0.690
lag logPopulation	2.141	2.709	-0.568	-4.945	0.000
lag Financial Openness	-0.181	0.108	-0.290	-3.410	0.007
lag Inflation	7.653	4.986	2.667	6.500	0.000
lag logTotal Expenditure	3.233	3.162	0.071	3.519	0.001
lag logTrade	4.310	4.134	0.176	6.320	0.000
lag logDebt	3.706	3.647	0.059	1.680	0.016
Control of corruption	-0.515	-0.259	-0.256	-7.3856	0.000
Observations	660	440			
After: weighting	[1]	[2]	[3]=[1]-[2]	[4]	[5]
Panel B : Covariate balancing	Non-FR	FR	Difference	t-Test	p-Val
lag GDPper capita Growth	2.632	2.632	0.000	0.004	0.997
lag logPopulation	2.708	2.709	-0.001	0,003	0.998
lag Financial Openness	0.108	0.1084	0.000	0,005	0,996
lag Inflation	4.992	4.986	0.006	-0,021	0.983
lag logTotal Expenditure	3.162	3.162	0.000	-0,008	0.994
lag logTrade	4.134	4.134	0.000	-0,003	0,998
lag logDebt	3.647	3.647	0.000	-0,003	0,997
Control of corruption	-0.2596	-0.2594	0.000	0,007	0.994
Observations	660	440			
Total of Weights	440	440			

Note: We lag all covariates by one year, except the institutional variables, to mitigate reverse causality issues.

Table 4.2 shows results of the causal impact (average effect) of fiscal rules on development outcomes without controls (Panel A) and with controls (Panel B) using the entropy balancing approach. The results show overall that countries with fiscal rules, have achieved better development outcomes over the period. More specifically, panel A, shows that countries with fiscal rules have achieved a lower infant mortality rate (1.4 percentage point), higher access to electricity (1.9 percentage point) and higher school enrollment (3.5 percentage point). This result is consistent with the results of (Castro, 2011; Afonso and Jalles, 2013) that provide evidence that fiscal rules are associated with better output and development outcomes, even when public resources are limited.

4.6 Robustness Checks

In this section, we undertake a series of robustness checks including, adding more control variables, an alternative estimation of the causal effect of rules employing an instrumental variable approach and exploring heterogeneity across countries (low-income countries vs emerging market economies) and the typology of fiscal rules.

Table 4.2: Fiscal Rules and Development Outcomes - Causal Impact from Entropy Balancing Approach

	Development Outcomes		
	(1) Infant Mortality Rate	(2) Access to Electricity	(3) School Enrollment
Panel A: Without Controls			
Fiscal Rules	-1.409** (0.628)	1.852*** (0.672)	3.454*** (1.074)
Country and Time FE	Yes	Yes	Yes
Observations	1,104	1,096	796
R-squared	0.953	0.978	0.937
Panel B: With Controls			
Fiscal Rules	-1.718*** (0.619)	1.423** (0.682)	2.879*** (1.079)
GDP per capita growth (Lag)	-0.0333 (0.0539)	0.158*** (0.0594)	0.196* (0.106)
Log Total Expenditure (Lag)	-4.737*** (1.347)	-1.148 (1.478)	9.907*** (2.704)
Financial Openness (Lag)	-0.201 (0.283)	0.692** (0.312)	0.829* (0.490)
Inflation (Lag)	-0.220*** (0.0471)	0.0572 (0.0516)	-0.155* (0.083)
Log Public Debt (Lag)	4.062*** (0.555)	1.320** (0.611)	-1.246 (1.169)
Controls	Yes	Yes	Yes
Country and Time FE	Yes	Yes	Yes
Observations	1,104	1,096	796
R-squared	0.957	0.978	0.939

Note: This table reports estimates of the impact of fiscal rules on development outcomes. Robust standard errors in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.6.1 Additional controls

First, we start by exploring how robust are our baseline results when we include additional control variables. The table 4.3 shows estimates including additional institutional quality variables in the analysis. The results remain consistent with the baseline findings, highlighting that fiscal rules (FR) have a statistically significant impact on development outcomes. Moreover, we find stronger effects of fiscal rules when we account for the role of the quality of the institutional framework as proxied by democratic accountability and control of corruption, reflecting their plausible enabling role in enhancing the effectiveness of these rules (see [Debrun and Kumar \(2007\)](#) and, [Caselli and Reynaud \(2020\)](#)). Indeed, more democratic and accountable governance is known to be conducive for a better provision of essential services and improved public health outcomes ([Knack, 2001](#); [Kaufmann et al., 2009](#)). In addition, as previously discussed control of corruption captures transparency and integrity in public resource management, directing funds toward productive uses and enhancing public service delivery ([Mauro, 1995](#); [Tanzi and Davoodi, 1998](#)).

Table 4.3: Estimates of the Impact of Fiscal Rules on Development Outcomes with Institutional Quality Variables

VARIABLES	Access to Electricity		Infant Mortality		School Enrollment	
	(1)	(2)	(1)	(2)	(1)	(2)
Fiscal rules	3.157*** (1.215)	1.347** (0.686)	-3.047*** (1.122)	-1.949*** (0.617)	3.978*** (1.401)	2.686** (1.106)
Democratic accountability	1.059*** (0.352)		-1.708*** (0.276)		-0.373 (0.566)	
Control of corruption		2.548*** (0.908)		-2.815*** (0.823)		0.0824 (1.514)
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country and Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	810	1,096	816	1,104	568	796
R-squared	0.981	0.979	0.966	0.958	0.937	0.939

Note: This table reports estimates of the impact of fiscal rules (FR) on development outcomes, adding institutional quality variables. All specifications include the variables of the baseline model. Robust standard errors in parentheses. All regressions include the constant, not reported in the table. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Second, we also include other macroeconomic controls that are likely to both influence the development outcomes under analysis and potentially correlated with fiscal policy. These include the size of foreign direct investment, the age dependency ratio and trade openness. Table A1 in the Appendix, show that results are robust to the inclusion of these variables.

Alternative estimation method: Instrumental Variable

Our main empirical approach to estimate the causal effect of fiscal rules is the entropy balancing. In this section, we employ an instrumental variable (IV) strategy, exploiting the spatial correlation of fiscal rules as discussed previously. Table 4.4 shows the IV estimates including the second stage (Panel A) and the first stage (Panel B). The first stage shows a positive and statistically significant correlation between our instrument (the spatial correlation in fiscal rules and country-specific fiscal rules, consistent with the mechanism of geographical diffusion of rules discussed previously. That is in other terms, countries tend to adopt fiscal rules as their neighbors put these rules in place. Further, diagnostics of the first stage including the Anderson canonical correlations LM test and the Cragg-Donald robust CUE-based (Wald version) test reject the null hypothesis of under-identification. These suggest that the first stage is well identified and that the instrument provides sufficient explanatory power to identify the endogenous variable (fiscal rules). While the magnitude of the estimates are larger in absolute value, our findings from the IV approach remain consistent with the baseline results that fiscal rules significantly improve development outcomes.

Table 4.4: Fiscal Rules and Development Outcomes - Causal Impact from IV Approach

VARIABLES	(1) Access to Electricity	(2) School Enrollment	(3) Infant Mortality Rate
Fiscal Rules	6.869*** (2.609)	10.42*** (2.928)	-12.83*** (2.351)
GDP per capita growth (Lag)	0.173*** (0.0339)	0.0212 (0.0564)	0.0208 (0.0352)
Log Total expenditure (Lag)	5.193*** (1.175)	7.773*** (1.283)	-1.970* (1.024)
Financial openness (Lag)	0.155 (0.344)	0.242 (0.394)	-0.591* (0.326)
Inflation (Lag)	0.0181 (0.0204)	-0.0192 (0.0155)	0.0292 (0.0199)
Log Debt (Lag)	0.317 (0.426)	-1.425*** (0.531)	4.342*** (0.628)
Constant	23.62*** (4.169)	12.92* (6.944)	59.02*** (5.765)
Kleibergen-Paap rk LM statistic (p value)	0.000	0.000	0.000
Cragg-Donald Wald F statistic	105.506	72.984	183.475
Baseline Controls	Yes	Yes	Yes
Country and Time FE	Yes	Yes	Yes
Observations	1,931	1,447	2,061
R-squared	0.966	0.937	0.933
Panel B: First Stage Result			
Instrument	1.97*** (0.192)	1.94*** (0.228)	2.11*** (0.151)
Baseline Controls	Yes	Yes	Yes
Country and Time FE	Yes	Yes	Yes
Observations	1,931	1,447	2,061

Note: This table reports estimates of the impact of fiscal rules on development outcomes using IV strategy. Robust standard errors in parentheses. The Kleibergen-Paap LM statistic tests the null hypothesis of under-identification, with a p-value of 0.000 in all cases, indicating that the instrument is valid, and the model is well-identified. The regressions include both country and time fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.6.2 Heterogeneity

Low Income Developing Countries (LICs) vs Emerging Market Economies (EMs)

We investigate whether the impact of fiscal rules on development outcomes is different across income groups as fiscal challenges may be also different across these groups. Table 4.5 shows estimates for LICs (Panel A) and EMs (Panel B). We find that the impact of fiscal rules on development outcomes is larger in LICs compared to EMs. The difference in magnitude is particularly pronounced for access to electricity and infant mortality. For instance, while in LICs, fiscal rules cause a reduction in infant mortality by 5.7 percentage point, this effect is around 1.4 percentage points only in EMs. These effects represent substantial improvements—in these development outcomes—highlighting the critical role fiscal rules and thus fiscal discipline can play in promoting development in lower-income settings, where the potential for improvement is also greater. Our finding is also consistent with the literature suggesting that fiscal rules are particularly effective in environments with weaker initial conditions, as they help enforce fiscal discipline and allocate resources more efficiently [Combes et al. \(2018\)](#); [Ardanaz et al. \(2021\)](#).

Table 4.5: Fiscal rules and Development Outcome - Heterogeneity across income groups

VARIABLES	(1) Access to Electricity	(2) School Enrollment	(3) Infant Mortality Rate
Panel A: Low Income Countries			
Fiscal Rulea	4.302*** (1.136)	4.626*** (1.724)	-5.712*** (1.015)
Baseline Controls	Yes	Yes	Yes
Observations	440	160	443
R-squared	0.976	0.987	0.980
Panel B: Emerging Markets			
Fiscal Rules	1.832*** (0.676)	3.210*** (1.199)	-1.408** (0.612)
Baseline Controls	Yes	Yes	Yes
Observations	725	574	734
R-squared	0.934	0.914	0.965

Note: This table reports estimates of the impact of fiscal rules on development outcomes using Entropy balancing. Robust standard errors in parentheses. All regressions include the constant, not reported in the table. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The types of fiscal rules

Finally, we investigate the heterogeneity across different types of rules. Table 4.6 highlights the impact of different types of fiscal rules—Balanced Budget Rules (BBR), Expenditure Rules (ER), and Debt Rules (DR)—on key development outcomes. The results are overall broadly consistent with the baseline finding of the virtuous effect of fiscal rules and thus fiscal discipline on development outcomes. However, expenditure rules (ER) stand out as having larger and statistically significant effect on all three development outcomes, compared to debt rules (DR) and balanced budget rules (BBR). This may reflect the fact

that public expenditure is at the center of the mechanism through which fiscal rules contribute to better development outcomes. For instance, government spending is known as a good proxy of discretionary fiscal policy [Fatás and Mihov \(2003\)](#) and could either be used as a tool to finance critical development needs or buy votes through political budget cycles ([Schuknecht, 2000](#); [Block, 2002](#)). This is consistent with [Cordes et al. \(2015\)](#) who find that expenditure rules have a higher compliance rate compared to BBR and ER and are associated with improved spending control and fiscal discipline. In addition, BBR and DR seem to matter mainly for long-term outcomes such as infant mortality and access to electricity (infrastructure) which could reflect the fact that these rules may be more binding in the longer-term compared to ER.

Table 4.6: Impact of Different Types of Fiscal Rules on Development Outcomes

VARIABLES	(1) Access to Electricity	(2) School Enrollment	(3) Infant Mortality Rate
Panel A: Balance Budget Rules			
BBR	1.564** (0.710)	1.696 (1.156)	-2.100*** (0.642)
Baseline Controls	Yes	Yes	Yes
Observations	1,096	796	1,104
R-squared	0.980	0.941	0.961
Panel B: Expenditure Rules			
ER	4.204* (2.501)	10.89*** (2.423)	-3.019** (1.327)
Baseline Controls	Yes	Yes	Yes
Observations	1,096	796	1,104
R-squared	0.980	0.941	0.961
Panel C: Debt Rules			
DR	3.861*** (0.721)	-0.965 (0.727)	-1.691** (0.664)
Baseline Controls	Yes	Yes	Yes
Observations	1,096	743	1,104
R-squared	0.979	0.899	0.957

Note: This table reports estimates of the impact of different types of fiscal rules on development outcomes using entropy balancing. Standard errors in parentheses. All specifications include specific time-fixed effects. All regressions include the constant, not reported in the table. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

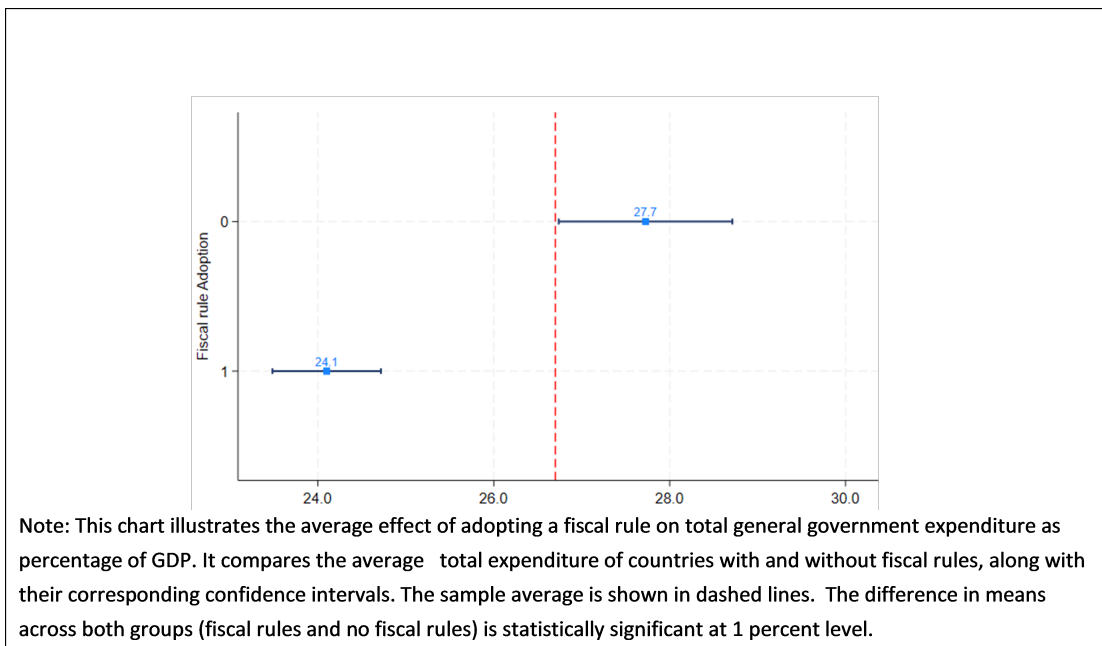
4.7 Transmission Channels

We have established in previous sections that fiscal rules improve development outcomes. In this section we discuss potential channels through which these improvements could take place. Two key channels through which fiscal rules could improve development outcomes include potential enlargement of fiscal space (see for instance [Nerlich and Reuter \(2015\)](#)) and the efficiency of public expenditures ([Castro, 2011](#); [Afonso and Jalles, 2013](#); [Combes et al., 2023](#)). Indeed, by inducing fiscal discipline, fiscal

rules could increase fiscal space and thus allow governments to spend more on development needs. On the other hand, through its impact on the effectiveness of public spending, fiscal rules can promote a better allocation of resources and could allow government to generate more output per dollar spent.

Figure 4.3 below, show that countries with fiscal rules in our sample have lower public spending on average (24.1 percent of GDP) compared to countries with no fiscal rules (27.7 percent of GDP). This suggests that there is no strong supportive argument for the fiscal space channel, leaving the efficiency channel as the more plausible in our sample. Indeed, consistently with the literature which shows that fiscal rules constrain public spending, they tend to enhance the efficiency of public spending [Apeti et al. \(2023\)](#). They argue that this efficiency is achieved by reallocating spending towards more productive sectors, ensuring that even with limited resources, governments can generate greater outcomes. This is also consistent with our previous finding on expenditure rules which have been shown to improve public investment efficiency ([Cordes et al. \(2015\)](#)).

Figure 4.3: Average Effect of Fiscal Rules on Development Outcomes



In addition to their impact on aggregate fiscal position (notably the size of spending), fiscal rules have been found to promote macroeconomic stability either by reducing excessive discretionary spending ([Fatás and Mihov \(2006\)](#)) or by alleviating inflationary pressures owing to fiscal discipline ([Combes et al. \(2018\)](#)). Fiscal rules could thus also improve development outcome by promoting macroeconomic stability. We undertake therefore an analysis of the macroeconomic stability channel of fiscal rules in shaping development outcomes. To this end, we follow a two-stage approach (see for instance [Chauvet](#)

and Ferry (2021); Apeti et al. (2023); Combes et al. (2024)) In the first stage, we use a panel fixed-effects (OLS) regression to evaluate the extent to which the identified channel influences development outcomes. This approach allows us to assess the correlation between the channel and key development indicators. In the second step we re-estimate our baseline model using entropy balancing, by controlling for the macroeconomic variables used in the first stage and replacing our dependent variable with the potential channel.

Table 4.7 investigates the empirical relevance of the macroeconomic channel, with panel A showing the first stage and panel B the second stage. The findings indicate from Panel A illustrate that inflation volatility, our proxy of macroeconomic instability, has a detrimental effect on all three development outcomes. Specifically, increased volatility hampers access to electricity, lowers school enrollment, and raises infant mortality rates. Moreover, Panel B reveals that fiscal rules effectively reduce inflation volatility, suggesting that these rules play a crucial role in fostering macroeconomic stability (Fatás and Mihov (2006); Combes et al. (2018)). Overall, our findings suggest that fiscal rules can also improve development outcome by promoting macroeconomic stability, which could be more conducive to investment in infrastructure, education and healthcare.

Table 4.7: Macroeconomic Stability as a Transmission Channel: A Two-Step Analysis

VARIABLES	(1) Access to Electricity	(2) School Enrollment	(3) Infant Mortality
Panel A: Regression of the Dependent on the Channel			
Inflation Volatility	-2.575*** (0.456)	-4.116*** (0.619)	3.926*** (0.589)
Observations	2,447	1,974	2,923
Panel B: Regression of the Channel on Treatment			
	Inflation Volatility		
Fiscal Rules	-0.237*** (0.0514)		
Covariates	Yes		
Observations	2,050		

Notes: This table displays the results for the transmission channel. Panel A reports the results of the first step, where Fiscal Rules is regressed on the channel identified. Columns [1]–[3] provide the results for Inflation Volatility. Panel B reports the results of the second step, regressing the treatment (fiscal rules) on the channel. Panel B includes covariates and weights. Robust standard errors are in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.8 Conclusion

This paper investigates the causal impact of fiscal discipline on development outcomes by focusing on the role of fiscal rules in a sample of 110 countries over the period 1990-2019. We find that developing countries with fiscal rules have better development outcomes in education, health and infrastructure as measured by school enrollment, infant mortality and access to electricity, respectively. Further, we find that this impact is larger for low-income countries where the potential for improvement is also greater compared to emerging market economies. Furthermore, we show that expenditure rules have larger impact on development outcomes compared to debt rules and balanced budget rules. Finally, our findings suggest that fiscal rules contribute to improve development outcomes by enhancing public expenditure efficiency and by fostering macroeconomic stability.

Overall, our findings suggest that fiscal discipline could be critical to achieve better development outcomes. While domestic resource mobilization is a centerpiece to finance sustainable development, fiscal discipline in managing these resources will play an important role in ensuring these development goals are achieved efficiently. Indeed, in many developing countries, a sizeable part of discretionary fiscal policy is driven by political economy considerations such as reelections ([Schuknecht \(2000\)](#); and [Block \(2002\)](#)) which signals a divergence between political incentives and social welfare maximization. More specifically, our findings suggest that expenditure rules, when well enforced, could lead to a better allocation of resources to finance critical development needs in infrastructures, health and education. This is supported by previous evidence showing that expenditure rules have high compliance rate, enhance fiscal discipline and, improve both spending control and public investment efficiency [Cordes et al. \(2015\)](#). It is worth highlighting however that the design of fiscal rules is key and should be tailored to country-specific context to enhance their effectiveness ([Eyraud et al., 2018](#); [Gaspar et al., 2015](#)).

4.9 Appendix

Figure 4.4: Education Outcome and Fiscal Rules Adoption

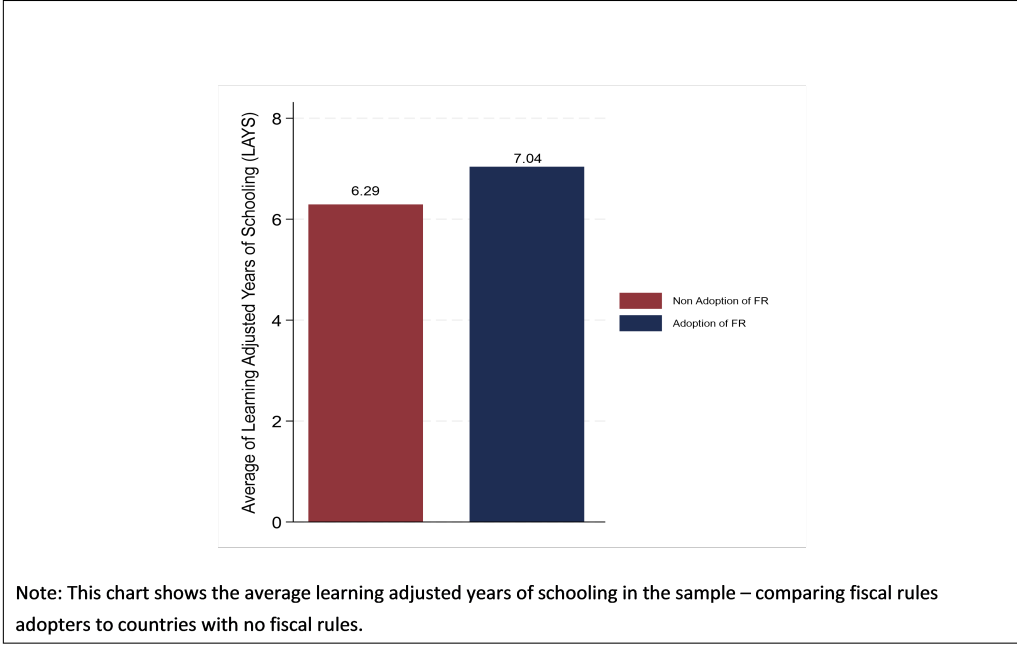


Figure 4.5: Fiscal Rules and Development Outcomes - Entropy Balancing Approach (Without controls variables)

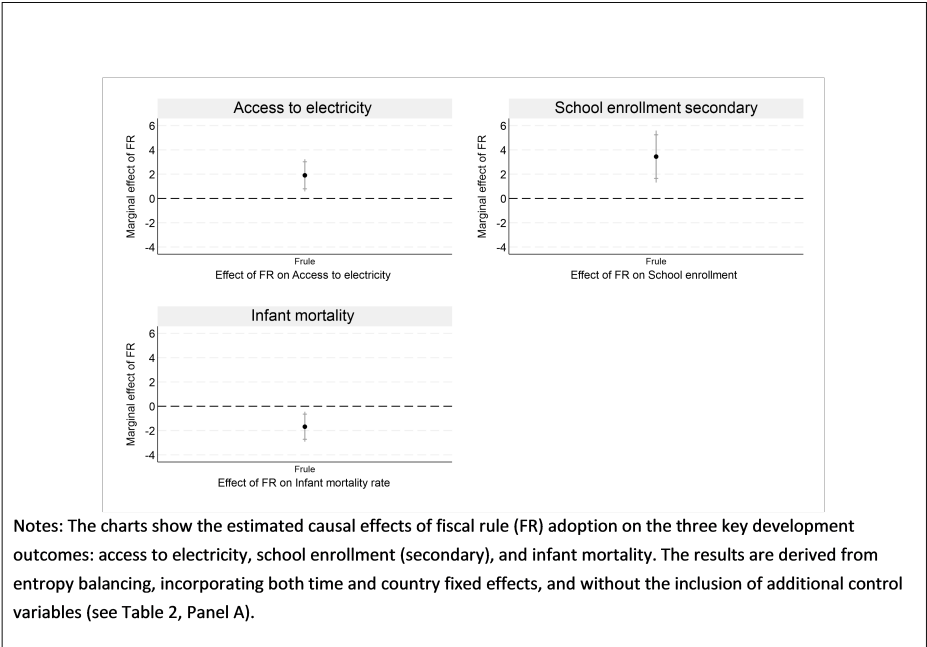


Table 4.8: Additional Control Variables

(1)			
VARIABLES	Access to electricity		
Fiscal rules	1.502** (0.686)	1.662** -0.0960 (0.0598)	1.331** (0.676)
FDI (Lag)	-0.0828 (0.0606)	-0.322*** (0.0591)	-0.132** (0.0599)
Age Dependency Ratio (Lag)		(2.690)	-0.375*** (0.0599)
Trade Openness(Lag)			0.0646*** (0.0152)
Baseline Controls	Yes	Yes	Yes
Country and Time FE	Yes	Yes	Yes
Observations	1,096	1,096	1,096
R-squared	0.979	0.979	0.979
(2)			
VARIABLES	Infant mortality		
Fiscal rules	-2.082*** (0.620)	-2.037*** (0.620)	-1.627*** (0.612)
FDI (Lag)	-0.0133 (0.0551)	-0.0177 (0.0550)	0.0302 (0.0546)
Log Population (Lag)		-0.101* (0.0540)	-0.0259 (0.0543)
Trade Openness(Lag)			-0.0859*** (0.0136)
Baseline Controls	Yes	Yes	
Country and Time FE	Yes	Yes	
Observations	1,104	1,104	1,104
R-squared	0.957	0.963	0.967
(3)			
VARIABLES	School enrollment		
Fiscal rules	2.535** (1.094)	2.566** (1.082)	2.446** (1.089)
FDI (Lag)	0.247** (0.106)	0.264** (0.105)	0.250** (0.106)
Age Dependency Ratio (Lag)		0.417*** (0.0991)	0.384*** (0.105)
Trade Openness(Lag)			0.0252 (0.0260)
Baseline Controls	Yes	Yes	Yes
Country and Time FE	Yes	Yes	Yes
Observations	796	796	796
R-squared	0.939	0.942	0.942

Note: This table reports estimates of the impact of fiscal rules on development outcomes by adding some additional controls: FDI, Age Dependency Ratio, Trade Openness. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.9: Variable Descriptions and Sources

Variables	Descriptions	Sources
Fiscal Rules (FR)	The treatment variable in the study, represented by a dummy variable that takes the value 1 in the year a country adopts a fiscal rule and 0 otherwise.	IMF's Fiscal Rules Dataset
Infant Mortality Rate (per 1,000 live births)	A key measure of public health outcomes and an indicator of child health. High infant mortality rates often reflect lower levels of health and development.	World Bank (World Development Indicators)
School Enrollment, Secondary (Net Enrollment Ratio)	Net enrollment rate is the ratio of children of official school age who are enrolled in school to the population of the corresponding official school age.	World Bank (World Development Indicators)
Access to Electricity (% of population)	Measures the percentage of a country's population that has access to electricity, an important determinant of economic development and quality of life.	World Bank (World Development Indicators)
GDP per Capita Growth	The annual percentage growth rate of GDP per capita, which reflects the economic performance of a country.	World Bank (World Development Indicators)
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Bank (World Development Indicators)
Inflation	Inflation, consumer prices (annual %).	World Bank (World Development Indicators)
Public Debt as % of GDP	Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debt or to the creditor at a date or dates in the future.	International Monetary Fund
Total Public Expenditure	It includes all expenses incurred by the government for providing goods and services. It also includes interest payments on debt and transfers like pensions, subsidies, and unemployment benefits.	International Monetary Fund
Population	Total population of a country, region, or group of countries.	World Bank (World Development Indicators)
Democratic Accountability	Democratic Accountability measures how responsive governments are to their citizens.	Worldwide Governance Indicators (Kaufmann et al., 2011)
Control of Corruption	Control of Corruption measures the extent to which public power is exercised for private gain.	Worldwide Governance Indicators (Kaufmann et al., 2011)
Fiscal Space Data	The database includes 29 indicators of fiscal space grouped into: Government debt sustainability, Balance sheet composition, External and private sector debt, Market access.	Kose et al. (2017)
Financial Openness	Measures the extent of a country's financial integration and openness to international capital markets.	Chinn-Ito Financial Openness Index

General Conclusion

General conclusion

“The strength of a nation’s economy is measured not by the wealth of a few, but by the ability of its policies to foster growth, equity, and resilience for all. ”

— Amartya Sen ,Development as Freedom(1999)

This thesis presents an in-depth exploration of the ways in which fiscal policies can drive sustainable development in developing countries, focusing specifically on tax structures, fiscal rules, public spending efficiency, and the fiscal dimensions of conflict and climate change. By using advanced econometric techniques and a comprehensive dataset, the thesis reveals how well-designed fiscal frameworks, especially when backed by strong institutions can significantly contribute to reduce income inequality, improve development outcomes, and foster macroeconomic stability in fragile contexts.

The thesis empirically addresses four main questions: how does tax structures impact income inequality in Sub-Saharan Africa? What are the fiscal challenges faced by conflict-affected regions in the Sahel? How does climate shocks influence public spending efficiency in developing countries? Can fiscal rules improve development outcomes in developing countries? In Chapter 1, the focus is on the effect of tax structures on income inequality in Sub-Saharan Africa. The analysis reveals that progressive personal income taxes are the most effective in reducing inequality, especially when supported by strong institutional frameworks. The findings highlight that well-designed tax systems—which prioritize equity—are vital for achieving sustainable development goals. Chapter 2 delves into the fiscal challenges faced by conflict-affected regions, particularly the Sahel, where internal armed conflict severely undermines the capacity of governments to mobilize domestic revenue. The results demonstrates that conflicts weaken fiscal capacity and reduce tax compliance, leading to diminished resources for critical development spending. However, the study also identifies digitalisation and institutional reforms as potential strategies for mitigating these adverse effects, offering actionable insights for state-building in fragile contexts. In Chapter 3, the the-

sis explores how climate shocks affect public spending efficiency. The analysis, using stochastic frontier analysis and fractional regression, demonstrates that climate change undermines the efficiency of public expenditure. This chapter emphasizes the urgent need for integrating climate resilience into fiscal frameworks to ensure that countries can maintain efficient public spending and achieve development goals, even in the face of increasing environmental volatility. Last but not the least, chapter 4 investigates the causal impact between fiscal rules and development outcomes. We find that countries with well-enforced fiscal rules, achieve better outcomes in sectors such as education, infrastructure, and healthcare. The adoption of fiscal rules not only enhances macroeconomic stability but also promotes more efficient allocation of public resources, ultimately driving long-term development. The findings reinforce the importance of fiscal discipline in ensuring that public investments contribute meaningfully to social and economic progress.

We clearly establish that the interaction between fiscal policy and development outcomes goes beyond simple budgetary management. In a rapidly changing global environment, where external shocks such as climate change and conflict threaten to destabilize developing economies, the importance of fiscal resilience and institutional quality is underscored as vital to achieve sustainable development goals. Without sound fiscal policies, efforts to reduce poverty, address inequality, and improve public services like education and healthcare will remain insufficient.

Limitations and Avenues for future research

Although this thesis makes significant strides, several limitations are acknowledged. Our analysis does not empirically account for structural fiscal reforms such as public financial management reforms or tax administration improvements, which are critical for enhancing fiscal credibility and improving public spending efficiency. These reforms could have significant implications for the efficiency of fiscal policies in resource-constrained developing countries. Also, we didn't fully address the fiscal challenges brought about by the COVID-19 pandemic and global conflicts, such as the Russia-Ukraine war. These global shocks have reshaped fiscal priorities, particularly in the areas of debt management and public health expenditures. Future research should explore the relation of these new dynamics and domestic revenue mobilization. Further, Since the informal economy contributes significantly to overall economic activity in many developing regions, future research should investigate how fiscal policies can effectively mobilize resources from the informal sector without exacerbating inequality or stifling economic growth. Finally, while the thesis addresses the impact of climate shocks on public spending efficiency, it does not explore the potential for green investments and climate-adaptive fiscal policies. Given the increasing frequency and severity of extreme weather events, future research should examine how developing countries can integrate climate resilience into their fiscal frameworks to ensure long-term economic stability. This would

involve assessing the role of green financing and infrastructure resilience in mitigating the fiscal risks posed by climate change.

The implications are profound-sound fiscal policies are not just about balancing budgets-but about building a fiscal foundation that promotes long-term, equitable growth. Our findings are economically significant and provide a solid empirical basis for future fiscal reforms aimed at improving governance, reducing inequality, adapting to climate challenge to achieve inclusive and sustainable development.

Bibliography

- Acemoglu, D., Johnson, S. and Robinson, J. A. (2001), ‘The colonial origins of comparative development: An empirical investigation’, *American economic review* **91**(5), 1369–1401.
- Acemoglu, D. and Robinson, J. A. (2000), ‘Political losers as a barrier to economic development’, *American Economic Review* **90**(2), 126–130.
- Acevedo, S., Mrkaic, M., Novta, N., Pugacheva, E. and Topalova, P. (2020), ‘The effects of weather shocks on economic activity: what are the channels of impact?’, *Journal of Macroeconomics* **65**, 103207.
- Adam, A., Kammas, P. and Lapatinas, A. (2015), ‘Income inequality and the tax structure: Evidence from developed and developing countries’, *Journal of Comparative Economics* **43**(1), 138–154.
- Addison, T., Chowdhury, A. and Murshed, S. (2004), The fiscal dimensions of conflict and reconstruction, in ‘Fiscal Policy for Development: Poverty, Growth and Reconstruction (eds T Addison and A Roe)’.
- Addison, T., Chowdhury, A. and Murshed, S. M. (2002), ‘Taxation and revenue reform in conflict-affected countries’, *Brighton: IDS, University of Sussex*.
- Addison, T. and McGillivray, M. (2004), ‘Aid to conflict-affected countries: lessons for donors’, *Conflict, Security & Development* **4**(3), 347–367.
- Adegboye, A., Uwuiigbe, U., Ojeka, S., Uwuiigbe, O., Dahunsi, O. and Adegboye, K. (2022), ‘Driving information communication technology for tax revenue mobilization in sub-saharan africa’, *Telecommunications Policy* **46**(7), 102329.
- Afonso, A. and Aubyn, M. S. (2005), ‘Non-parametric approaches to education and health efficiency in oecd countries’, *Journal of applied economics* **8**(2), 227–246.
- Afonso, A. and Jalles, J. T. (2013), ‘Do fiscal rules matter for growth?’, *Applied Economics Letters* **20**(1), 34–40.
- Afonso, A. and Jalles, J. T. (2019), ‘Fiscal rules and government financing costs’, *Fiscal Studies* **40**(1), 71–90.

- Afonso, A., Jalles, J. T. and Venâncio, A. (2022), ‘Do financial markets reward government spending efficiency?’, *Journal of International Financial Markets, Institutions and Money* **77**, 101505.
- Afonso, A., Jalles, J. T. and Venâncio, A. (2023), Government spending efficiency, measurement and applications: A cross-country efficiency dataset, in ‘Handbook on Public Sector Efficiency’, Edward Elgar Publishing, pp. 44–71.
- Afonso, A., Schuknecht, L. and Tanzi, V. (2005), ‘Public sector efficiency: an international comparison’, *Public choice* **123**(3), 321–347.
- Afonso, A., Schuknecht, L. and Tanzi, V. (2010a), ‘Income distribution determinants and public spending efficiency’, *The Journal of Economic Inequality* **8**(3), 367–389.
- Afonso, A., Schuknecht, L. and Tanzi, V. (2010b), ‘Public sector efficiency: evidence for new eu member states and emerging markets’, *Applied economics* **42**(17), 2147–2164.
- Agbeyegbe, T. D., Stotsky, J. and WoldeMariam, A. (2006), ‘Trade liberalization, exchange rate changes, and tax revenue in sub-saharan africa’, *Journal of Asian Economics* **17**(2), 261–284.
- Agnello, L. and Sousa, R. M. (2014), ‘How does fiscal consolidation impact on income inequality?’, *Review of Income and Wealth* **60**(4), 702–726.
- Aigner, D., Lovell, C. K. and Schmidt, P. (1977), ‘Formulation and estimation of stochastic frontier production function models’, *Journal of econometrics* **6**(1), 21–37.
- Alassani, A. (2023), Women’s political empowerment, institution and tax revenue mobilization in developing countries [inclusion politique des femmes, institutions et mobilisation des recettes fiscales dans les pays en développement], Technical report.
- Alassani, A., Laporte, B. and Gervasio, S. (2022), ‘How does tax structure affect income inequality? empirical evidence from sub-saharan africa’.
- Alavuotunki, K., Haapanen, M. and Pirttilä, J. (2019), ‘The effects of the value-added tax on revenue and inequality’, *The Journal of Development Studies* **55**(4), 490–508.
- Alesina, A., Perotti, R. and Tavares, J. (1998), ‘The political economy of fiscal adjustments’, *Papers on Economic Activity* **29**(1), 197–266.
- Alesina, A., Perotti, R. et al. (1996), ‘Budget deficits and budget institutions’, *National Bureau of Economic Research Cambridge, MA* .

- Aligishiev, M. Z., Massetti, E. and Bellon, M. M. (2022), *Macro-fiscal implications of adaptation to climate change*, International Monetary Fund.
- Alvaredo, F., Chancel, L., Piketty, T., Saez, E. and Zucman, G. (2017), ‘Global inequality dynamics: New findings from wid. world’, *American Economic Review* **107**(5), 404–409.
- Amir Imam, P. and Kpodar, K. (2023), ‘Changement climatique et viabilité budgétaire en afrique subsaharienne 1’, *Économie du développement* **36**(3), 89–124.
- Anderson, M. L. (2008), ‘Multiple inference and gender differences in the effects of early intervention: A reevaluation of the abecedarian, perry preschool, and early training projects’, *Journal of the American statistical Association* **103**(484), 1481–1495.
- Apeti, A. E., Bambe, B.-W.-W. and Lompo, A. A. B. (2024), ‘Determinants of public sector efficiency: a panel database from a stochastic frontier analysis’, *Oxford Economic Papers* **76**(3), 741–758.
- Apeti, A. E., Combes, J.-L. et al. (2023), ‘On the macroeconomic effects of fiscal reforms: Fiscal rules and public expenditure efficiency’, *LEO Working Paper* .
- Apeti, A. E. and Edoh, E. D. (2023), ‘Tax revenue and mobile money in developing countries’, *Journal of Development Economics* **161**, 103014.
- Ardanaz, M., Cavallo, E., Izquierdo, A. and Puig, J. (2021), ‘Growth-friendly fiscal rules? safeguarding public investment from budget cuts through fiscal rule design’, *Journal of International Money and Finance* **111**, 102319.
- Arnold, J. M., Brys, B., Heady, C., Johansson, Å., Schwellnus, C. and Vartia, L. (2011), ‘Tax policy for economic recovery and growth’, *The economic journal* **121**(550), F59–F80.
- Ashcroft, L., Coll, J. R., Gilabert, A., Domonkos, P., Brunet, M., Aguilar, E., Castella, M., Sigro, J., Harris, I., Unden, P. et al. (2018), ‘A rescued dataset of sub-daily meteorological observations for europe and the southern mediterranean region, 1877–2012’, *Earth System Science Data* **10**(3), 1613–1635.
- Atkinson, A. B., Piketty, T. and Saez, E. (2011), ‘Top incomes in the long run of history’, *Journal of economic literature* **49**(1), 3–71.
- Atkinson, A. B. and Stiglitz, J. E. (1976), ‘The design of tax structure: direct versus indirect taxation’, *Journal of public Economics* **6**(1-2), 55–75.
- Auerbach, A. J. and Gorodnichenko, Y. (2013), ‘Output spillovers from fiscal policy’, *American Economic Review* **103**(3), 141–146.

- Baarsch, F., Granadillos, J. R., Hare, W., Knaus, M., Krapp, M., Schaeffer, M. and Lotze-Campen, H. (2020), ‘The impact of climate change on incomes and convergence in africa’, *World Development* **126**, 104699.
- Bachner, G. and Bednar-Friedl, B. (2019), ‘The effects of climate change impacts on public budgets and implications of fiscal counterbalancing instruments’, *Environmental Modeling & Assessment* **24**, 121–142.
- Bahl, R. (2004), ‘Reaching the hardest to tax: Consequences and possibilities’, *Contributions to economic analysis* **268**, 337–354.
- Balvir, D. (2024), ‘Fiscal rules: the imitation game’, *Applied Economics* **56**(6), 708–727.
- Barbier-Gauchard, A., Baret, K. and Minea, A. (2021), ‘National fiscal rules and fiscal discipline in the european union’, *Applied Economics* **53**(20), 2337–2359.
- Bardhan, P. (2005), ‘Institutions matter, but which ones?’, *Economics of transition* **13**(3), 499–532.
- Barr, R., Fankhauser, S. and Hamilton, K. (2010), ‘Adaptation investments: a resource allocation framework’, *Mitigation and adaptation strategies for global change* **15**, 843–858.
- Barrage, L. (2020), The fiscal costs of climate change, in ‘AEA Papers and Proceedings’, Vol. 110, American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203, pp. 107–112.
- Barro, R. J. and Lee, J. W. (2013), ‘A new data set of educational attainment in the world, 1950–2010’, *Journal of development economics* **104**, 184–198.
- Bastagli, F., Coady, D. and Gupta, S. (2015), ‘Fiscal redistribution in developing countries: Overview of policy issues and options’, *Inequality and fiscal policy* pp. 57–76.
- Basu, P. and Guariglia, A. (2007), ‘Foreign direct investment, inequality, and growth’, *Journal of Macroeconomics* **29**(4), 824–839.
- Battese, G. E. and Coelli, T. J. (1992), ‘Frontier production functions, technical efficiency and panel data: with application to paddy farmers in india’, *Journal of productivity analysis* **3**, 153–169.
- Bauer, P. W. (1990), ‘Recent developments in the econometric estimation of frontiers’, *Journal of econometrics* **46**(1-2), 39–56.
- Baum, M. A., Hodge, A., Mineshima, M. A., Badia, M. M. M. and Tapsoba, R. (2017), *Can they do it all? Fiscal space in low-income countries*, International Monetary Fund.

- Beck, T., Demirgüç-Kunt, A. and Levine, R. (2007), 'Finance, inequality and the poor', *Journal of economic growth* **12**, 27–49.
- Beck, T., Demirgüç-Kunt, A. and Levine, R. (2004), *Finance, Inequality, and Poverty: Cross-Country Evidence*, The World Bank.
- Benno, T. (2003), 'To evade or not to evade: That is the question', *Journal of Socio-economics* **3**, 283–302.
- Berg, A. G. and Ostry, J. D. (2017), 'Inequality and unsustainable growth: two sides of the same coin?', *IMF Economic Review* **65**, 792–815.
- Berlemann, M. and Wenzel, D. (2018), 'Hurricanes, economic growth and transmission channels: Empirical evidence for countries on differing levels of development', *World Development* **105**, 231–247.
- Besley, T. and Persson, T. (2014), 'Why do developing countries tax so little?', *Journal of economic perspectives* **28**(4), 99–120.
- Best, R. and Burke, P. J. (2018), 'Electricity availability: A precondition for faster economic growth?', *Energy Economics* **74**, 321–329.
- Bird, R. M., Martinez-Vazquez, J. and Torgler, B. (2008), 'Tax effort in developing countries and high income countries: The impact of corruption, voice and accountability', *Economic analysis and policy* **38**(1), 55–71.
- Bird, R. M. and Zolt, E. M. (2005), 'The limited role of the personal income tax in developing countries', *Journal of Asian Economics* **16**(6), 928–946.
- Block, S. A. (2002), 'Political business cycles, democratization, and economic reform: the case of africa', *Journal of Development economics* **67**(1), 205–228.
- Blundell, R. and Bond, S. (1998), 'Initial conditions and moment restrictions in dynamic panel data models', *Journal of econometrics* **87**(1), 115–143.
- Boly, A., Coulibaly, S. and Kéré, E. N. (2020), 'Tax policy, foreign direct investment and spillover effects in africa', *Journal of African Economies* **29**(3), 306–331.
- Boly, A. and Kere, E. N. (2022), 'Terrorism and military expenditure in africa: An analysis of spillover effects', *Available at SSRN 4304796* .
- Borensztein, E., De Gregorio, J. and Lee, J.-W. (1998), 'How does foreign direct investment affect economic growth?', *Journal of international Economics* **45**(1), 115–135.

- Born, B., D’Ascanio, F., Müller, G. J. and Pfeifer, J. (2019), ‘The worst of both worlds: Fiscal policy and fixed exchange rates’, *CESifo Working Paper No. 7922* .
- Bose, N., Capasso, S. and Andreas Wurm, M. (2012), ‘The impact of banking development on the size of shadow economies’, *Journal of Economic Studies* **39**(6), 620–638.
- Bourguignon, F. (2017), ‘The globalization of inequality’, *Princeton University Press* .
- Brun, J.-F., Chambas, G. and Guérineau, S. (2011), Aide et mobilisation fiscale dans les pays en développement. working paper or preprint.
URL: <https://shs.hal.science/halshs-00556804>
- Brun, J.-F., Chambas, G. and Mansour, M. (2015), ‘Tax effort of developing countries: An alternative measure’, *Financing sustainable development addressing vulnerabilities* pp. 205–216.
- Brun, J.-F., Chambas, G., Tapsoba, J., Wandaogo, A.-A. et al. (2020), Are ict’s boosting tax revenues? evidence from developing countries, Technical report, HAL.
- Buera, F. J., Monge-Naranjo, A. and Primiceri, G. E. (2011), ‘Learning the wealth of nations’, *Econometrica* **79**(1), 1–45.
- Buhaug, H. and Gleditsch, K. S. (2008), ‘Contagion or confusion? why conflicts cluster in space’, *International studies quarterly* **52**(2), 215–233.
- Burgess, R. and Stern, N. (1993), ‘Taxation and development’, *Journal of economic literature* **31**(2), 762–830.
- Burke, M., Hsiang, S. M. and Miguel, E. (2015), ‘Climate and conflict’, *Annu. Rev. Econ.* **7**(1), 577–617.
- Calderon, C. A. and Servén, L. (2004), ‘The effects of infrastructure development on growth and income distribution’, *Available at SSRN 625277* .
- Canavire-Bacarreza, G. and Hanauer, M. M. (2013), ‘Estimating the impacts of bolivia’s protected areas on poverty’, *World Development* **41**, 265–285.
- Caselli, F. and Reynaud, J. (2020), ‘Do fiscal rules cause better fiscal balances? a new instrumental variable strategy’, *European Journal of Political Economy* **63**, 101873.
- Castro, V. (2011), ‘The impact of the european union fiscal rules on economic growth’, *Journal of Macroeconomics* **33**(2), 313–326.
- Catalano, M., Forni, L. and Pezzolla, E. (2020), ‘Climate-change adaptation: The role of fiscal policy’, *Resource and Energy Economics* **59**, 101111.

- Cevik, M. S. and Jalles, J. T. (2023a), *Eye of the storm: the impact of climate shocks on inflation and growth*, International Monetary Fund.
- Cevik, S. and Jalles, J. T. (2022), ‘An apocalypse foretold: Climate shocks and sovereign defaults’, *Open Economies Review* **33**(1), 89–108.
- Cevik, S. and Jalles, J. T. (2023b), ‘For whom the bell tolls: Climate change and income inequality’, *Energy Policy* **174**, 113475.
- Chambas, G. (2005), ‘Afrique au sud du sahara’, *Afrique contemporaine* **213**(1), 133–163.
- Chan, S.-G., Ramly, Z. and Karim, M. Z. A. (2017), ‘Government spending efficiency on economic growth: Roles of value-added tax’, *Global Economic Review* **46**(2), 162–188.
- Chancel, L. and Piketty, T. (2021), ‘Global income inequality, 1820–2020: the persistence and mutation of extreme inequality’, *Journal of the European Economic Association* **19**(6), 3025–3062.
- Chauvet, L. and Ferry, M. (2021), ‘Taxation, infrastructure, and firm performance in developing countries’, *Public Choice* **187**, 455–480.
- Chen, H., Jin, L., Wang, M., Guo, L. and Wu, J. (2023), ‘How will power outages affect the national economic growth: Evidence from 152 countries’, *Energy Economics* **126**, 107055.
- Cho, S. S.-W. and Muñoz, M. S. (2003), ‘Social impact of a tax reform: The case of ethiopia’, *International Monetary Fund* .
- Chong, A. and Gradstein, M. (2007), ‘Inequality and informality’, *Journal of Public Economics* **91**(1), 159–179.
- Chowdhury, A. (2004), ‘The fiscal dimensions of conflict and reconstruction’, *Economics Faculty Research and Publications*. 127. .
- Ciccarelli, M. and Marotta, F. (2024), ‘Demand or supply? an empirical exploration of the effects of climate change on the macroeconomy’, *Energy Economics* **129**, 107163.
- Ciminelli, G., Ernst, E., Merola, R. and Giuliadori, M. (2019), ‘The composition effects of tax-based consolidation on income inequality’, *European Journal of Political Economy* **57**, 107–124.
- Claessens, S. and Perotti, E. (2007), ‘Finance and inequality: Channels and evidence’, *Journal of Comparative Economics* **35**(4), 748–773.
- Clements, B., Gupta, S., Jalles, J. and Adroque, B. (2023), ‘Climate change and government borrowing costs: a triple whammy for emerging market economies’.

- Clements, M. B. J., De Mooij, R. A., Gupta, M. S. and Keen, M. M. (2015), 'Inequality and fiscal policy', *International Monetary Fund*.
- Coady, D., De Mooij, R. and Shang, B. (2015), 'Inequality and fiscal redistribution in advanced economies', *Inequality and Fiscal Policy* pp. 37–56.
- Coady, M. D. and Gupta, M. S. (2012), *Income inequality and fiscal policy*, International Monetary Fund.
- Collier, P. (2000), 'Economic causes of civil conflict and their implications for policy', *World Bank* pp. 5–26.
- Collier, P. and Hoeffler, A. (2004), 'Greed and grievance in civil war', *Oxford economic papers* **56**(4), 563–595.
- Combes, J.-L., Apeti, A. E. et al. (2023), 'On the macroeconomic effects of fiscal reforms: Fiscal rules and public expenditure efficiency'.
- Combes, J.-L., Debrun, X., Minea, A., Sawadogo, P. N. and Vinturis, C. (2024), 'On the side effects of fiscal policy: Fiscal rules and income inequality', *European Journal of Political Economy* p. 102534.
- Combes, J.-L., Debrun, X., Minea, A. and Tapsoba, R. (2018), 'Inflation targeting, fiscal rules and the policy mix: cross-effects and interactions', *The Economic Journal* **128**(615), 2755–2784.
- Cordes, T., Kinda, M. T., Muthooru, M. P. S. and Weber, A. (2015), *Expenditure rules: effective tools for sound fiscal policy?*, International Monetary Fund.
- Cornia, G. A., Gómez-Sabaini, J. C. and Martorano, B. (2011), *A new fiscal pact, tax policy changes and income inequality: Latin America during the last decade*, WIDER Working Paper.
- Correia, I. (2010), 'Consumption taxes and redistribution', *American Economic Review* **100**(4), 1673–94.
- Corugedo, E. F., Gonzalez Gomez, A. and Guerson, A. (2023), 'The macroeconomic returns of investment in resilience to natural disasters under climate change: A dsge approach'.
- Crivelli, E. and Gupta, S. (2014), 'Resource blessing, revenue curse? domestic revenue effort in resource-rich countries', *European Journal of Political Economy* **35**, 88–101.
- Cuaresma, J. C. (2010), 'Natural disasters and human capital accumulation', *The World Bank Economic Review* **24**(2), 280–302.
- Dabla-Norris, M. E., Kochhar, M. K., Suphaphiphat, M. N., Ricka, M. F. and Tsounta, M. E. (2015), 'Causes and consequences of income inequality: A global perspective', *International Monetary Fund*.

- Dafermos, Y., Nikolaidi, M. and Galanis, G. (2018), ‘Climate change, financial stability and monetary policy’, *Ecological Economics* **152**, 219–234.
- Danish and Ulucak, R. (2020), ‘The pathway toward pollution mitigation: does institutional quality make a difference?’, *Business Strategy and the Environment* **29**(8), 3571–3583.
- Dao, H. and Godbout, L. (2014), ‘Le rôle de la fiscalité dans la réduction des inégalités: doit-on se soucier de la structure fiscale servant à prélever les recettes?’, *L’Actualité économique* **90**(4), 303–327.
- De Gregorio, J. (1993), ‘Inflation, taxation, and long-run growth’, *Journal of monetary economics* **31**(3), 271–298.
- De la Fuente, A. et al. (2007), ‘Climate shocks and their impact on assets’, *Occasional paper for UNDP*.
- De Mooij, R., Fenochietto, R. and Hebous, S. (2020), ‘Politique fiscale pour une croissance inclusive après la pandémie’, *International Monetary Fund* p. 16.
- Debrun, X. and Kumar, M. (2007), ‘Fiscal rules, fiscal councils and all that: commitment devices, signaling tools or smokescreens?’, *Fiscal Councils and All That: Commitment Devices, Signaling Tools or Smokescreens*.
- Debrun, X. and Kumar, M. S. (2009), The discipline-enhancing role of fiscal institutions: Theory and empirical evidence, in ‘Policy Instruments for Sound Fiscal Policies: Fiscal Rules and Institutions’, Springer, pp. 51–88.
- Dell, M., Jones, B. F. and Olken, B. A. (2012), ‘Temperature shocks and economic growth: Evidence from the last half century’, *American Economic Journal: Macroeconomics* **4**(3), 66–95.
- Devarajan, S., Swaroop, V. and Zou, H.-f. (1996), ‘The composition of public expenditure and economic growth’, *Journal of monetary economics* **37**(2), 313–344.
- Diakite, M., Diarra, S., Tapsoba, S. J.-A. and Zongo, T. (2019), ‘Foreign aid and domestic revenue mobilization in conflict-affected countries’, *No P248, Working Papers, FERDI*.
- Diallo, Y. (2023), *The effects of climate and conflict shocks on household welfare: Niger*, International Monetary Fund.
- Donaubauer, J., Meyer, B. E. and Nunnenkamp, P. (2016), ‘A new global index of infrastructure: Construction, rankings and applications’, *The World Economy* **39**(2), 236–259.
- Doumbia, D. and Kinda, M. T. (2019), *Reallocating Public Spending to Reduce Income Inequality: Can It Work?*, International Monetary Fund.

- Downing, B. M. (1992), *The Military Revolution: Origins and Autocracy in Early Modern Europe*, Princeton: Princeton University Press.
- Dreher, A. (2006), ‘Does globalization affect growth? evidence from a new index of globalization’, *Applied Economics* **38**(10), 1091–1110.
- Duncan, D. and Sabirianova Peter, K. (2016), ‘Unequal inequalities: Do progressive taxes reduce income inequality?’, *International Tax and Public Finance* **23**, 762–783.
- d’Agostino, G., Dunne, J. P. and Pieroni, L. (2016), ‘Government spending, corruption and economic growth’, *World Development* **84**, 190–205.
- Easterly, W. and Rebelo, S. (1994), ‘Fiscal policy and economic growth: an empirical investigation’, *CEPR Discussion Papers* .
- Edwards, S. (1997), ‘Trade policy, growth, and income distribution’, *The American Economic Review* **87**(2), 205–210.
- Eklou, K. M. and Joanis, M. (2019), *Do fiscal rules cause fiscal discipline over the electoral cycle?*, International Monetary Fund.
- Ekoula, H. W. M. A., Kamguia, B. and Ndoya, H. (2023), ‘Do women hold the key to financial sector development in africa?’, *International Economics* **173**, 233–248.
- Engel, E. M., Galetovic, A. and Raddatz, C. E. (1999), ‘Taxes and income distribution in chile: some unpleasant redistributive arithmetic’, *Journal of Development Economics* **59**(1), 155–192.
- Ertman, T. (1997), *Birth of the Leviathan: Building states and regimes in medieval and early modern Europe*, Cambridge University Press.
- Escolano, J. and Escolano, J. (2010), *A practical guide to public debt dynamics, fiscal sustainability, and cyclical adjustment of budgetary aggregates*, Vol. 2, International Monetary Fund Washington, DC.
- Eyraud, L., Debrun, M. X., Hodge, A., Lledo, V. D. and Pattillo, M. C. A. (2018), *Second-generation fiscal rules: Balancing simplicity, flexibility, and enforceability*, International Monetary Fund.
- Fan, S. (2008), *Public expenditures, growth, and poverty: lessons from developing countries*, Vol. 51, Intl Food Policy Res Inst.
- Fang, X., Kothari, S., McLoughlin, C. and Yenice, M. (2020), ‘The economic consequences of conflict in sub-saharan africa’, *IMF Working Papers* **2020**(221).

- Fatás, A. and Mihov, I. (2003), ‘The case for restricting fiscal policy discretion’, *The Quarterly Journal of Economics* **118**(4), 1419–1447.
- Fatás, A. and Mihov, I. (2006), ‘The macroeconomic effects of fiscal rules in the us states’, *Journal of public economics* **90**(1-2), 101–117.
- Ferrari, S. and Cribari-Neto, F. (2004), ‘Beta regression for modelling rates and proportions’, *Journal of applied statistics* **31**(7), 799–815.
- Ferreira G, F. H., Lustig, N. and Teles, D. (2015), ‘Appraising cross-national income inequality databases: An introduction’, *The Journal of Economic Inequality* **13**(4), 497–526.
- Fiorentino, E., Karmann, A. and Koetter, M. (2006), ‘The cost efficiency of german banks: a comparison of sfa and dea’, *Bundesbank Series 2 Discussion Paper* .
- Fjeldstad, O.-H. (2004), ‘What’s trust got to do with it? non-payment of service charges in local authorities in south africa’, *The Journal of Modern African Studies* **42**(4), 539–562.
- Fjeldstad, O.-H. and Heggstad, K. (2012), ‘Local government revenue mobilisation in anglophone africa’, *ICTD Working Paper 7* .
- Fuje, H., Yao, J., Choi, S. M. and Mighri, H. (2023), ‘Fiscal impacts of climate disasters in emerging markets and developing economies’.
- Gallup, J. L., Sachs, J. D. and Mellinger, A. D. (1999), ‘Geography and economic development’, *International regional science review* **22**(2), 179–232.
- Gaspar, V., Jaramillo, L. and Wingender, M. P. (2016), *Tax Capacity and Growth: Is There a Tipping Point?*, International Monetary Fund.
- Gaspar, V., Jenkner, E., Rozenov, R., De Broeck, M., Mattina, T., Acosta-Ormaechea, S., Amaglobeli, D., Anh Bui, M., Cevik, S., Correa, C. et al. (2015), ‘Fiscal policy and long-term growth’, *International Monetary Fund* .
- Gassebner, M., Keck, A. and Teh, R. (2010), ‘Shaken, not stirred: the impact of disasters on international trade’, *Review of international Economics* **18**(2), 351–368.
- Gates, S., Hegre, H., Nygård, H. M. and Strand, H. (2012), ‘Development consequences of armed conflict’, *World Development* **40**(9), 1713–1722.
- Geloso, V. J. and Salter, A. W. (2020), ‘State capacity and economic development: Causal mechanism or correlative filter?’, *Journal of Economic Behavior & Organization* **170**, 372–385.

- Gemmell, N. and Morrissey, O. (2005), ‘Distribution and poverty impacts of tax structure reform in developing countries: how little we know’, *Development Policy Review* **23**(2), 131–144.
- Gilmore, M. S., Straka, J. M. and Rasmussen, E. N. (2004), ‘Precipitation uncertainty due to variations in precipitation particle parameters within a simple microphysics scheme’, *Monthly weather review* **132**(11), 2610–2627.
- Giovanis, E. and Ozdamar, O. (2022), ‘The impact of climate change on budget balances and debt in the middle east and north africa (mena) region’, *Climatic Change* **172**(3-4), 34.
- Giuliano, P., Mishra, P. and Spilimbergo, A. (2013), ‘Democracy and reforms: evidence from a new dataset’, *American Economic Journal: Macroeconomics* **5**(4), 179–204.
- Gleditsch, N. P., Wallensteen, P., Eriksson, M., Sollenberg, M. and Strand, H. (2002), ‘Armed conflict 1946-2001: A new dataset’, *Journal of peace research* **39**(5), 615–637.
- Gnangnon, S. K. (2021), ‘Financial development and tax revenue in developing countries: investigating the international trade channel’, *SN Business & Economics* **2**(1), 1.
- Gnangnon, S. K. and Brun, J.-F. (2018), ‘Impact of bridging the internet gap on public revenue mobilization’, *Information Economics and Policy* **43**, 23–33.
- Gnangnon, S. K. and Brun, J.-F. (2019), ‘Trade openness, tax reform and tax revenue in developing countries’, *The World Economy* **42**(12), 3515–3536.
- Goñi, E., López, J. H. and Servén, L. (2011), ‘Fiscal redistribution and income inequality in latin america’, *World development* **39**(9), 1558–1569.
- Gootjes, B., de Haan, J. and Jong-A-Pin, R. (2021), ‘Do fiscal rules constrain political budget cycles?’, *Public Choice* **188**(1), 1–30.
- Gopinath, M. and Chen, W. (2003), ‘Foreign direct investment and wages: a cross-country analysis’, *Journal of International Trade & Economic Development* **12**(3), 285–309.
- Grigoli, F. and Kapsoli, J. (2018), ‘Waste not, want not: the efficiency of health expenditure in emerging and developing economies’, *Review of Development Economics* **22**(1), 384–403.
- Gu, G. W., de Mooij, R. and Poghosyan, T. (2015), ‘Taxation and leverage in international banking’, *International Tax and Public Finance* **22**(2), 177–200.
- Gu, G. W. and Hale, G. (2023), ‘Climate risks and fdi’, *Journal of International Economics* p. 103731.

- Gupta, A. S. (2007), ‘Determinants of tax revenue efforts in developing countries’, *IMF Working Papers* **2007**(184).
- Gupta, S., Clements, B., Bhattacharya, R. and Chakravarti, S. (2004), ‘Fiscal consequences of armed conflict and terrorism in low-and middle-income countries’, *European journal of political economy* **20**(2), 403–421.
- Gupta, S. and Verhoeven, M. (2001), ‘The efficiency of government expenditure: experiences from africa’, *Journal of policy modeling* **23**(4), 433–467.
- Gupta, S., Verhoeven, M. and Tiongson, E. R. (2002), ‘The effectiveness of government spending on education and health care in developing and transition economies’, *European Journal of Political Economy* **18**(4), 717–737.
- Hainmueller, J. (2012), ‘Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies’, *Political analysis* **20**(1), 25–46.
- Hanushek, E. A. and Woessmann, L. (2012), ‘Schooling, educational achievement, and the latin american growth puzzle’, *Journal of Development Economics* **99**(2), 497–512.
- Hauner, D. and Kyobe, A. (2010), ‘Determinants of government efficiency’, *World Development* **38**(11), 1527–1542.
- Heinemann, F., Moessinger, M.-D. and Yeter, M. (2018), ‘Do fiscal rules constrain fiscal policy? a meta-regression-analysis’, *European Journal of Political Economy* **51**, 69–92.
- Heller, P., Katz, M., Debrun, X., Thomas, T., Koranchelian, T. and Adenauer, I. (2006), ‘Making fiscal space happen: Managing fiscal policy in a world of scaled-up aid’, *IMF Working Paper* .
- Hemming, R. (2003), ‘Policies to promote fiscal discipline’, *Fiscal Affairs Department, IMF* (s 2).
- Hossain, S. M. (1995), ‘The equity impact of the value-added tax in bangladesh’, *Staff Papers* **42**(2), 411–430.
- Howell, L. D. (2011), ‘International country risk guide methodology’, *East Syracuse, NY: PRS Group* **7**.
- Hugon, P. (2003), ‘Les conflits armés en afrique: apports, mythes et limites de l’analyse économique’, *Revue tiers monde* **176**(4), 829–855.
- IEP (2023), *Global Terrorism Index 2023: Measuring the Impact of Terrorism*, Available from: <http://visionofhumanity.org/resources> (accessed Date Month Year).

- Iliyasu, J., Mamman, S. O. and Ahmed, U. A. (2023), ‘Impact of climate change on output and inflation in africa’s largest economies’, *Climate and Development* **15**(10), 864–875.
- Imam, P. A. and Kpodar, K. (2022), ‘Changement climatique et viabilité budgétaire en afrique subsaharienne’, *Revue d’économie du développement* **32**(4), 89–124.
- IMF (1999), *Sri Lanka : recent economic and policy developments*, IMF staff country report, International Monetary Fund.
- Isak, N. N. (2018), ‘Challenges of domestic revenue mobilization in somalia’, *International Journal of Economics, Commerce and Management* **6**(9), 172–181.
- Jacquemot, P. and Raffinot, M. (2018), ‘La mobilisation fiscale en afrique’, *Revue d’économie financiere* **131**(3), 243–263.
- Javaid, A., Arshed, N., Munir, M., Amani Zakaria, Z., Alamri, F. S., Abd El-Wahed Khalifa, H. and Hanif, U. (2022), ‘Econometric assessment of institutional quality in mitigating global climate-change risk’, *Sustainability* **14**(2), 669.
- Jenkins, G. P., Jenkins, H. P. and Kuo, C. Y. (2006), ‘Is the value added tax naturally progressive?’, *Available at SSRN 897677*.
- Jenkins, S. P. (2015), ‘World income inequality databases: an assessment of wiid and swiid’, *The Journal of Economic Inequality* **13**(4), 629–671.
- Jones, B., Keen, M., Norregaard, J. and Strand, J. (2007), ‘Climate change: economic impact and policy responses’, *World economic outlook* pp. 53–68.
- Jones, B., Keen, M. and Strand, J. (2013), ‘Fiscal implications of climate change’, *International Tax and Public Finance* **20**, 29–70.
- Jordà, Ò. and Taylor, A. M. (2016), ‘The time for austerity: estimating the average treatment effect of fiscal policy’, *The Economic Journal* **126**(590), 219–255.
- Joumard, I., Pisu, M. and Bloch, D. (2013), ‘Tackling income inequality: The role of taxes and transfers’, *OECD Journal: Economic Studies* **2012**(1), 37–70.
- Junquera-Varela, R. F., Verhoeven, M., Shukla, G. P., Haven, B. and Moreno-Dodson, B. (2017), *Strengthening domestic resource mobilization: Moving from theory to practice in low-and middle-income countries*, World Bank Publications.

- Kahn, M. E., Mohaddes, K., Ng, R. N., Pesaran, M. H., Raissi, M. and Yang, J.-C. (2021), ‘Long-term macroeconomic effects of climate change: A cross-country analysis’, *Energy Economics* **104**, 105624.
- Kaldor, N. (1963), ‘Taxation for economic development’, *The Journal of Modern African Studies* **1**(1), 7–23.
- Karim, A. and Noy, I. (2020), ‘Risk, poverty or politics? the determinants of subnational public spending allocation for adaptive disaster risk reduction in bangladesh’, *World Development* **129**, 104901.
- Kaufmann, D., Kraay, A. and Mastruzzi, M. (2009), ‘Governance matters viii: aggregate and individual governance indicators, 1996-2008’, *World bank policy research working paper* (4978).
- Kaufmann, D., Kraay, A. and Mastruzzi, M. (2011), ‘The worldwide governance indicators: Methodology and analytical issues1’, *Hague journal on the rule of law* **3**(2), 220–246.
- Keen, M. and Lockwood, B. (2010), ‘The value added tax: Its causes and consequences’, *Journal of Development Economics* **92**(2), 138–151.
- Kelly, R. (2012), ‘Property tax collection and enforcement’, *A primer on property tax: Administration and policy* pp. 141–171.
- Keneck-Massil, J., Nvuh-Njoya, Y., Kouotou, H. L., de Paul Mboutchouang, V. and Nsoe, J. B. (2021), ‘Diversification dans les ex-colonies: l’importance de l’histoire’, *Revue économique* **72**(3), 459–489.
- Kenworthy, L. and McCall, L. (2008), ‘Inequality, public opinion and redistribution’, *Socio-Economic Review* **6**(1), 35–68.
- Khattry, B. and Rao, J. M. (2002), ‘Fiscal faux pas?: an analysis of the revenue implications of trade liberalization’, *World Development* **30**(8), 1431–1444.
- Kim, D.-H. and Lin, S.-C. (2018), ‘Oil abundance and income inequality’, *Environmental and Resource Economics* **71**(4), 825–848.
- Klasen, S. (2016), ‘Rising inequality in developing countries: what can be done’, *KfW Development Research-Views on Development* **2**.
- Kleibergen, F. and Paap, R. (2006), ‘Generalized reduced rank tests using the singular value decomposition’, *Journal of econometrics* **133**(1), 97–126.
- Knack, S. (2001), ‘Aid dependence and the quality of governance: Cross-country empirical tests’, *Southern economic journal* **68**(2), 310–329.
- Kopits, M. G. and Symansky, M. S. A. (1998), *Fiscal policy rules*, International monetary fund.

- Kreutz, J. (2010), 'How and when armed conflicts end: Introducing the ucdp conflict termination dataset', *Journal of Peace Research* **47**(2), 243–250.
- Kumbhakar, S. C., Ghosh, S. and McGuckin, J. T. (1991), 'A generalized production frontier approach for estimating determinants of inefficiency in us dairy farms', *Journal of Business & Economic Statistics* **9**(3), 279–286.
- Kumbhakar, S. C. and Lovell, C. K. (2003), *Stochastic frontier analysis*, Cambridge university press.
- Kumbhakar, S. C., Wang, H.-J. and Horncastle, A. P. (2015), *A practitioner's guide to stochastic frontier analysis using Stata*, Cambridge University Press.
- Kunawotor, M. E., Bokpin, G. A., Asuming, P. O. and Amoateng, K. A. (2022), 'The implications of climate change and extreme weather events for fiscal balance and fiscal policy in africa', *Journal of Social and Economic Development* **24**(2), 470–492.
- Kuznets, S. (1955), 'Economic growth and income inequality', *The American Economic Review* **45**(1), 1–28.
- Laframboise, M. N. and Loko, M. B. (2012), 'Natural disasters: mitigating impact, managing risks', *International Monetary Fund*.
- Landau, D. (1983), 'Government expenditure and economic growth: a cross-country study', *Southern economic journal* pp. 783–792.
- Lee, Y. and Gordon, R. (2005), 'Tax structure and economic growth', *Journal of Public Economics* **89**(5), 1027–1043.
- Lee, Y. H. and Schmidt, P. (1993), 'A production frontier model with flexible temporal variation in technical efficiency', *The measurement of productive efficiency: Techniques and applications* **237**, 255.
- Leepipatpiboon, P., Castrovillari, C. and Mineyama, T. (2023), 'Macroeconomic shocks and conflict', *IMF Working Papers* **2023**(068).
- Leichenko, R. and Silva, J. A. (2014), 'Climate change and poverty: vulnerability, impacts, and alleviation strategies', *Wiley Interdisciplinary Reviews: Climate Change* **5**(4), 539–556.
- Leppänen, S., Solanko, L. and Kosonen, R. (2017), 'The impact of climate change on regional government expenditures: evidence from russia', *Environmental and Resource Economics* **67**, 67–92.
- Lis, E. M. and Nickel, C. (2010), 'The impact of extreme weather events on budget balances', *International Tax and Public Finance* **17**, 378–399.

- Loayza, N. V., Olaberria, E., Rigolini, J. and Christiaensen, L. (2012), ‘Natural disasters and growth: Going beyond the averages’, *World Development* **40**(7), 1317–1336.
- Lurton, G. (2007), ‘Mesurer la pression fiscale’, *Regards croisés sur l’économie* **1**, 66–68.
- Maïmouna, D., Souleymane, D., Tapsoba, S. and Tertius, Z. (2019), Foreign aid and domestic revenue mobilization in conflict-affected countries, Technical report, FERDI.
- Mallick, H. (2021), ‘Do governance quality and ict infrastructure influence the tax revenue mobilisation? an empirical analysis for india’, *Economic Change and Restructuring* **54**(2), 371–415.
- Mansour, M. (2014), ‘A tax revenue dataset for sub-saharan africa: 1980-2010’, *Revue d’économie du développement* **22**(3), 99–128.
- Mansour, M. and Rota-Graziosi, G. (2012), ‘Coordination fiscale dans l’union économique et monétaire ouest africaine. tax coordination in the west african economic and monetary union’, *Revue d’économie du développement* **20**(3), 9–34.
- Martinez-Vazquez, J., Moreno-Dodson, B. and Vulovic, V. (2012), ‘The impact of tax and expenditure policies on income distribution: Evidence from a large panel of countries’, *Andrew Young School of Policy Studies Research Paper Series* **12-30**.
- Marto, R., Papageorgiou, C. and Klyuev, V. (2018), ‘Building resilience to natural disasters: An application to small developing states’, *Journal of Development Economics* **135**, 574–586.
- Martorano, B. (2018), ‘Taxation and inequality in developing countries: Lessons from the recent experience of latin america’, *Journal of International Development* **30**(2), 256–273.
- Mascagni, G., Moore, M. and McCluskey, R. (2014), ‘Tax revenue mobilisation in developing countries: Issues and challenges’, *European Union (Belgium)* .
- Mauro, P. (1995), ‘Corruption and growth’, *The quarterly journal of economics* **110**(3), 681–712.
- Mawejje, J. (2019), ‘Natural resources governance and tax revenue mobilization in sub saharan africa: The role of the extractive industries transparency initiative (eiti)’, *Resources Policy* **62**, 176–183.
- Mawejje, J. and Francis Munyambonera, E. (2016), ‘Tax revenue effects of sectoral growth and public expenditure in uganda’, *South African Journal of Economics* **84**(4), 538–554.
- McLoughlin, C., Newiak, M., Ouedraogo, R., Tenison, B., Yao, J., Yenice, M. et al. (2017), ‘Les conséquences économiques des conflits’, *IMF Working papers* .

- McNabb, K. (2018), 'Tax structures and economic growth: New evidence from the government revenue dataset', *Journal of International development* **30**(2), 173–205.
- Meeusen, W. and van Den Broeck, J. (1977), 'Efficiency estimation from cobb-douglas production functions with composed error', *International economic review* pp. 435–444.
- Melecky, M. and Raddatz, C. E. (2011), 'How do governments respond after catastrophes? natural-disaster shocks and the fiscal stance', *Natural-Disaster Shocks and the Fiscal Stance (February 1, 2011). World Bank Policy Research Working Paper* (5564).
- Meltzer, A. H. and Richard, S. F. (1981), 'A rational theory of the size of government', *Journal of political Economy* **89**(5), 914–927.
- Mirrlees, J. A. (1971), 'An exploration in the theory of optimum income taxation', *The review of economic studies* **38**(2), 175–208.
- Mohan, P. and Strobl, E. (2021), 'The impact of tropical storms on tax revenue', *Journal of international development* **33**(3), 472–489.
- Moore, M. and Prichard, W. (2017), 'Comment les gouvernements de pays à faible revenu peuvent-ils augmenter leurs recettes fiscales?', *Institute of Development Studies, Document de travail ICTD* **70**.
- Morrissey, O., Von Haldenwang, C., Von Schiller, A., Ivanyina, M. and Bordon, I. (2016), 'Tax revenue performance and vulnerability in developing countries', *The Journal of Development Studies* **52**(12), 1689–1703.
- Mourfou, A. and Ouedraogo, I. M. (2021), 'Effect of tax revenue mobilization on income inequalities in west african economic and monetary union countries (WAEMU)', *American Journal of Theoretical and Applied Business* **7**(1), 8.
- Mullins, P., Gupta, S. and Liu, J. (2020), 'Domestic revenue mobilization in low income countries: where to from here', *Center for Global Development Policy Paper* **195**.
- Musgrave, R. A. (1959), 'The theory of public finance; a study in public economy', *Kogakusha Co.* .
- Mwega, F. M. (1986), 'The incidence of taxes and transfers in kenya: A general equilibrium analysis', *Eastern Africa Economic Review* **2**(1), 6–13.
- Myles, J. (2014), 'Joseph stiglitz (2012) the price of inequality. london: Allen lane. 414pp.,£ 25, hbk.', *Journal of Social Policy* **43**(1), 216–218.

- Ndikumana, L. and Abderrahim, K. (2010), 'Revenue mobilization in african countries: does natural resource endowment matter?', *African Development Review* **22**(3), 351–365.
- Nerlich, C. and Reuter, W. H. (2015), *Fiscal rules, fiscal space and procyclical fiscal policy*, number 1872, ECB Working Paper.
- Neuenkirch, M. and Neumeier, F. (2016), 'The impact of us sanctions on poverty', *Journal of Development Economics* **121**, 110–119.
- Newbery, D. and Stern, N. (1988), *The theory of taxation for developing countries*, A World Bank Research Publication.
- Niyonkuru, F. (2016), 'Failure of foreign aid in developing countries: A quest for alternatives', *Business and Economics Journal* **7**(3), 1–9.
- Nkurunziza, J. (2004), How long can inflation tax compensate for the loss of government revenue in war economies? evidence from burundi, Technical report, University Library of Munich, Germany.
- Nordhaus, W. D. (2006), 'Geography and macroeconomics: New data and new findings', *Proceedings of the National Academy of Sciences* **103**(10), 3510–3517.
- Nordhaus, W. D. and Boyer, J. (2000), 'Warming the world'.
- Norregaard, M. J. (2013), *Taxing immovable property revenue potential and implementation challenges*, International Monetary Fund.
- North, D. C. (1990), *Institutions, institutional change and economic performance*, Vol. 332, Cambridge university press.
- North, M. A. (2009), A method for implementing a statistically significant number of data classes in the jenks algorithm, in '2009 sixth international conference on fuzzy systems and knowledge discovery', Vol. 1, IEEE, pp. 35–38.
- Novignon, J. and Nonvignon, J. (2015), 'Fiscal space for health in sub-saharan african countries: an efficiency approach', *African Journal of Health Economics* **4**, 1–11.
- Noy, I. (2009), 'The macroeconomic consequences of disasters', *Journal of Development economics* **88**(2), 221–231.
- Ocran, M. K. (2011), 'Fiscal policy and economic growth in south africa', *Journal of Economic Studies* .

- Ogrokhina, O. and Rodriguez, C. M. (2019), ‘The effect of inflation targeting and financial openness on currency composition of sovereign international debt’, *Journal of International Money and Finance* **97**, 1–18.
- Ortiz-Bobea, A., Ault, T. R., Carrillo, C. M., Chambers, R. G. and Lobell, D. B. (2021), ‘Anthropogenic climate change has slowed global agricultural productivity growth’, *Nature Climate Change* **11**(4), 306–312.
- Osborn, T. J., Jones, P. D. and Joshi, M. (2017), ‘Recent united kingdom and global temperature variations’, *Weather* **72**(11), 323–329.
- Osborn, T. J., Jones, P. D., Lister, D. H., Morice, C. P., Simpson, I. R., Winn, J., Hogan, E. and Harris, I. C. (2021), ‘Land surface air temperature variations across the globe updated to 2019: The crutem5 data set’, *Journal of Geophysical Research: Atmospheres* **126**(2), e2019JD032352.
- Ostry, J., Berg, A. and Tsangarides, C. G. (2014), ‘Redistribution, inequality, and growth’, *Revista de Economía Institucional* **16**(30), 53–81.
- Ostry, J. D., Ghosh, A. R., Kim, J. I., Qureshi, M. S. et al. (2010), *Fiscal space*, International Monetary Fund, Research Department Washington.
- Ostry, M. J. D., Ghosh, M. A. R. and Espinoza, M. R. A. (2015), *When should public debt be reduced?*, International Monetary Fund.
- Paglalunga, E., Coveri, A. and Zanfei, A. (2022), ‘Climate change and within-country inequality: New evidence from a global perspective’, *World Development* **159**, 106030.
- Papke, L. E. and Wooldridge, J. M. (1996), ‘Econometric methods for fractional response variables with an application to 401 (k) plan participation rates’, *Journal of applied econometrics* **11**(6), 619–632.
- Pedersen, D. (2002), ‘Political violence, ethnic conflict, and contemporary wars: broad implications for health and social well-being’, *Social science & medicine* **55**(2), 175–190.
- Perotti, R. (2007), ‘Fiscal policy in developing countries: a framework and some questions’, *World Bank Policy Research Working Paper* (4365).
- Phelps, E. (1961), ‘The golden rule of accumulation: a fable for growthmen’, *The American Economic Review* **51**(4), 638–643.
- Phelps, E. S. (1965), ‘Second essay on the golden rule of accumulation’, *The American Economic Review* **55**(4), 793–814.

- Pickering, A. and Rajput, S. (2018), ‘Inequality and the composition of taxes’, *International tax and public finance* **25**(4), 1001–1028.
- Piketty, T. and Saez, E. (2014), ‘Inequality in the long run’, *Science* **344**(6186), 838–843.
- Polachek, S. W. and Sevastianova, D. (2012), ‘Does conflict disrupt growth? evidence of the relationship between political instability and national economic performance’, *The Journal of International Trade & Economic Development* **21**(3), 361–388.
- Prasad, M. and Deng, Y. (2009), ‘Taxation and the worlds of welfare’, *Socio-economic review* **7**(3), 431–457.
- Prichard, W. (2016), ‘Reassessing tax and development research: a new dataset, new findings, and lessons for research’, *World Development* **80**, 48–60.
- Prichard, W., Cobham, A. and Goodall, A. (2014), ‘The ictd government revenue dataset’, *ICTD Working paper 19*.
- Prichard, W., Salardi, P. and Segal, P. (2018), ‘Taxation, non-tax revenue and democracy: New evidence using new cross-country data’, *World Development* **109**, 295–312.
- Raddatz, C. E. (2009), ‘The wrath of god: macroeconomic costs of natural disasters’, *World Bank working paper*.
- Ramalho, E. A., Ramalho, J. J. and Henriques, P. D. (2010), ‘Fractional regression models for second stage dea efficiency analyses’, *Journal of Productivity Analysis* **34**, 239–255.
- Ramalho, E. A., Ramalho, J. J. and Murteira, J. M. (2011), ‘Alternative estimating and testing empirical strategies for fractional regression models’, *Journal of Economic Surveys* **25**(1), 19–68.
- Ramey, V. A. and Zubairy, S. (2018), ‘Government spending multipliers in good times and in bad: evidence from us historical data’, *Journal of political economy* **126**(2), 850–901.
- Ravallion, M. (2004), *Pro-Poor Growth: A Primer*, Policy Research Working Papers, The World Bank.
- Rodrik, D. (1997), ‘Trade, social insurance, and the limits to globalization’, *International Finance*.
- Ryngaert, J. M. (2022), ‘Inflation disasters and consumption’, *Journal of Monetary Economics* **129**, S67–S81.
- Saez, E. (2004), ‘Reported incomes and marginal tax rates, 1960-2000: evidence and policy implications’, *Tax policy and the economy* **18**, 117–173.

- Sah, R. K. (1983), ‘How much redistribution is possible through commodity taxes?’, *Journal of Public Economics* **20**(1), 89–101.
- Sahn, M. D. E. and Younger, M. S. D. (1999), ‘Dominance testing of social sector expenditures and taxes in africa’, *International Monetary Fund* .
- Sargent, T. J., Wallace, N. et al. (1981), ‘Some unpleasant monetarist arithmetic’, *Federal reserve bank of minneapolis quarterly review* **5**(3), 1–17.
- Schick, A. (2009), ‘Budgeting for fiscal space’, *OECD Journal on budgeting* **9**(2), 1–18.
- Schuknecht, L. (2000), ‘Fiscal policy cycles and public expenditure in developing countries’, *Public Choice* **102**(1), 113–128.
- Schuknecht, L. (2004), ‘Eu fiscal rules: issues and lessons from political economy’, *Available at SSRN 631661* .
- Schwab, B., Janzen, S., Magnan, N. P. and Thompson, W. M. (2020), ‘Constructing a summary index using the standardized inverse-covariance weighted average of indicators’, *The Stata Journal* **20**(4), 952–964.
- Sen, A. (1988), ‘The concept of development’, *Handbook of development economics* **1**, 9–26.
- Siddique, A. B. (2021), ‘Impact of trade on inequality: New evidence of what, when, and where’, *CESifo Economic Studies* **67**(4), 405–439.
- Singh, T. (2010), ‘Does international trade cause economic growth? a survey’, *The World Economy* **33**(11), 1517–1564.
- Skidmore, M. and Toya, H. (2002), ‘Do natural disasters promote long-run growth?’, *Economic inquiry* **40**(4), 664–687.
- Skinner, J. and Mundial, B. (1988), ‘Taxation and output growth in africa’, *World Bank* **73**.
- Solt, F. (2020), ‘Measuring income inequality across countries and over time: The standardized world income inequality database’, *Social Science Quarterly* **101**(3), 1183–1199.
- Stern, N. H. (2007), *The economics of climate change: the Stern review*, cambridge University press.
- Stern, N. and Stiglitz, J. E. (2023), ‘Climate change and growth’, *Industrial and Corporate Change* **32**(2), 277–303.

- Stewart, F. (2008), Horizontal inequalities and conflict: An introduction and some hypotheses, *in* 'Horizontal inequalities and conflict: Understanding group violence in multiethnic societies', Springer, pp. 3–24.
- Stiglitz, J. E. (2006), 'Global public goods and global finance: does global governance ensure that the global public interest is served', *Advancing public goods* **149**, 149–64.
- Stiglitz, J. E. (2015a), 'Inequality and economic growth', *The Political Quarterly* **86**, 134–155.
- Stiglitz, J. E. (2015b), 'Inequality in america: A policy agenda for a stronger future', *The Annals of the American Academy of Political and Social Science* **657**(1), 8–20.
- Stock, J. H. and Watson, M. W. (2007), 'Why has us inflation become harder to forecast?', *Journal of Money, Credit and banking* **39**, 3–33.
- Stockhammer, E. (2015), 'Rising inequality as a cause of the present crisis', *Cambridge Journal of Economics* **39**(3), 935–958.
- Stolper, W. F. and Samuelson, P. A. (1941), 'Protection and real wages', *The Review of Economic Studies* **9**(1), 58–73.
- Strömberg, D. (2007), 'Natural disasters, economic development, and humanitarian aid', *Journal of Economic perspectives* **21**(3), 199–222.
- Sutherland, D. and Hoeller, P. (2014), 'Growth policies and macroeconomic stability', *OECD Economic Policy Papers* .
- Tan, H.-B. and Law, S.-H. (2012), 'Nonlinear dynamics of the finance-inequality nexus in developing countries', *The Journal of Economic Inequality* **10**(4), 551–563.
- Tanzi, V. (1974), 'Redistributing income through the budget in latin america', *PSL Quarterly Review* **26**(108).
- Tanzi, V. and Davoodi, H. (1998), Corruption, public investment, and growth, *in* 'The Welfare State, Public Investment, and Growth: Selected Papers from the 53 rd Congress of the International Institute of Public Finance', Springer, pp. 41–60.
- Tapsoba, M. S. J., Baum, M. A., Kimani, E., Gupta, M. S. et al. (2017), Corruption, taxes and compliance, Technical report, International Monetary Fund.
- Tapsoba, R. (2012), 'Do national numerical fiscal rules really shape fiscal behaviours in developing countries? a treatment effect evaluation', *Economic Modelling* **29**(4), 1356–1369.

- Themnér, L. and Wallensteen, P. (2011), ‘Armed conflict, 1946–2010’, *Journal of peace research* **48**(4), 525–536.
- Tilly, C. et al. (1992), *Coercion, capital, and European states, AD 990-1992*, Blackwell Oxford.
- Timmons, J. F. (2010), ‘Does democracy reduce economic inequality?’, *British Journal of Political Science* **40**(4), 741–757.
- Tobin, J. (1989), *Policies for prosperity: Essays in a Keynesian mode*, MIT Press.
- Tobler, W. R. (1970), ‘A computer movie simulating urban growth in the detroit region’, *Economic geography* **46**(sup1), 234–240.
- Torgler, B. (2003), ‘Tax morale and institutions’, *Crema Working Papers NO. 2003-09*.
- Torgler, B., Schneider, F. and Macintyre, A. (2011), Shadow economy, voice and accountability, and corruption, in ‘Handbook on the shadow economy’, Edward Elgar Publishing.
- Tsai, P.-L. (1995), ‘Foreign direct investment and income inequality: Further evidence’, *World Development* **23**(3), 469–483.
- Tsopmo, P. C., Foudjo, S. I., Elanga, M. J. E. et al. (2022), *Climate vulnerability and government resource mobilization in developing countries*, United Nations University World Institute for Development Economics Research.
- Tübbicke, S. (2022), ‘Entropy balancing for continuous treatments’, *Journal of Econometric Methods* **11**(1), 71–89.
- Van Den Boogaard, V., Prichard, W., Benson, M. S. and Milicic, N. (2018), ‘Tax revenue mobilization in conflict-affected developing countries’, *Journal of International Development* **30**(2), 345–364.
- Vera, L. (2009), ‘Reassessing fiscal policy: perspectives from developing countries’, *Development and Change* **40**(4), 611–643.
- Vergara, D. (2022), ‘Do policies and institutions matter for pre-tax income inequality? cross-country evidence’, *International Tax and Public Finance* pp. 1–23.
- Vinturis, C. (2022), ‘A multi-speed fiscal europe? fiscal rules and fiscal performance in the eu former communist countries’, *Post-Communist Economies* **34**(2), 149–172.
- Walle, d. v. D. (1999), *Public spending and the poor: What we know, what we need to know*, The World Bank.

- Walter, B. F. (2002), *Committing to peace: The successful settlement of civil wars*, Princeton University Press.
- Wang, E. C. and Alvi, E. (2011), ‘Relative efficiency of government spending and its determinants: Evidence from east asian countries’, *Eurasian Economic Review* **1**, 3–28.
- Wenli, L. and Sarte, P.-D. (2004), ‘Progressive taxation and long-run growth’, *American Economic Review* **94**(5), 1705–1716.
- Westlake, M. (1973), ‘Tax evasion, tax incidence and the distribution of income in kenya’, *Eastern Africa Economic Review* **5**(2), 1–27.
- Williams, C. C. and Krasniqi’s, B. (2017), ‘Evaluating the individual-and country-level variations in tax morale: evidence from 35 eurasian countries’, *Journal of Economic Studies* .
- Williams, G. and Hay, R. (2005), Fiscal space and sustainability from the perspective of the health sector, in ‘High-Level Forum on the Health Millennium Development Goal: selected papers, 2003–2005’.
- Wong, S. Y. (2020), ‘Assessment of public expenditure efficiency: A review’, *Journal of Economics and Sustainability (JES)* **2**(2), 27–38.
- Woo, J., Bova, M. E., Kinda, M. T. and Zhang, M. Y. S. (2013), ‘Distributional consequences of fiscal consolidation and the role of fiscal policy: What do the data say?’, *International Monetary Fund* .
- Woodford, M. (1995), Price-level determinacy without control of a monetary aggregate, in ‘Carnegie-Rochester conference series on public policy’, Vol. 43, Elsevier, pp. 1–46.
- Zhao, Q. and Percival, D. (2017), ‘Entropy balancing is doubly robust’.

Résumé français

Essais Sur La Politique Fiscale et le Développement Economique

Les pays en développement font face à de multiples défis qui entravent leurs efforts pour atteindre un développement durable. Ces défis incluent une pauvreté persistante, des inégalités profondément enracinées, une vulnérabilité aux chocs externes tels que les crises économiques et les catastrophes naturelles, les conflits armés, l'insécurité alimentaire, la faible productivité et un taux de chômage élevé. Les conséquences de ces problèmes vont au-delà des dimensions sociales et affectent la santé économique des pays en limitant leur croissance et en entravant la réalisation des objectifs de développement à long terme. Pour répondre à ces contraintes, la politique budgétaire est apparue comme un puissant outil pour les gouvernements, leur permettant de réguler l'activité économique, de promouvoir l'équité sociale et de maintenir la stabilité macroéconomique. La politique budgétaire, telle que définie par (Wong, 2020), englobe les stratégies du gouvernement pour orienter les dépenses et la fiscalité, qui sont au cœur de la gestion des résultats économiques. Cela inclut à la fois l'allocation des ressources et la répartition de la charge fiscale entre les différents segments de la population. En s'appuyant sur les travaux fondateurs de Musgrave (1959), qui définissent les trois fonctions principales de la politique budgétaire — allocation, distribution et stabilisation — les gouvernements peuvent utiliser des mesures fiscales pour répondre à toutes les contraintes. Cependant, pour que la politique budgétaire soit efficace, elle nécessite un espace budgétaire — la capacité nécessaire du gouvernement à ajuster les dépenses ou la fiscalité sans compromettre la soutenabilité de la dette (stabilité financière).

Théoriquement, la fiscalité joue un rôle central — source fiable de financement pour le développement — dans la génération de revenus Burgess et Stern (1993), avec des systèmes fiscaux progressifs reconnus comme particulièrement efficaces pour favoriser un processus de développement économique inclusif Kaldor (1963). Une structure fiscale bien conçue permet aux gouvernements de mobiliser des ressources domestiques, qui peuvent être orientées vers des secteurs critiques tels que la santé, l'éducation et les infrastructures. En général, les pays en développement sont souvent confrontés à de graves limitations dans leur capacité à exploiter pleinement la politique budgétaire en raison d'un manque d'espace budgétaire. Ostry et al. (2010) définit l'espace budgétaire comme l'écart entre le niveau actuel de la dette publique d'un pays et sa limite d'endettement, qui est déterminée par ses performances fiscales historiques et sa capacité à s'ajuster à l'avenir. La disponibilité d'une marge dans le budget d'un gouvernement lui permet de fournir des ressources pour un objectif donné sans compromettre la soutenabilité de sa position financière ou la stabilité de l'économie. De nombreux pays en développement sont contraints de consacrer une part importante de leur budget au service de la dette, laissant peu de marge pour les investissements critiques.

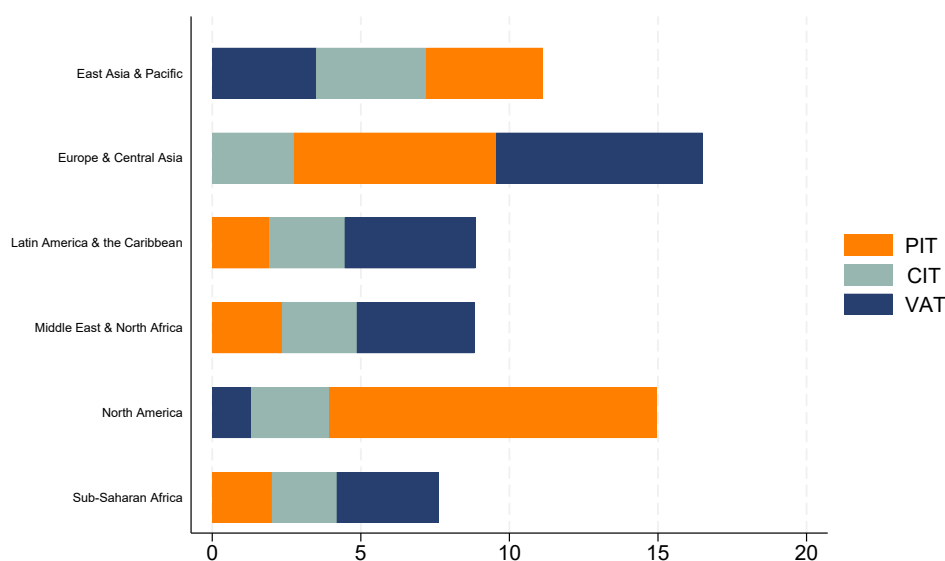
Les réalités fiscales des pays en développement résultent également de défis structurels au sein de leurs économies. Nombre de ces pays ont des bases fiscales faibles, caractérisées par un haut degré d’informalité et une faible conformité fiscale. Comme le souligne [Stiglitz \(2006\)](#), les problèmes de conformité fiscale proviennent souvent de l’évasion fiscale, de l’évitement fiscal et d’une capacité administrative insuffisante. De plus, ([Ostry et al., 2015](#); [Baum et al., 2017](#)) soutiennent que des facteurs structurels expliquent l’absence d’espace budgétaire nécessaire pour mener des politiques contracycliques ou répondre adéquatement aux chocs externes. En général, ces pays font souvent face à des niveaux élevés d’endettement, un accès limité aux marchés internationaux de capitaux et des institutions fiscales faibles. Actuellement, les ressources nécessaires pour financer les Objectifs de Développement Durable (ODD) sont significatives [Mascagni et al. \(2014\)](#), et la capacité des pays avancés à transférer des ressources par le biais de l’aide publique au développement est sévèrement limitée par leurs ratios dette/PIB, qui dépassent en moyenne 100% du PIB et devraient continuer à augmenter.

Historiquement, la littérature sur la politique budgétaire s’est concentrée sur les économies développées, où les règles et cadres budgétaires sont bien établis. Alors que certaines études explorent l’impact de la politique budgétaire dans le monde en développement ([Williams et Hay, 2005](#); [Heller et al., 2006](#); [Perotti, 2007](#); [Vera, 2009](#); [Schick, 2009](#); [Catalano et al., 2020](#); [Ostry et al., 2010](#); [Escolano et Escolano, 2010](#); [Novignon et Nonvignon, 2015](#)), certaines connexions pertinentes aux défis actuels restent sous-explorées. Nous contribuons à la littérature en examinant plusieurs relations macroéconomiques liées aux défis de la politique budgétaire dans ces pays (structure fiscale-inégalité, conflit armé interne-recettes fiscales, efficacité des dépenses publiques-chocs climatiques, règles budgétaires-résultats de développement). Compte tenu des incertitudes liées à l’obtention de financements externes, la mobilisation des recettes domestiques ne devrait pas se faire au détriment des populations vulnérables ou en augmentant les inégalités de revenus. De nombreuses études de l’économie politique montrent que l’augmentation des inégalités est préjudiciable à la durabilité et à la croissance économique [Dabla-Norris et al. \(2015\)](#), au cycle de croissance [Berg et Ostry \(2017\)](#), à la réduction de la pauvreté [Ravallion \(2004\)](#), à la crise financière [Stockhammer \(2015\)](#), à la productivité du travail [Stiglitz \(2015a\)](#), à la stabilité politique et économique [Sutherland et Hoeller \(2014\)](#), et à la résolution des conflits [Bardhan \(2005\)](#). La dépendance aux taxes indirectes contraste fortement avec l’efficacité des taxes directes bien conçues, telles que les impôts sur le revenu des personnes physiques (IRPP). Comme le soutient [Atkinson et Stiglitz \(1976\)](#), les taxes directes, en particulier les IRPP progressifs, sont plus efficaces pour atteindre des objectifs de redistribution, car elles sont structurées pour taxer les individus en fonction de leur capacité à payer. Cette approche garantit que les individus les plus riches contribuent davantage aux finances publiques,

favorisant ainsi l'équité.

La figure ci-dessous présente une vue d'ensemble comparative de la composition fiscale à travers les régions du monde, avec un accent particulier sur l'impôt sur le revenu des personnes physiques (IRPP), l'impôt sur les sociétés (IS), et la taxe sur la valeur ajoutée (TVA). Les données soulignent d'importantes différences régionales dans les structures fiscales. Les régions comme l'Europe et l'Asie centrale, l'Asie de l'Est et le Pacifique, ainsi que l'Afrique subsaharienne montrent une forte dépendance à la TVA, soulignant une préférence pour les taxes basées sur la consommation. En revanche, l'Amérique du Nord repose principalement sur l'IRPP, mettant davantage l'accent sur les impôts sur le revenu, qui sont souvent progressifs. Des études récentes, telles que celles de [Coady et al. \(2015\)](#), confirment le pouvoir redistributif des impôts directs et des transferts de revenus, qui ont réduit les inégalités d'environ un tiers dans les économies avancées.

FIGURE 4.6 : Composition moyenne des taxes de 1980 à 2021 dans le monde : Afrique subsaharienne versus autres régions (construction de l'auteur)



La politique budgétaire peut allouer efficacement les ressources aux secteurs prioritaires, redistribuer les revenus pour réduire les inégalités, et stabiliser l'économie face aux chocs. Compte tenu de ces contraintes - espace budgétaire limité, conflits internes et impact croissant du changement climatique - il est urgent de redéfinir les politiques fiscales pour un développement à long terme dans les pays en développement. Cette thèse se concentre sur quatre problèmes critiques - inégalité des revenus, conflit armé, chocs climatiques et résultats de développement - en raison de leur relation profonde avec l'efficacité de la politique budgétaire.

efficacement contre les inégalités. L'attrait de la fiscalité réside dans sa capacité à fournir un flux continu et fiable de financement pour des initiatives visant à réduire les inégalités. Contrairement à la redistribution sporadique ou limitée, une fiscalité solide offre un flux continu de ressources pouvant être allouées de manière stratégique pour traiter les causes profondes de l'inégalité, telles que l'accès à l'éducation, à la santé et aux services sociaux, et promouvoir un développement équitable. L'inégalité peut également exacerber les tensions sociales et politiques, qui à leur tour peuvent conduire à l'instabilité et aux conflits.

Dans de nombreux pays en développement, en particulier dans la région du Sahel, les conflits armés internes constituent une autre contrainte majeure au développement. La région du Sahel a été dévastée par des conflits récurrents qui ont détruit les économies locales, déplacé des populations et sapé la capacité fiscale. Ces conflits en Afrique, allant des guerres de libération nationale visant à obtenir l'indépendance, aux luttes internes entre groupes rivaux après la décolonisation, ont marqué l'histoire. De plus, de nombreux conflits sont sécessionnistes ou fondés sur l'identité, alimentés par des divisions régionales et ethniques. Les conflits religieux, en particulier ceux impliquant des incursions terroristes en Afrique de l'Ouest (par exemple, au Nigeria, au Mali), ont encore aggravé l'instabilité. Les luttes de pouvoir et les coups d'État sont courants dans les économies de rente, en particulier dans les États caractérisés par de profondes inégalités, une mauvaise gouvernance ou des institutions faibles [Hugon \(2003\)](#).

Plusieurs études ont examiné les impacts et les déterminants des conflits armés dans les pays en développement ([Gupta et al., 2004](#); [Gates et al., 2012](#); [Polachek et Sevastianova, 2012](#); [Pedersen, 2002](#)). Aujourd'hui, l'instabilité persistante a créé un environnement où les gouvernements peinent à maintenir une sécurité efficace, permettant ainsi à des groupes terroristes de fonctionner et de contrôler des territoires. Cette dynamique affaiblit la durabilité fiscale et entrave les efforts de relèvement après conflit. Le conflit ne détruit pas seulement les infrastructures, mais il érode également la capacité des gouvernements à lever des recettes et à allouer les ressources de manière efficiente. [Addison et al. \(2004\)](#) souligne les dimensions fiscales du conflit, notant que les guerres et les conflits civils forcent souvent les gouvernements à détourner des ressources vers les dépenses militaires, au détriment des dépenses orientées vers le développement. La stabilité politique d'un pays est essentielle pour atteindre les Objectifs de Développement Durable (ODD). Nous contribuons à cette littérature en examinant l'effet des conflits armés internes sur les recettes fiscales dans le Sahel et explorons comment les gouvernements peuvent reconstruire et protéger leur espace fiscal dans ce contexte.

Enfin, le changement climatique progresse à un rythme alarmant. Selon le Groupe d'experts intergouvernemental sur l'évolution du climat (GIEC), si les tendances actuelles se poursuivent, les températures

pourraient augmenter de 3 °C ou plus au-dessus des niveaux préindustriels d'ici 2100. Ces changements entraînent des chocs d'offre induits par le climat, qui contribuent à une récession économique mondiale (Stern, 2007) avec des implications fiscales considérables (Lis et Nickel, 2010; Imam et Kpodar, 2022; Barrage, 2020; Fuje et al., 2023).

FIGURE 4.8 : Pluviométrie moyenne dans les pays en développement

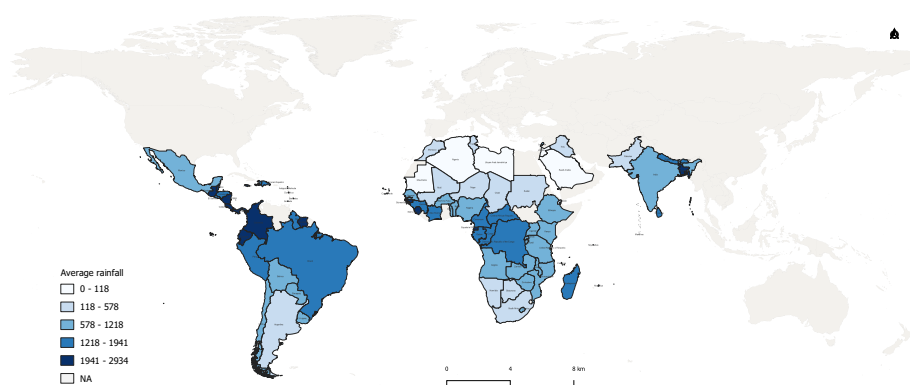
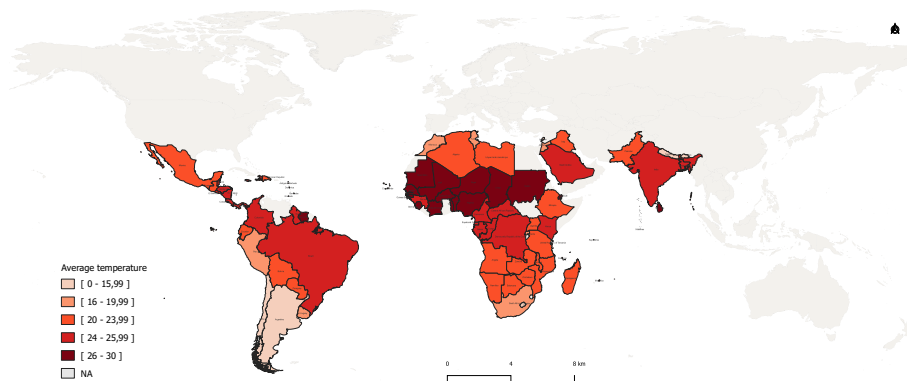


FIGURE 4.9 : Température moyenne dans les pays en développement



Ces figures fournissent une perspective cruciale pour comprendre la variabilité climatique à travers les régions. Les effets du changement climatique, notamment les événements météorologiques extrêmes, les augmentations de température, les inondations et les sécheresses, imposent des charges fiscales significatives aux gouvernements, en particulier dans les pays à faible revenu et vulnérables. [Raddatz \(2009\)](#) et [Acevedo et al. \(2020\)](#) montrent que les chocs climatiques peuvent perturber l'activité économique, réduire la productivité agricole et augmenter les coûts d'infrastructure, entraînant des recettes fiscales plus faibles et des besoins de dépenses publiques plus élevés. Pour les pays en développement, déjà contraints par un espace budgétaire limité, ces chocs peuvent exacerber les vulnérabilités existantes et compromettre les objectifs de développement à long terme.

Cette perspective est cruciale pour comprendre la variabilité climatique à travers les régions. Les effets du changement climatique, notamment les événements météorologiques extrêmes, l'élévation des températures, les inondations et les sécheresses, imposent des charges fiscales considérables aux gouvernements, en particulier dans les pays à faible revenu et vulnérables. [Raddatz \(2009\)](#) et [Acevedo et al. \(2020\)](#) montrent que les chocs climatiques peuvent perturber l'activité économique, réduire la productivité agricole et augmenter les coûts des infrastructures, entraînant ainsi des recettes fiscales plus faibles et des besoins de dépenses publiques plus élevés. Pour les pays en développement, déjà contraints par un espace budgétaire limité, ces chocs peuvent exacerber les vulnérabilités existantes et compromettre les

objectifs de développement à long terme. Nous examinons comment l'efficacité des dépenses publiques peut être améliorée pour atténuer les risques fiscaux associés aux chocs climatiques, et comment la politique budgétaire peut être utilisée pour renforcer la résilience face à ces chocs. Renforcer la résilience budgétaire est essentiel pour garantir la durabilité à long terme des efforts de développement dans un contexte climatique de plus en plus imprévisible.

L'objectif ultime de l'atténuation et de l'adaptation aux défis liés aux inégalités, aux conflits et au climat grâce à la politique budgétaire est de promouvoir un développement durable. Cependant, les résultats en matière de développement dans de nombreux pays restent faibles en raison de la fragilité des institutions fiscales. Dans les nations émergentes et en développement, des défis majeurs subsistent en matière de développement, tels que des taux de mortalité infantile élevés, une faible scolarisation et un accès limité à l'électricité. Par exemple, malgré une réduction de 51% du taux mondial de mortalité des enfants de moins de cinq ans depuis 2000 (UNICEF, 2023), des millions d'enfants meurent encore chaque année avant leur cinquième anniversaire. En ce qui concerne la scolarisation, d'importantes disparités persistent entre les régions. De plus, la Banque mondiale rapporte que près de 770 millions de personnes étaient privées d'accès à l'électricité en 2019, la majorité d'entre elles se trouvant en Afrique subsaharienne. Ce manque d'accès entrave la croissance économique, car une électricité fiable est essentielle pour l'éducation, les soins de santé et le développement des infrastructures.

La politique budgétaire joue un rôle central dans la structuration de ces résultats de développement. Une gestion fiscale efficace est essentielle pour garantir que les ressources publiques soient dirigées vers des secteurs cruciaux. La littérature a montré que des réglementations fiscales solides peuvent améliorer l'efficacité des dépenses publiques, réduire les gaspillages et réorienter les ressources vers des domaines qui stimulent la croissance économique [Apeti et al. \(2023\)](#). Des politiques budgétaires bien conçues aident à maintenir la stabilité macroéconomique en contrôlant l'inflation et en réduisant la volatilité des politiques fiscales, qui sont essentielles pour attirer des investissements privés et favoriser la stabilité économique globale ([Sargent et al., 1981](#); [Woodford, 1995](#)). Les institutions fiscales, en particulier les règles budgétaires, offrent une voie prometteuse pour renforcer la discipline budgétaire et améliorer les résultats de développement dans les pays en développement. En imposant des contraintes claires et à long terme sur les politiques fiscales, ces règles peuvent stabiliser les finances publiques, réduire les déficits budgétaires et contrôler la dette publique [Hemming \(2003\)](#); [Barbier-Gauchard et al. \(2021\)](#). Cette stabilité est cruciale pour créer un environnement propice à une croissance économique durable et au développement à long terme.

Cela dit, une politique budgétaire efficace nécessite l'utilisation appropriée des outils fiscaux, y compris la structure de la fiscalité, les règles budgétaires et les dépenses publiques. Chacun de ces outils joue un rôle crucial dans la structuration des résultats fiscaux et dans la réponse aux défis liés aux inégalités, aux conflits et aux chocs climatiques.

En général, les outils fiscaux examinés soulignent que la structure fiscale est essentielle pour la mobilisation des ressources et la réduction des inégalités de revenus, en particulier dans les pays en développement où les bases fiscales sont souvent étroites, et où le respect des obligations fiscales est faible en raison de l'évasion fiscale, de l'évitement fiscal et d'une capacité institutionnelle limitée. Les règles budgétaires jouent un rôle crucial pour garantir la discipline budgétaire et la stabilité macroéconomique en imposant des contraintes sur l'emprunt public, les dépenses et l'accumulation de dettes ([Kopits et Symansky, 1998](#)). Dans les pays en développement, où l'instabilité politique et économique est fréquente, ces règles aident à stabiliser les finances publiques et à réduire le risque de crises de la dette. Enfin, l'efficacité des dépenses publiques est essentielle pour obtenir de meilleurs résultats en matière de santé, d'éducation et d'infrastructures ([Combes et al., 2023](#)). Dans le contexte du changement climatique, nous explorons comment celui-ci compromet l'efficacité des dépenses publiques et comment elle peut être optimisée pour garantir que les ressources fiscales limitées soient allouées de manière efficace afin de maximiser les bénéfices sociaux et économiques.

Malgré l'abondante littérature sur la politique budgétaire dans les pays développés et en développement, une grande partie des recherches s'est concentrée sur la fiscalité et les inégalités dans les économies avancées, où les cadres fiscaux sont bien établis et l'accès aux marchés de capitaux est plus robuste ([Piketty et Saez, 2014](#); [Alvaredo et al., 2017](#)). En revanche, moins d'attention a été accordée à la façon dont les structures fiscales dans les pays d'Afrique subsaharienne impactent les inégalités. De même, alors que les conflits armés et la capacité fiscale ont été étudiés dans le contexte de la construction de l'État et du financement de la guerre dans les contextes historiques ([Tilly et al., 1992](#)), il existe une pénurie de recherches empiriques sur les conséquences fiscales des conflits modernes dans des régions comme le Sahel. Enfin, les implications fiscales du changement climatique restent un domaine de recherche émergent. Bien qu'il soit de plus en plus reconnu que la résilience au climat est nécessaire dans la gestion des finances publiques, il existe peu de preuves empiriques sur la manière dont le climat affecte l'efficacité des dépenses publiques.

L'objectif de cette thèse est de contribuer au corpus existant de connaissances sur la politique budgétaire dans les pays en développement en examinant l'interaction entre l'espace budgétaire, les inégalités, les conflits armés et les chocs climatiques, ainsi que le rôle crucial des institutions fiscales fortes dans

l'amélioration des résultats de développement. Nous comblons des lacunes importantes en fournissant des éclairages sur la manière dont des cadres fiscaux robustes peuvent être conçus pour atténuer ces défis et favoriser un développement durable. Dans un monde post-COVID-19 marqué par les incertitudes d'une reprise fragile, alimentée par les chocs climatiques et les conflits entre les plus grands producteurs alimentaires mondiaux, la conception des politiques fiscales est cruciale pour assurer une reprise économique durable.

Fondements Théoriques

Les fondements théoriques de cette thèse sont multi-facettes, s'appuyant sur des théories économiques clés pour explorer le rôle de la politique budgétaire dans la résolution des problèmes pressants tels que les inégalités, les conflits et le changement climatique dans les pays en développement. Au cœur de ces fondements se trouvent les trois fonctions de la politique budgétaire de Musgrave—allocation, distribution et stabilisation [Musgrave \(1959\)](#). Ces fonctions forment la base de la compréhension des mécanismes fiscaux qui peuvent être adaptés aux défis uniques auxquels sont confrontés les nations à faible revenu.

La fonction d'allocation met en avant le devoir de l'État de fournir des biens publics, tels que les soins de santé, les infrastructures et l'éducation, que le marché sous-fournit souvent. Cette fonction devient particulièrement cruciale dans les régions vulnérables aux chocs externes, car il incombe à l'État de s'assurer que les systèmes fondamentaux de la société restent robustes. La fonction de distribution se concentre sur la réduction des inégalités par le biais de la fiscalité progressive et des politiques redistributives. En s'appuyant sur les travaux pionniers de ([Kaldor, 1963](#); [Piketty et Saez, 2014](#)), cette thèse postule que les systèmes fiscaux progressifs sont essentiels pour aborder les inégalités profondément enracinées qui freinent la croissance inclusive. En garantissant que les plus riches contribuent de manière équitable, la politique budgétaire peut redistribuer les ressources de manière à promouvoir le bien-être de la société dans son ensemble, réduire la pauvreté et stimuler une croissance économique inclusive.

Pendant ce temps, la fonction de stabilisation prend une place centrale dans des environnements où l'instabilité économique, les crises de la dette et l'inflation sont élevées, en particulier dans les pays en développement confrontés au changement climatique et aux conflits. La politique budgétaire, lorsqu'elle est bien gérée, peut être une force stabilisatrice puissante. Cette thèse s'appuie sur les cadres (néo)Keynésiens et (néo)Classiques, tels que ceux avancés par ([Phelps, 1961, 1965](#); [Tobin, 1989](#)), qui soulignent que la politique budgétaire optimale ne peut non seulement stabiliser les économies en crise, mais aussi favoriser la croissance à long terme en soutenant des investissements à haute productivité qui « attirent » l'activité du secteur privé. Ainsi, des dépenses publiques bien orientées non seulement augmentent la demande

immédiate, mais peuvent aussi transformer les dynamiques structurelles au sein de l'économie, stimulant ainsi le développement durable.

Nous mettons également l'accent sur les implications fiscales des chocs liés au climat, tels que les événements météorologiques extrêmes, l'élévation du niveau de la mer et les sécheresses prolongées. Ces événements obligent les gouvernements à réallouer des fonds publics vers des besoins urgents, tels que les secours en cas de catastrophe, la reconstruction des infrastructures et l'adaptation au climat. Le changement climatique, en tant qu'externalité négative classique, illustre comment les échecs du marché se produisent lorsque les coûts environnementaux des activités (comme les émissions) ne sont pas supportés par ceux qui en sont responsables, mais par la société dans son ensemble. Les théories des biens publics et des externalités offrent une justification convaincante pour l'intervention du gouvernement par des politiques fiscales ciblées afin de corriger ces déséquilibres (Noy, 2009; Aligishiev et al., 2022).

La réallocation des ressources fiscales vers la résilience et l'adaptation au climat, bien que critique, soulève des défis complexes concernant la durabilité à long terme des finances publiques. Les politiques fiscales efficaces doivent naviguer entre les pressions croissantes d'augmenter les dépenses pour l'adaptation au climat et le maintien de la stabilité financière, offrant un chemin stratégique aux gouvernements pour protéger les populations vulnérables contre les pires effets du changement climatique tout en garantissant la résilience économique future.

Concernant la théorie de l'économie politique des conflits, cette thèse s'appuie sur les travaux influents de (Bardhan, 2005; Tilly et al., 1992) pour explorer comment les conflits internes épuisent la capacité fiscale et entravent le développement. Les conflits, souvent alimentés par les inégalités économiques et les faiblesses institutionnelles, créent un cercle vicieux où les ressources sont détournées des investissements productifs dans les biens publics—tels que l'éducation et les infrastructures—vers les dépenses militaires et la gestion des conflits. Cela non seulement étouffe la croissance, mais affaiblit également la capacité de l'État à générer des revenus et à fournir des services essentiels.

Enfin, les fondements théoriques sur les institutions fiscales et leur impact sur les résultats en matière de développement se concentrent sur le rôle des règles budgétaires dans la promotion de la stabilité macroéconomique et de la croissance à long terme. La discipline budgétaire, obtenue grâce à des règles qui limitent l'emprunt et les dépenses, améliore la crédibilité des gouvernements, réduit le risque de mauvaise gestion fiscale et renforce les institutions économiques (North, 1990; Alesina et al., 1996; Kopits et Symansky, 1998). Ces règles, lorsqu'elles sont bien conçues, créent un environnement stable pour

les investissements privés et l'efficacité des dépenses publiques, essentiels pour un développement durable.

Ce modèle explique comment les ressources sont détournées des investissements productifs, exacerbant ainsi l'instabilité et érodant encore plus la stabilité fiscale. De plus, la théorie des inégalités horizontales avancée par [Stewart \(2008\)](#) montre comment l'accès inégal aux ressources entre les groupes ethniques ou régionaux agit souvent comme un précurseur aux conflits, nécessitant des politiques fiscales qui promeuvent l'équité et l'inclusivité.

Enfin, la fondation théorique sur les institutions fiscales et leur impact sur les résultats en matière de développement se concentre sur le rôle des règles budgétaires dans la promotion de la stabilité macroéconomique et de la croissance à long terme. La discipline budgétaire, atteinte par des règles qui restreignent l'emprunt et les dépenses, améliore la crédibilité des gouvernements, réduit le risque de mauvaise gestion fiscale, et renforce les institutions économiques ([North, 1990](#); [Alesina et al., 1996](#); [Kopits et Symansky, 1998](#)). Ces règles, lorsqu'elles sont bien conçues, créent un environnement stable pour les investissements privés et l'efficacité des dépenses publiques, qui sont essentiels pour un développement durable. En fournissant un cadre qui limite les politiques fiscales opportunistes, les règles budgétaires contribuent à la stabilité macroéconomique, favorisant une plus grande transparence et prévisibilité dans les finances publiques. Cette thèse postule que les règles budgétaires, en favorisant la discipline budgétaire, jettent les bases de résultats de développement résilients et à long terme.

Contributions de la recherche

La contribution principale de cette thèse réside dans son analyse approfondie de la manière dont des politiques fiscales bien conçues peuvent favoriser le développement économique à long terme, en particulier dans les pays en développement. Nous avons identifié et étudié les canaux par lesquels des politiques fiscales saines peuvent favoriser un développement durable. La thèse examine l'impact des instruments fiscaux désagrégés sur les inégalités de revenus, fournissant de nouvelles perspectives sur la manière dont la conception de la structure fiscale influence l'équité économique. En outre, la thèse explore les implications fiscales des conflits armés internes et la manière dont ces conflits sapent la capacité des gouvernements à mobiliser des recettes domestiques. Cette analyse éclaire les dimensions fiscales des conflits, en montrant que la bonne gouvernance et les réformes institutionnelles sont essentielles pour renforcer la capacité fiscale des États touchés par les conflits, notamment au Sahel.

De plus, nous explorons les chocs climatiques et leur effet sur l'efficacité des dépenses publiques. Les

résultats soulignent l'importance d'intégrer la résilience climatique dans les cadres fiscaux pour protéger l'efficacité des dépenses publiques face à une volatilité climatique croissante. Une autre contribution clé est l'exploration de la relation causale entre les règles budgétaires et les résultats en matière de développement, démontrant que la discipline budgétaire, en particulier grâce aux règles de dépenses, conduit à des améliorations tangibles dans les infrastructures, l'éducation et les soins de santé.

En employant des méthodes empiriques avancées, l'étude fournit des résultats robustes qui sont significatifs sur le plan économique et résistants à diverses spécifications de modélisation. Elle révèle également des hétérogénéités et des non-linéarités dans ces effets, façonnées par les conditions macroéconomiques uniques et les cadres institutionnels des pays en développement. Ces résultats offrent des orientations pratiques aux décideurs politiques, montrant comment des politiques fiscales efficaces peuvent améliorer le développement tout en répondant aux défis externes tels que le changement climatique et les conflits armés.

Chapitre 1 : Comment la structure fiscale affecte-t-elle les inégalités de revenus ? Preuves empiriques en Afrique subsaharienne

Au cours des dernières décennies, la fiscalité a émergé comme un instrument crucial non seulement pour financer le développement à long terme, mais aussi pour influencer la répartition des revenus. Ce chapitre explore l'impact des structures fiscales sur les inégalités de revenus dans 30 pays d'Afrique subsaharienne de 2000 à 2017. En se concentrant sur les instruments fiscaux individuels, l'analyse utilise à la fois la méthode des moindres carrés avec effets fixes (LSDV) et l'approche à deux étapes des variables instrumentales (2SLS) pour garantir la robustesse des estimations.

Les résultats d'une série complète de tests économétriques et de spécifications alternatives révèlent que l'impôt sur le revenu des personnes physiques est le seul instrument fiscal qui réduit efficacement les inégalités de revenus dans la région. En revanche, d'autres impôts, tels que les taxes indirectes et les prélèvements liés au commerce, ne montrent pas le même impact redistributif. De plus, l'analyse souligne que la qualité institutionnelle et la protection des droits de propriété sont des éléments critiques pour favoriser un environnement propice à la réduction des inégalités. Cependant, l'efficacité de la progressivité fiscale est réduite dans les pays gouvernés par des régimes militaires et où les conflits ethniques sont fréquents, suggérant que les facteurs politiques et sociaux influencent de manière significative les résultats des politiques fiscales.

Pour les décideurs politiques, ces résultats soulignent la nécessité de privilégier des systèmes fiscaux progressifs, en particulier l'impôt sur le revenu des personnes physiques, comme l'outil le plus efficace pour lutter contre les inégalités. De plus, le renforcement des cadres institutionnels et la garantie de la stabilité politique sont essentiels pour maximiser le potentiel redistributif des politiques fiscales. En fin de compte, ce chapitre souligne que la conception de la structure fiscale importe et que des politiques fiscales équitables, efficaces et socialement cohésives sont indispensables pour atteindre l'Objectif de développement durable 10.

Chapitre 2 : Conflit armé et capacité fiscale au Sahel : une approche empirique

Ce chapitre explore l'impact des conflits armés internes sur la mobilisation des recettes fiscales dans la région du Sahel. La génération de revenus domestiques est une source clé de financement des Objectifs de développement durable (ODD), fournissant aux pays les ressources nécessaires pour construire des institutions fonctionnelles, améliorer la gouvernance et réduire la dépendance à l'aide étrangère. Avec un financement externe insuffisant pour répondre aux besoins massifs nécessaires à l'atteinte des ODD, les gouvernements doivent de plus en plus compter sur la collecte de revenus internes, principalement par la fiscalité. Cependant, dans de nombreux pays sahéliens, les conflits armés récurrents ont gravement compromis la capacité de mobiliser des recettes fiscales. Ces conflits, souvent alimentés par des griefs ethniques et régionaux, des luttes de pouvoir et l'extraction des ressources naturelles, créent un environnement où la collecte d'impôts devient de plus en plus difficile.

En utilisant des données de 10 pays du Sahel de 2000 à 2021, cette étude applique plusieurs techniques économétriques, notamment la méthode des moindres carrés ordinaires Driscoll-Kraay (OLS), des méthodes à effets fixes, des variables instrumentales à deux étapes (2SLS) et des projections locales. Les résultats révèlent un effet négatif significatif des conflits armés internes sur la collecte fiscale. Plus précisément, les conflits armés affaiblissent la base fiscale, réduisent l'activité économique et affaiblissent la capacité des gouvernements à mobiliser des ressources. Malgré ces défis, l'analyse montre que certains facteurs peuvent atténuer les effets négatifs du conflit sur les recettes fiscales. Une qualité institutionnelle solide et les avancées dans les technologies de l'information et de la communication (TIC) jouent un rôle positif dans l'amélioration de la mobilisation des recettes fiscales.

En conclusion, alors que les pays du Sahel s'efforcent de parvenir à un développement durable, une fiscalité efficace reste cruciale. Cependant, les conflits en cours dans la région présentent des obstacles importants qui compromettent la mobilisation des recettes fiscales. Pour surmonter ces défis, il est néces-

saire de mener des réformes institutionnelles globales, y compris l'amélioration des cadres de gouvernance et la modernisation des systèmes d'administration fiscale. Les investissements dans les technologies sont essentiels pour renforcer la capacité des autorités fiscales et améliorer la collecte des revenus, en particulier dans les zones touchées par les conflits. De plus, les partenaires internationaux et les donateurs ont un rôle crucial à jouer en soutenant ces efforts par l'apport d'expertise technique et d'une assistance financière. Grâce à une combinaison de soutien externe et de réformes domestiques, les pays du Sahel peuvent surmonter les défis fiscaux posés par les conflits.

Chapitre 3 : Efficience des dépenses publiques face aux chocs climatiques : Comment les chocs climatiques affectent-ils l'efficience des dépenses publiques dans les pays en développement ?

Ce chapitre explore la relation complexe entre le changement climatique et l'efficience des dépenses publiques dans les pays en développement. En utilisant un ensemble de données complet couvrant 35 pays de 2000 à 2019, nous employons à la fois une analyse de frontière stochastique et des régressions logit et probit fractionnelles pour évaluer comment les chocs climatiques — tels que les fluctuations extrêmes de température et les précipitations irrégulières — influencent l'efficience des dépenses publiques. Les résultats révèlent que le changement climatique compromet significativement l'allocation efficiente des fonds publics, en particulier dans les régions qui souffrent déjà d'une capacité fiscale limitée. De plus, nos résultats indiquent que les chocs liés aux précipitations et aux températures exacerbent ces inefficiences, rendant la gestion budgétaire plus complexe et intensifiant le défi de parvenir à un développement durable.

L'imprévisibilité croissante des incidents climatiques entraîne un changement des priorités gouvernementales, souvent en détournant les fonds des secteurs essentiels tels que l'éducation et la santé vers des efforts immédiats de secours en cas de catastrophe et de reconstruction des infrastructures. Ce réaffectation des fonds tend à contraindre les budgets publics et à réduire l'efficience des dépenses, en particulier dans les économies disposant d'une faible capacité d'absorption. En conséquence, les gouvernements sont souvent contraints de choisir entre des objectifs de développement à long terme et des stratégies d'adaptation climatique à court terme, un dilemme qui peut nuire à l'efficience budgétaire globale.

Ces chocs économiques déstabilisent non seulement les budgets publics, mais réduisent aussi l'efficience des dépenses publiques en forçant les gouvernements à allouer davantage de ressources aux efforts de mitigation et de relèvement, souvent au détriment des services sociaux vitaux. Nos résultats soulignent l'urgence pour les gouvernements d'intégrer la résilience climatique dans leurs stratégies de gestion des finances publiques. Pour atteindre une durabilité à long terme, les pays en développement doivent adop-

ter des mesures fiscales proactives qui équilibrent la réponse immédiate aux chocs climatiques avec des investissements dans des secteurs critiques comme l'éducation, la santé et les infrastructures. Renforcer les capacités institutionnelles, améliorer la gouvernance fiscale et construire des infrastructures résilientes au climat sont des étapes clés pour améliorer l'efficacité des dépenses publiques et maintenir les progrès vers un développement durable.

Chapitre 4 : Discipline budgétaire et résultats en matière de développement : Preuves empiriques des règles fiscales

Ce chapitre examine si les règles fiscales, en renforçant la discipline budgétaire, ont contribué à améliorer les résultats en matière de développement dans les pays en développement. En s'appuyant sur des approches d'équilibrage entropique et de variables instrumentales, nous examinons l'impact causal de l'adoption de règles fiscales sur des indicateurs clés du développement — notamment les infrastructures, la santé et l'éducation — dans un échantillon de 110 pays en développement sur la période de 1990 à 2019. Les résultats montrent que les pays dotés de règles fiscales ont tendance à obtenir de meilleurs résultats en matière de développement comparativement à ceux qui n'ont pas de tels cadres, notamment dans des domaines critiques tels que la mortalité infantile, le taux de scolarisation et l'accès à l'électricité.

Notamment, il a été constaté que les pays ayant des règles fiscales avaient en moyenne un taux de mortalité infantile inférieur de 1,4 point de pourcentage par rapport à ceux sans règles fiscales. L'impact est particulièrement prononcé dans les pays à faible revenu, où le potentiel d'amélioration est plus grand. De plus, parmi les différents types de règles fiscales, les règles relatives aux dépenses ont l'effet positif le plus significatif sur les résultats en matière de développement, surpassant les règles relatives à la dette et au budget équilibré. Cela suggère que les règles fiscales qui ciblent directement l'allocation des dépenses sont plus efficaces pour orienter les ressources vers des biens publics essentiels comme l'éducation, les soins de santé et les infrastructures, améliorant ainsi le bien-être social.

En outre, ces résultats montrent que les règles fiscales contribuent à de meilleurs résultats en matière de développement en améliorant l'efficacité des dépenses publiques et en favorisant la stabilité macroéconomique. Ces règles aident les gouvernements à éviter les dépenses inefficaces, à allouer les ressources de manière plus efficace et à réduire la volatilité budgétaire, créant ainsi un environnement plus stable pour les investissements à long terme dans les infrastructures sociales et économiques. Les résultats soulignent l'importance à la fois de la discipline budgétaire et de règles fiscales bien conçues pour garantir que les ressources limitées soient utilisées efficacement pour atteindre les objectifs de développement.

Essays on Fiscal Policy and Economic Development

Essais sur la politique fiscale et le développement économique

Résumé :

Cette thèse explore les mécanismes par lesquels la politique budgétaire peut favoriser un développement durable et inclusif, en mettant l'accent sur les structures fiscales, les règles budgétaires, l'efficacité des dépenses publiques et les implications fiscales posés par les chocs climatiques et les conflits armés. À travers une analyse empirique utilisant des méthodes économétriques avancées, nous mettons en évidence comment des cadres fiscaux bien conçus, appuyés par des institutions solides, peuvent favoriser la stabilité macroéconomique, réduire les inégalités et améliorer les résultats en matière de développement. Le premier chapitre analyse l'impact des structures fiscales sur les inégalités de revenus. Il révèle que l'impôt sur le revenu des personnes physiques est l'instrument le plus efficace pour réduire les inégalités, en particulier lorsque le système fiscal est soutenu par des institutions robustes. Les résultats soulignent l'importance de réformes fiscales qui favorisent l'équité sans compromettre la collecte des recettes. Le second chapitre examine les défis fiscaux auxquels sont confrontés les pays du Sahel en proie à des conflits armés internes. L'étude révèle que les conflits affaiblissent la capacité des gouvernements à mobiliser des recettes fiscales, réduisant ainsi les ressources disponibles pour les dépenses publiques essentielles. Dans le troisième chapitre, l'impact des chocs climatiques sur l'efficacité des dépenses publiques est exploré. Les résultats montrent que les changements climatiques compromettent l'efficacité des dépenses publiques. Le chapitre souligne l'urgence d'intégrer la résilience climatique dans les cadres fiscaux pour maintenir une gestion efficace des dépenses publiques, même face à des crises environnementales croissantes. Enfin, le dernier chapitre s'intéresse à l'impact des règles budgétaires sur les résultats en matière de développement. L'étude démontre que les pays ayant adopté des règles budgétaires obtiennent de meilleurs résultats en matière de santé, d'éducation et d'infrastructures. Ces règles renforcent la discipline budgétaire, ce qui permet une allocation plus efficace des ressources publiques et contribue au développement à long terme. Cette thèse fournit des indications précieuses sur la manière dont la politique fiscale peut être un outil puissant pour relever les défis clés tout en favorisant le développement durable.

Mots clés : Politique Budgétaire, Inégalités de Revenus, Règles Budgétaires, Chocs Climatiques, Mobilisation des Recettes fiscales, Efficacité des Dépenses Publiques, Conflits Internes Armés, Résilience Climatique, Développement Inclusif, Résultats de Développement, Institutions, Pays en développement, Analyse d'Impact.

Abstract :

This thesis explores the mechanisms by which fiscal policy can foster sustainable and inclusive development in developing countries, with a focus on tax structures, fiscal rules, public spending efficiency, and the fiscal implications of climate shocks and armed conflicts. Through in-depth empirical analysis utilizing advanced econometric methods, this research highlights how well-designed fiscal frameworks, supported by strong institutions, can promote macroeconomic stability, reduce inequality, and improve development outcomes. The first Chapter analyzes the impact of tax structures on income inequality in Sub-Saharan African countries. The analysis reveals that progressive personal income tax is the most effective instrument for reducing inequality, especially when the tax system is supported by robust institutions. The findings emphasize the importance of tax reforms that promote equity without compromising internal resource mobilization. The second examines the fiscal challenges faced by Sahel countries affected by armed conflicts. The study reveals that conflicts weaken governments' capacity to mobilize tax revenues, thus reducing the resources available for essential public spending. In chapter three, we explore the impact of climate shocks on public spending efficiency. The findings show that climate change undermines the efficiency of public spending. The chapter emphasizes the urgency of integrating climate resilience into fiscal frameworks to ensure effective public spending management, even in the face of growing environmental crises. Finally, chapter four focuses on the impact of fiscal rules on development outcomes in developing countries. The study demonstrates that countries adopting stringent fiscal rules achieve better outcomes in sectors such as health, education, and infrastructure. These rules strengthen fiscal discipline, allowing for more efficient allocation of public resources, thereby contributing to long-term development. This thesis provides valuable insights into how fiscal policy can be a powerful tool in addressing the key challenges, while fostering sustainable development.

Keywords : Fiscal Policy, Income Inequality, Fiscal Rules, Climate Shocks, Domestic Resource Mobilization, Public Spending Efficiency, Internal Armed Conflicts, Climate Resilience, Inclusive Development, Development Outcomes, Institutions, Developing Countries, Causal Impact Analysis.