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NATURAL RESOURCE GOVERNANCE, DEVELOPMENT FINANCING, AND PUBLIC DEBT DYNAMICS IN DEVELOPING COUNTRIES

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À mes parents, Rasmané Pafadnam et Lydie Nonguierma
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Résumé

Cette thèse examine comment l'amélioration de la gouvernance dans la gestion des ressources naturelles affecte la situation macroéconomique dans les pays en développement, et explore l'évolution de la dette publique dans les pays africains au cours des deux dernières décennies. Elle s'appuie sur des méthodes économétriques avancées pour tester nos hypothèses, tout en analysant de manière empirique les mécanismes économiques qui sous-tendent ces résultats. En outre, ce document aborde les implications politiques découlant des principaux résultats.

Le [Chapitre 1](#) évalue les effets dynamiques de la mise en œuvre de l'Initiative pour la Transparence dans les Industries Extractives (ITIE) sur la mobilisation des recettes tirées des ressources naturelles. À partir d'un échantillon de 83 pays en développement couvrant la période 1995-2019, notre approche empirique s'appuie sur l'estimateur dynamique de la méthode de différences-en-différences robuste à l'hétérogénéité. Les résultats montrent que la mise en œuvre de l'ITIE augmente la part des recettes issues des ressources naturelles dans le Produit Intérieur Brut (PIB) des pays membres comparativement aux non-membres. Cette étude met en évidence la contribution significative de la mise en œuvre de l'ITIE à la mobilisation des recettes extractives en particulier et des recettes domestiques en général.

Le [Chapitre 2](#) examine comment la mise en œuvre de l'ITIE affecte la croissance économique. En considérant un échantillon de 99 pays en développement sur la période 1995-2019 et en utilisant l'estimateur dynamique de la méthode de différences-en-différences robuste à l'hétérogénéité, nous avons mis en évidence une relation positive et statistiquement significative entre la mise en œuvre de l'ITIE et la croissance économique. Plus intéressant encore, l'analyse des effets dynamiques de l'ITIE révèle que ces effets ne se manifestent qu'à court et moyen terme. Enfin, nous avons émis et examiné quatre explications possibles aux résultats mitigés de l'ITIE sur la croissance à long terme.

Le [Chapitre 3](#) analyse la relation entre la mise en œuvre de l'ITIE et le ratio dette publique/PIB. Nous utilisons un panel de 69 pays en développement dépendants des ressources naturelles couvrant la période 1995-2021, et notre stratégie empirique repose sur l'estimateur dynamique de la méthode de

différences-en-différences robuste à l'hétérogénéité. Le principal résultat est que la mise en œuvre de l'ITIE réduit le ratio de la dette publique par rapport au PIB, grâce à l'amélioration du climat d'investissement, à l'augmentation des recettes tirées des ressources et des recettes totales, à la hausse des investissements directs étrangers et des investissements privés domestiques, ainsi qu'à une meilleure croissance économique. Bien que l'ITIE ne soit pas une panacée pour mettre fin au surendettement, cette étude apporte des preuves que l'ITIE est une politique efficace pouvant aider à réduire les vulnérabilités liées à l'endettement dans les pays en développement dépendants des ressources naturelles.

Le [Chapitre 4](#) examine l'évolution de la dynamique de la dette publique dans les pays africains entre 2000 et 2023. Premièrement, sur la base de données quantitatives et historiques portant sur 39 pays africains, les principaux résultats suggèrent que ces pays ont connu des épisodes de stabilisation et de consolidation de la dette, même en dehors des épisodes de restructuration de la dette. Ensuite, une décomposition comptable met en évidence l'importance de la stabilité macroéconomique dans les épisodes de stabilisation et de consolidation de la dette, caractérisés par une forte croissance, des finances publiques saines, un taux de change relativement stable et bien aligné, ainsi que des ajustements des flux de stocks limités. De plus, nous appliquons la méthode de régression logistique et les résultats suggèrent qu'un environnement extérieur favorable et des politiques publiques nationales ont contribué tous deux à la réduction du ratio dette publique/PIB au cours de ces épisodes.

Keywords: Ressources naturelles · Malédiction des ressources · Gouvernance · Transparence des industries extractives · Recettes tirées des ressources · Croissance économique · Dette publique · Consolidation de la dette · Économétrie appliquée · Effets de traitement hétérogènes et dynamiques.

Codes JEL: C22, F34, G38, H63, O11, O13, O19, O43, Q32, Q38.

Abstract

This thesis examines how improving governance in natural resource management affects the macroeconomic situation in developing countries and explores the evolution of public debt in African countries over the past two decades. It draws on advanced econometric methods to test our hypotheses, while empirically analyzing the economic mechanisms underlying these results. In addition, this paper addresses the policy implications arising from the main findings.

[Chapter 1](#) assesses the dynamic effects of the implementation of the Extractive Industries Transparency Initiative (EITI) on natural resource revenue mobilization. Using a sample of 83 developing countries covering the period 1995–2019, our empirical approach relies on the dynamic heterogeneity-robust difference-in-differences estimator. The results show that implementing the EITI increases, on average, the share of natural resource revenue in the gross domestic product (GDP) in developing member countries compared to non-member countries. This study highlights the significant contribution of EITI implementation to the mobilization of extractive revenues in particular and domestic revenues in general.

[Chapter 2](#) examines how EITI implementation affects economic growth. By considering a sample of 99 developing countries over the period 1995–2019 and applying heterogeneity-robust difference-in-differences (DID) estimators, we found a positive and statistically significant relationship between EITI implementation and economic growth. More interestingly, the analysis of the EITI's dynamic effects reveals that these effects occur only in the short and medium terms. Finally, we postulate and investigate four possible explanations behind the EITI's mixed results on long-term growth.

[Chapter 3](#) analyzes the relationship between EITI implementation and the public debt-to-GDP ratio. We use a panel of 69 natural resource-dependent developing countries from 1995 to 2021, and our empirical strategy relies on the dynamic heterogeneity-robust difference-in-

differences estimator. The main finding is that implementing the EITI reduces the government debt-to-GDP ratio, thanks to an improved investment climate, increased resource revenues and total revenues, higher foreign direct investment and domestic private investment, and enhanced economic growth. Although the EITI is not a panacea for breaking the debt overhang, this study provides evidence that the EITI is an effective policy for reducing indebtedness vulnerabilities in natural resource-dependent developing countries.

[Chapter 4](#) explores the evolution of public debt dynamics in the region between 2000 and 2023. First, using quantitative and historical data from 39 African countries, the main findings suggest that these countries experienced episodes of debt stabilization and consolidation, even outside of debt restructuring episodes. Second, an accounting decomposition highlights the importance of macroeconomic stability during these episodes, characterized by strong growth, sound public finances, a relatively stable and well-aligned exchange rate, and limited stock-flow adjustments. Moreover, we apply a logistic regression method, and the results suggest that both a supportive external environment and domestic public policies contributed to the reduction in the public debt-to-GDP ratio during these episodes.

Keywords: Natural resources · Resource curse · Governance · Extractive industries transparency · Resource revenue · Economic growth · Government public debt · Debt consolidation · Applied econometrics · Heterogeneous and dynamic treatment effects

JEL Codes: C22, F34, G38, H63, O11, O13, O19, O43, Q32, Q38.

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CHAPTER 0

General Introduction

0.1 Development financing challenges in developing countries

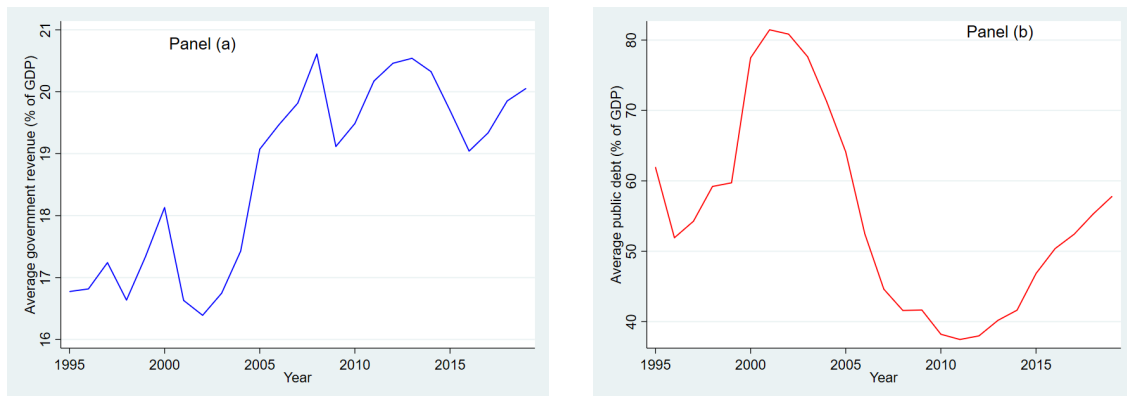
Many developing countries face important challenges in financing economic development while maintaining macroeconomic stability ([United Nations, Inter-agency Task Force on Financing for Development, 2026](#)). To achieve sustained economic growth, these countries require large and long-term investments in public infrastructure and human capital (education, health). Indeed, public infrastructure plays a central role in supporting productivity and long-term growth ([Aschauer, 1989](#); [Calderón and Servén, 2010](#)), and human capital accumulation also represents a key driver of economic growth ([Barro, 1991](#); [Bloom et al., 2004](#)). Moreover, climate change has recently emerged as a major source of fiscal pressure for developing countries because increased exposure to climate-related shocks increases the need for adaptation and resilience-building investments ([Kahn et al., 2021](#); [United Nations Environment Programme, 2025](#)).

However, while developing countries face substantial spending needs, the capacity of governments to finance these investments through domestic resources remains limited. The literature has shown that developing countries have weak domestic revenue mobilization, as they typically rely on narrow tax bases, high levels of informality, and weak tax administration ([Knack, 2009](#); [Gordon and Li, 2009](#); [McGuirk, 2013](#); [Besley and Persson, 2014](#); [Mascagni and Nell, 2022](#)). These structural constraints are exacerbated by a significant decline in official development assistance and foreign direct investment in recent years, and by limited access to affordable external financing, particularly when global financial conditions tighten ([United Nations, Inter-agency Task Force on Financing for Development, 2026](#); [International Monetary Fund. Strategy, Policy, and Review Department, 2026](#)). Consequently,

these conditions lead to persistent gaps between the unlimited needs for development spending and the limited budgetary resources available.

Public debt has become a central feature of development financing strategies across developing countries (World Bank, 2025). On the one hand, borrowing can support economic growth by allowing governments to smooth expenditures and finance productive public investment when domestic revenues are insufficient (Presbitero, 2012). On the other hand, a large part of the literature has provided empirical evidence that rising debt levels increasingly generate concerns about debt sustainability and fiscal vulnerability, particularly beyond some thresholds (Reinhart and Rogoff, 2010b; Checherita-Westphal and Rother, 2012). Indeed, in recent years, many developing countries have experienced sharp increases in debt-to-GDP ratios, increased interest payments on debt, and a progressive erosion of fiscal space.

Figure 1: Average government revenue and public debt in developing countries, 1995-2019



Source: Author's construction based on data from UNU-WIDER Government Revenue Dataset and IMF World Economic Outlook.

Panels (a) and (b) of Figure 1 provide a descriptive illustration of these financing constraints. Average government revenue increased after the early 2000s, but remained broadly confined within a relatively narrow range as a share of GDP (on average, between 17% and 21%). By contrast, after a period of decline in the early 2000s, public debt exhibited a renewed upward trend after 2012, highlighting the growing reliance on debt-financed development strategies in a context of limited domestic revenue mobilization.

As a result, these high debt ratios and interest payments have reduced developing countries' ability to finance urgent development needs. Indeed, these dynamics are particularly problematic because high debt servicing obligations tend to crowd out productive public spending, limiting governments' ability to invest in public

infrastructure, human capital, and climate resilience ([World Bank, 2025](#)). The theory of debt overhang suggests that excessive debt acts as a tax on future investment by discouraging both public and private investment, thereby undermining growth prospects ([Krugman, 1988](#); [Sachs, 1990](#)). Consequently, the renewed buildup of public debt in developing countries has intensified policy concerns about governments' ability to reconcile ambitious development objectives with macroeconomic stability and long-term debt sustainability.

At the same time, many developing countries are endowed with large natural resources. In principle, these abundant natural resources could help relax financing constraints as their exploitation should generate substantial revenues and foreign exchange earnings. Indeed, as shown by theoretical and empirical analyses, natural resource rents can expand fiscal space by increasing government revenues, improving the current account, and reducing dependence on external borrowing ([Auty, 2002](#); [Sachs and Warner, 1995](#)). Through the rents provided, resource wealth could enable governments to finance public investment and smooth consumption over time and even accumulate savings in stabilization or sovereign wealth funds to help preserve public finances from deteriorating when facing external shocks ([Bems and de Carvalho Filho, 2011](#); [Van der Ploeg and Venables, 2011](#)).

From a development-financing perspective, resource abundance can be viewed as a potentially important asset. Resource revenues may facilitate large infrastructure investment, participate in human capital formation, and support long-term growth, particularly in capital-scarce economies ([Brunnschweiler, 2008](#); [Alexeev and Conrad, 2009](#)). Moreover, by strengthening export revenues and foreign exchange earnings, natural resource windfalls can improve sovereign balance sheets by reducing external debt and lowering default risk, at least in countries with strong political institutions ([Arezki and Brückner, 2012](#)). In this sense, natural resource endowments could, under appropriate conditions, ease fiscal and financing constraints that typically restrict development strategies in developing countries.

Unfortunately, a large part of the literature demonstrates that many developing countries endowed with abundant natural resources have failed to use their natural wealth to finance sustainable development, leading to the resource curse theory (this concept is fully developed in Subsection 0.2, which is dedicated to the link between natural resources and development financing). While resource dependence was expected to help reduce macroeconomic vulnerabilities, it has often been associated with pro-cyclical fiscal policy and weak fiscal discipline ([Frankel, 2010](#); [Van der Ploeg,](#)

2011). Commodity price fluctuations tend to be transmitted directly to government revenues, leading to spending booms during upswings and fiscal adjustments when prices collapse. Moreover, resource revenues have also been linked to rising public debt, rather than reduced reliance on external borrowing. [Manzano and Rigobon \(2001\)](#) have highlighted that developing countries with abundant natural resources frequently accumulate significant levels of public debt during commodity booms, based on optimistic expectations about future revenues. However, when commodity prices subsequently decline, these anticipated revenues fail to materialize, leaving governments exposed to debt overhang and refinancing risks. Moreover, in some cases, future resource revenues are used explicitly as collateral for borrowing, and this amplifies vulnerability to price shocks ([Manzano and Rigobon, 2001](#); [Arezki and Brückner, 2012](#)).

As a result, many resource-rich countries experience a debt cycle closely tied to the commodity cycle, as they accumulate debt during boom periods and enter episodes of fiscal stress during downturns. Nevertheless, empirical evidence shows that resource windfalls reduce external debt in countries with strong institutional frameworks but have little or no debt-reducing effect in countries with poor institutions, where revenues are often diverted toward unproductive spending ([Arezki and Brückner, 2012](#)). These patterns suggest that natural resource abundance alone is not sufficient to ensure sustainable development financing and may, under certain circumstances, exacerbate fiscal vulnerability rather than alleviate it.

Taken together, this literature highlights that natural resources are neither a guarantee of development financing nor an automatic solution to fiscal constraints. Resource endowments certainly create opportunities to mobilize large revenues, but their developmental impact depends crucially on how these revenues are managed over time. In the absence of appropriate fiscal frameworks and political institutions capable of limiting the power of the executive and influencing the facility with which natural resources can be controlled or appropriated, resource revenues may lead to inefficiencies, rent-seeking behavior, and macroeconomic instability, rather than expanding sustainable fiscal space ([Auty, 2002](#); [Van der Ploeg, 2011](#); [Masi et al., 2024](#)). Consequently, the ability of developing countries endowed with abundant natural resources to harness natural wealth for development depends not on the size of resource rents per se, but on the institutional context in which these rents are managed, allocated, and integrated into broader fiscal and macroeconomic frameworks ([Savoia and Sen, 2021](#); [Brückner et al., 2023](#)), including budgetary institutions, stabilization mechanisms, and public investment strategies ([Van der](#)

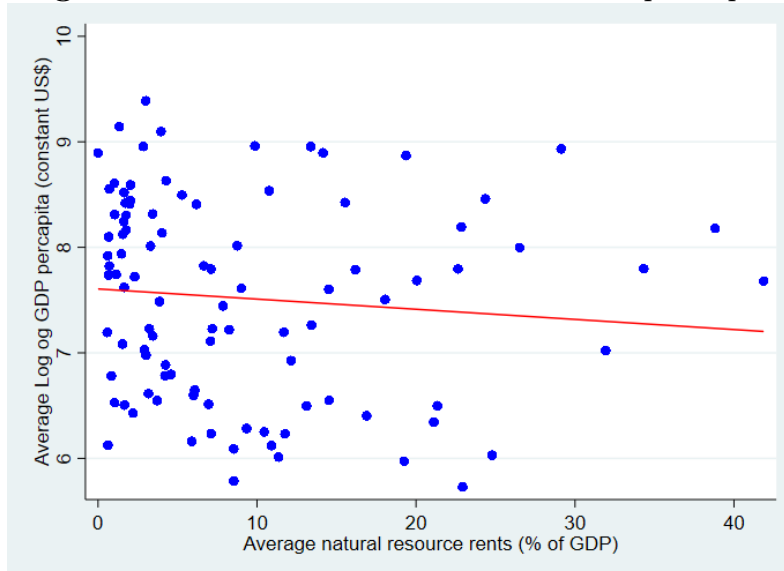
[Ploeg and Venables, 2011](#)).

0.2 Natural resources and development financing

0.2.1 Literature review on natural resources, growth, and debt

The relationship between natural resource abundance and economic growth has long been debated in the literature, but researchers do not reach a consensus on the efficiency of exploiting natural resources and their contribution to economic growth in countries endowed with abundant natural resources ([Havranek et al., 2016](#)).

Figure 2: Natural resource rents and GDP per capita



Source: Author's construction based on data from WDI.

Figure 2 illustrates the weak and heterogeneous unconditional relationship between natural resource rents and income levels (measured by log GDP per capita) in developing countries. It highlights substantial dispersion in income levels across the sample, particularly among countries with low levels of resource rents, where both high- and low-income outcomes are observed.

On the one hand, early empirical contributions documented a negative association between resource dependence and economic growth, giving rise to the concept of the resource curse ([Sachs and Warner, 1995](#); [Gylfason, 2000](#); [Van der Ploeg, 2011](#)). [Sachs and Warner \(1995\)](#) represent the founding authors of this literature. Their analysis has highlighted a negative and significant relationship between natural resource abundance and economic growth, which has been qualified as the "resource

curse". Following their seminal work, the economic literature has shown considerable interest in analyzing the determinants of the resource curse.

Firstly, an economic determinant of the resource curse that explains the poor performance of resource-rich countries is the "Dutch disease", which is the appreciation of a country's exchange rate following a boom in foreign exchange earnings from its natural resource exports (Corden and Neary, 1982). This appreciation leads to a loss of competitiveness in the agricultural and industrial sectors because exports from these two sectors are penalized in favor of the emerging extractive sector that attracts production factors like capital and workforce (Sachs and Warner, 1995).

Secondly, conflicts represent another channel through which natural resources can negatively affect economic growth (Collier and Hoeffler, 1998; Berman et al., 2017). By analyzing the impact of mining on conflicts in African countries, Berman et al. (2017) have concluded that the commodities supercycle explains a significant portion of violence observed in these countries. They explain that the presence of natural resources increases the likelihood of rebellion and the potential for rent-seeking and contributes to weak state capacities and extractive institutions. Lessmann and Steinkraus (2019) have shown that natural resources can favor conflicts mainly when these resources are unequally distributed across a country's different ethnic groups, inducing rent-seeking behavior. Nevertheless, transferring a large part of the oil wealth can mitigate this issue, mainly if these transfers are direct, meaning unconditional cash transfers to the population (Cordella and Onder, 2020).

Thirdly, public debt is another channel through which natural resources affect economic development (Manzano and Rigobon, 2001). Indeed, based on anticipated future resource revenues, governments assess their borrowing capacity according to their financing needs. The efficiency of global financial markets is crucial because inefficient markets can lead resource-rich countries' governments to overestimate their borrowing capacity, resulting in high indebtedness. Also, poor institutional quality tends to reduce the efficiency of public spending, which can favor indebtedness due to higher inefficient expenditures. Moreover, world natural resource prices are volatile (Hansen and Gross, 2018). Then, the fall in global commodity prices reduces the capacity of resource-dependent countries to settle their debts and contributes to the debt trap phenomenon because it decreases the expected revenues on which these countries were relying to pay off their debts. Consequently, these countries move into a state of "debt overhang", where high debt levels lead to an inability for governments to generate sufficient revenues not only to pay off debts but also to

finance future spending ([Manzano and Rigobon, 2001](#)). The accumulation of debt is detrimental to economic growth, as high levels of debt act as a tax on future investment projects, limiting the financing of such projects in the future ([Arezki and Brückner, 2012](#)).

Finally and more importantly, governance and institutional quality are the main determinants of the resource curse identified in the literature. Governance and institutional quality have been identified as initial conditions of the resource curse. As shown by [Sala-i Martin and Subramanian \(2013\)](#), institutional quality influences natural resource management. Poor institutional quality favors the appropriation of natural resource revenues by political leaders through rent-seeking and patronage ([Mehlum et al., 2006](#); [Robinson et al., 2006](#)), leading to an inability of these countries to use these revenues as an engine for economic growth. [Mehlum et al. \(2006\)](#) have found that institutional quality is a key factor in the resource curse. Countries with high levels of institutional quality do not suffer from the resource curse, whereas countries with low levels of institutional quality are more likely to do so. [Robinson et al. \(2006\)](#) have analyzed the political foundations of the resource curse. They show that institutions influence the effect of resource booms on the economy. Countries with institutions that promote government accountability and competence will tend to benefit from resource booms, while countries lacking such institutions are more likely to suffer from the resource curse and will not be able to use the resource boom to finance their growth.

Natural resources also seem to deteriorate governance and institutional quality. Indeed, resource revenues can be used to enforce corruption ([Busse and Gröning, 2013](#)), specifically when the quality of democratic institutions is relatively low ([Bhattacharyya and Hodler, 2010](#); [Arezki and Gylfason, 2011](#)). [Morrison \(2007\)](#) has provided evidence that the simple existence of natural resources in non-democratic countries favors the political resource curse and reduces chances for democratization. Dependence on natural resources tends to have a negative impact on the quality of governance. [Ross \(2001\)](#) has explored three aspects of the argument that oil hinders democracy. He showed that there is: (1) a "rentier effect" (governments in resource-rich countries manage to reduce pressure for greater accountability through low tax rates and patronage); (2) a "repression effect" (resource abundance allows governments to increase funding for internal security, which delays democratization); and (3) a "modernization effect" (growth driven by oil and/or mineral extraction fails to bring about the social and cultural changes that tend to produce democratic government). [Bhattacharyya and Hodler \(2010\)](#) have analyzed the mechanism

through which natural resources can fuel corruption and the role of the quality of democratic institutions. Their results indicate that resource rents increase corruption only when the quality of democratic institutions is relatively low, thereby reducing the levels of state efficiency and accountability, which negatively impacts economic growth. [Busse and Gröning \(2013\)](#) have analyzed the impact of natural resource abundance on governance indicators and have shown that natural resource exports have led to an increase in corruption. However, they find no effect on other governance indicators such as public order and the quality of the bureaucracy. [Crespo Cuaresma et al. \(2011\)](#) have found that oil resources can hinder democracy since autocratic leaders in oil-rich countries remain longer in power.

On the other hand, other authors have provided evidence that natural resources have positively contributed to long-term economic growth in developing countries. Indeed, [Brunnschweiler \(2008\)](#) has analyzed the effects of natural resource endowment on economic growth, and their results have revealed a positive direct and statistically significant relationship between natural resource endowment and economic growth. [Brunnschweiler and Bulte \(2008\)](#) have found that abundant natural resources have a positive effect on growth and the quality of institutions. The observation that some countries with abundant natural resources achieve strong growth (e.g., Norway, Botswana), while others with equally significant resources struggle to develop (e.g., the Democratic Republic of Congo), suggests that factors other than resource abundance may explain this underperformance in certain countries. In the same line, [Alexeev and Conrad \(2009\)](#) have examined the effects of natural resources on economic growth and provided evidence that extractive resources have enhanced rather than inhibited long-term growth. Similarly, [Smith \(2015\)](#) has analyzed the impact of major natural resource discoveries on GDP per capita since 1950 and finds that resource exploitation positively affects economic growth, with effects that persist in the long run. [Arin and Braunfels \(2018\)](#) have also failed to find empirical evidence for a "resource curse". However, their analysis has highlighted a positive and statistically significant robust effect between oil rents and long-term economic growth. Furthermore, [Brückner et al. \(2023\)](#) have examined the relationship between countries' natural resource wealth and GDP per capita using data for more recent years. They have found no evidence that countries' natural resource abundance is a curse for economic development, but cross-country regressions have concluded that natural resource abundance has a significant positive effect on the level of GDP per capita. Importantly, state ownership is a significant transmission channel through which countries' natural resource abundance affects economic development.

Additional results of this paper are that while natural resource abundance does not significantly affect inequality (measured through the Gini coefficient), it is associated with lower poverty rates and a higher Human Development Index.

It is important to notice that despite the positive effect of natural resources highlighted by this part of the literature, the authors emphasize the importance of institutions in the growth process, particularly in the long term ([Brunnschweiler, 2008](#); [Apergis and Payne, 2014](#); [Arin and Braunfels, 2018](#)).

0.2.2 The contribution of natural resources to development financing: institutional quality and governance matter

A large part of the literature highlights that the quality of institutions and governance represents the key determinants that reconcile the divergent points of view on how natural resources can affect economic outcomes like public finances, economic growth, and public debt. Indeed, the literature developed previously has shown that while some authors have highlighted a negative relationship between natural resource abundance and development outcomes, other authors have provided evidence that these effects are heterogeneous across countries. Differences in the quality of institutions and governance appear to explain why some developing countries have successfully used their natural resources to finance development, while others have experienced persistent fiscal vulnerability, macroeconomic instability, and debt accumulation ([Auty, 2002](#); [Mehlum et al., 2006](#); [Van der Ploeg, 2011](#)).

The political economy literature argues that in countries that are characterized by poor institutional quality, high levels of corruption, and limited accountability, natural resource abundance favors incentives for rent appropriation rather than productive investment. Some authors have shown that in countries facing weak oversight mechanisms and public resource management, political elites and corrupt agents are more likely to capture resource rents for personal or political gain, preventing these revenues from contributing to economic growth and fiscal stability ([Bhattacharyya and Hodler, 2010](#); [Sala-i Martin and Subramanian, 2013](#)).

Strong institutions can favor the effective use of natural resource revenues to achieve higher economic and fiscal outcomes. Countries which benefit from credible institutional constraints may manage resource revenues transparently, smooth expenditure over the commodity cycle, and allocate funds toward productive public investment. In such environments, resource revenues are more likely to expand fiscal space sustainably and reduce reliance on debt over the long run.

However, poor governance tends to exacerbate the adverse effects of resource abundance on economic and fiscal outcomes. A large part of the literature has found that in countries with low institutional quality, resource windfalls often lead to inefficient public spending, higher public investment costs, and expansion of government consumption rather than productivity-enhancing expenditures (Arezki and Gylfason, 2011; Pritchett et al., 2013). These inefficiencies decrease the potential effect of public investment on growth while preventing countries from having sufficient revenues needed to sustain fiscal balances. Consequently, resource revenues may fuel public debt accumulation (rather than reducing borrowing needs), particularly during commodity booms, amplifying debt vulnerabilities when prices decline (Manzano and Rigobon, 2001).

Institutional quality thus plays a central role in mediating the relationship between natural resources and economic development. Robinson et al. (2006) have shown that governments in resource-rich countries tend to over-exploit natural resources due to a political bias toward the present. Resource booms may therefore induce short-term spending expansions and misallocation toward politically targeted sectors rather than long-term development priorities. The quality of institutions determines the extent to which political incentives translate into fiscal policy distortions. Countries with institutions that promote accountability are more likely to resist these pressures and use resource rents productively, while those with poor institutions face a higher probability of experiencing the resource curse.

Empirical evidence strongly supports this conditional effect. Boschini et al. (2007), using a sample of developed and developing countries, show that institutional quality significantly conditions the extent to which natural resources affect economic growth. Developing countries with abundant natural resources that benefit from high-quality institutions and strong governance are substantially less likely to suffer from the resource curse than those with poor institutional frameworks. Similarly, Mehlum et al. (2006) have distinguished between “producer-friendly” and “grabber-friendly” institutions, demonstrating that natural resources promote growth only in the former case. In the latter, resource rents tend to be dissipated through rent-seeking activities, undermining both growth and fiscal sustainability.

0.2.3 Research questions and objectives of the thesis

In recent years, transparency and accountability in natural resource management have emerged as critical dimensions of governance reform aimed at fostering the

contribution of natural resources to growth. [Kolstad and Wiig \(2009\)](#) have shown that greater transparency allows public scrutiny of resource revenues and limits discretionary control by political elites, thereby reducing opportunities for corruption and resource misappropriation. By improving access to information and strengthening monitoring mechanisms, transparency reforms can enhance the credibility of fiscal policy and increase the efficiency of revenue use. [Mejía Acosta \(2013\)](#) have highlighted that initiatives promoting transparency and accountability in the extractive sector not only strengthen government accountability but also improve socio-economic outcomes through reductions in poverty and income inequality.

Since the early 2000s, growing recognition of governance's central role in enabling natural resources to contribute effectively to development has spurred a wide range of international initiatives and policy reforms aimed at improving transparency, accountability, and oversight in extractive industries. These initiatives seek to address governance failures that allow rent appropriation, revenue leakage, and the inefficient use of resource revenues, all identified in the literature as important mechanisms leading to the resource curse ([Auty, 2002](#); [Mehlum et al., 2006](#); [Van der Ploeg, 2011](#)). Among the earliest initiatives is the "Publish What You Pay (PWYP)" campaign, launched in the early 2000s to advocate for public disclosure of payments made by extractive companies to governments, to strengthen citizens' ability to hold governments accountable ([Gillies and Heuty, 2011](#)). In the same line, organizations such as the Natural Resource Governance Institute (NRGI) have developed analytical frameworks, diagnostics, and policy guidance to improve governance along the extractive value chain, with a focus on fiscal transparency, contract disclosure, and revenue management ([Heller et al., 2014](#)). Another initiative that has adopted a more sector-specific focus is the Kimberley Process Certification Scheme, established to prevent the trade of conflict diamonds by introducing international certification and supply-chain controls. This reflects efforts to link natural resource governance with peace and development objectives ([Grant and Taylor, 2004](#)). These initiatives differ in scope and enforcement mechanisms, but they collectively signal a broader international consensus that improving governance in extractive industries is essential for allowing natural resource wealth to be an engine for development financing.

Among these various initiatives, the Extractive Industries Transparency Initiative (EITI) has emerged as the most comprehensive and widely adopted global governance reform in the extractive sector. Launched in 2003, the EITI promotes systematic disclosure of information along the extractive value chain, including payments, revenues, contracts, and revenue allocation ([EITI, 2019](#)). Most importantly, the

EITI combines transparency requirements with a country-level multi-stakeholder governance structure, bringing together governments, extractive industries, and civil society throughout the implementation process of the reform, which represents its strength (Sovacool et al., 2016). Because of its broad international coverage and multi-stakeholder governance structure, while explicitly focusing on transparency and accountability, the EITI provides a relevant instrument for analyzing how governance reforms in natural resource management affect public revenues, economic growth, and development financing strategies.

Despite this growing recognition of the central role of institutions and governance, there is limited empirical evidence establishing an explicit and direct link between governance reforms in natural resource management and resource revenue mobilization, economic growth, and public debt dynamics. Understanding whether and how reforms aimed at improving governance in the extractive sector, like the EITI, can move developing countries with abundant natural resources toward greater inclusive economic growth and lower indebtedness by providing diversified sources of financing, therefore, remains an open question.

Addressing this gap constitutes the central objective of this thesis, which aims to respond to the following questions:

- **How does governance in natural resource management contribute to resource revenue mobilization and economic growth in developing countries?**
- **How does governance in natural resource management affect public debt dynamics in resource-dependent developing countries, and how have African countries managed to stabilize or reduce their public debt-to-GDP ratio over the past two decades?**

To answer these questions, the thesis proceeds as follows. First, it examines whether improving governance in extractive industries strengthens resource revenue mobilization (Chapter 1) in developing countries. Second, it studies how improving governance in extractive industries affects economic growth (Chapter 2) in developing countries. Third, it analyzes whether the benefits of better governance in extractive industries affect public debt dynamics in resource-dependent developing countries (Chapter 3). Fourth, it identifies debt stabilization and consolidation episodes in African countries over the last two decades while exploring their broader macroeconomic and fiscal correlates, independently of specific governance reforms (Chapter 4).

By examining how reforms aiming at improving governance within the extractive sector affect revenues, economic growth, and public debt dynamics, the thesis contributes to a more integrated understanding of how to fuel the contribution of natural resources to development financing in developing countries. Moreover, identifying debt stabilization and consolidation episodes in African countries while exploring their broader macroeconomic and fiscal correlates contributes to the debate and also helps to confirm the mechanism through which governance in natural resources management affects debt dynamics.

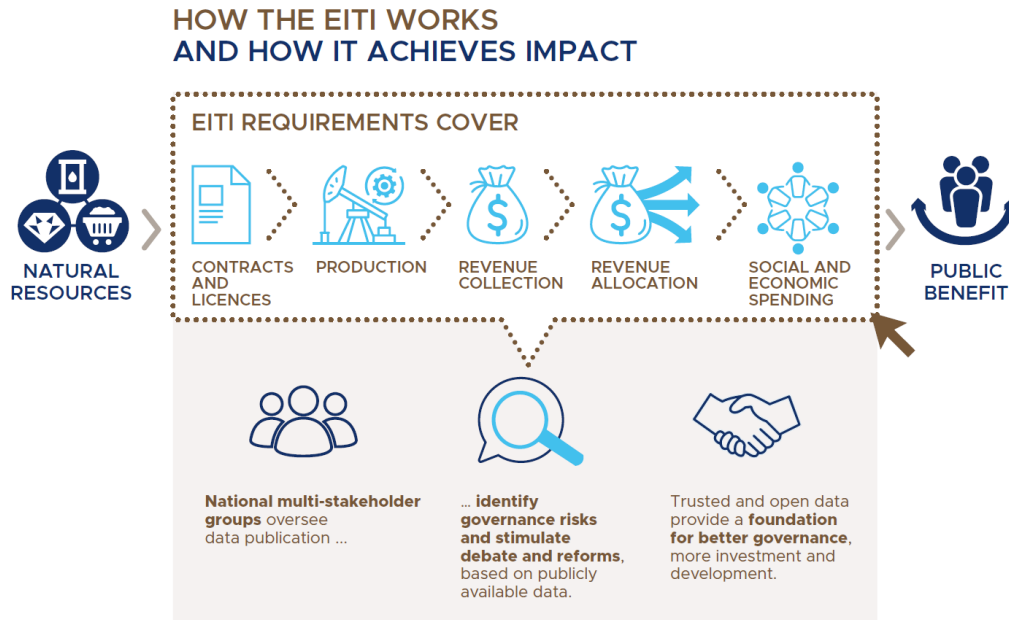
0.3 The Extractive Industries Transparency Initiative (EITI)

0.3.1 The EITI: background and objectives

The idea of the Extractive Industries Transparency Initiative (EITI) was first publicly articulated at the World Summit on Sustainable Development in Johannesburg in 2002, before being formally launched in London in June 2003 ([Lujala, 2018](#)). Headquartered in Oslo (Norway), the EITI is today recognized as the most comprehensive, institutionalized, and widely implemented global standard for transparency and accountability in oil, gas, and mining governance. Since its creation, the EITI has received strong international support and endorsement from major multilateral actors, including the United Nations, the African Union, the G8 and G20 countries, as well as international financial institutions such as the International Monetary Fund and the World Bank ([David-Barrett and Okamura, 2016](#); [Sovacool et al., 2016](#)). As of the early 2020s, more than fifty countries were EITI implementing countries, most of which are developing economies, with sub-Saharan Africa accounting for nearly two-thirds of implementing countries.

The objective of the EITI is to strengthen governance in natural resource management by promoting transparency and accountability throughout the extractive value chain. By requiring systematic disclosure of information on payments, revenues, contracts, production, and revenue allocation, the EITI aims to improve revenue mobilization, foster public debate, and support institutional reforms to ensure that natural resource revenues finance productive public expenditure (Figure 3). Ultimately, the EITI seeks to contribute to sustainable economic growth, poverty reduction, and improved welfare outcomes in developing countries endowed with natural resources ([EITI, 2023](#)).

Figure 3: The EITI process



Source: reused from [EITI \(2019\)](#), under EITI copyright.

0.3.2 The EITI principles and implementation process

The EITI is founded on a set of principles that explicitly link natural resource governance to development and macro fiscal outcomes. These principles affirm that natural resource wealth belongs to citizens, that transparent and accountable management of extractive revenues is essential for development, and that public disclosure must be accompanied by credible oversight and stakeholder participation ([Bouterige and Pafadnam, 2024](#)).

The EITI Standard defines the rules and requirements governing implementation. The 2023 EITI Standard significantly expands the scope of mandatory disclosures, reflecting the evolving understanding of governance risks in the extractive sector ([EITI, 2023](#)). In addition to revenue transparency, the standard now emphasizes contract transparency, beneficial ownership disclosure, state-owned enterprise governance, environmental and social expenditures, and revenue allocation across levels of government.

It is essential to note that membership in the EITI is voluntary and begins with a formal public commitment by the government. Implementing countries must appoint a senior government official to oversee implementation, establish a national EITI secretariat, and create an independent multi-stakeholder group (MSG) with

representatives from government, extractive companies, and civil society. The MSG is responsible for supervising implementation, defining national priorities, and ensuring compliance with the Standard.

EITI member countries are required to produce annual EITI reports disclosing information across all key stages of the extractive value chain. These include exploration and licensing procedures, production and export data, payments made by companies, revenues received by governments, allocation of revenues to public administrations and local governments, and social and economic expenditures. All information must be reconciled and verified through a credible independent audit conducted in accordance with international auditing standards.

The EITI also relies on a regular validation mechanism managed by the EITI Board to assess countries' progress. Countries that fail to meet reporting deadlines, demonstrate insufficient progress, violate EITI principles, or experience political instability that undermines implementation may be suspended. While suspension is not uncommon, it is generally reversible, and several countries have re-entered the initiative after addressing identified weaknesses.

0.3.3 Brief literature review on the EITI

The empirical literature on the EITI has expanded substantially over the past decade. This literature can be broadly organized into three strands: studies on the determinants of EITI adoption and implementation, studies analyzing the effects of EITI on institutional and governance indicators, and studies examining the effects of EITI on economic and macro-fiscal outcomes.

The first strand focuses on the determinants of EITI adoption ([Pitlik et al., 2010](#); [David-Barrett and Okamura, 2016](#); [Kasekende et al., 2016](#); [Öge, 2016a](#); [Magno and Gatmaytan, 2017](#); [Lujala, 2018](#)). Some authors have analyzed the reasons explaining the decisions of countries to implement the EITI. [Lujala \(2018\)](#) finds that countries with high resource dependence, greater corruption, and stronger exposure to international aid and investment flows are more likely to join the EITI. [David-Barrett and Okamura \(2016\)](#) and [Öge \(2016a\)](#) highlight the importance of international legitimacy concerns and domestic political economy factors, showing that EITI adoption often serves as an instrument to send a good signal to investors and donors about the countries' objective to combat corruption and improve governance in the extractive sector.

A second strand of the literature investigates the effects of EITI on institutional

and governance indicators, with mixed results (Mejía Acosta, 2013; Sovacool et al., 2016; Kasekende et al., 2016; Papyrakis et al., 2017; Villar and Papyrakis, 2017; Villar, 2022). On the one hand, Papyrakis et al. (2017) and Villar (2022) have found reductions in perceived corruption and improvements in institutional quality following EITI adoption. Mejía Acosta (2013) has also shown that transparency and accountability initiatives in the extractive sector can strengthen government accountability. On the other hand, other studies have found limited or heterogeneous effects. Kasekende et al. (2016) and Sovacool et al. (2016) have provided evidence that EITI implementation alone has not been sufficient to reduce corruption systematically, particularly in contexts characterized by weak enforcement capacity and limited political competition. These findings reinforce the view that transparency reforms must be embedded within broader institutional frameworks to produce meaningful governance changes.

A third and growing strand examines the economic and macro-fiscal implications of EITI implementation (Corrigan (2014; 2017); Sovacool et al., 2016; Malden, 2017; Mawejje, 2019). Corrigan (2014; 2017) has found that EITI has had a positive effect on economic development. Sovacool et al. (2016) and Malden (2017) have provided evidence that EITI implementation enhances the attractiveness of foreign direct investment. Mawejje (2019) has shown that EITI implementation mitigates the negative effect of extractive revenues on non-resource revenue mobilization, while Berman et al. (2017) have provided evidence that EITI implementation may attenuate the conflict-enhancing effects of mining activity.

Despite the benefits of the Extractive Industries Transparency Initiative (EITI), some criticisms exist in policy briefs and evaluations that caution against overstating its impact. In its findings, *Independent Evaluation of EITI* (2023) recognized EITI's effectiveness but stressed the need for renewal. Indeed, the reports recognized the EITI's achievements in disclosure while noting the need for adaptation to remain impactful. This cautious perspective aligns with broader governance debates about the limits of externally driven reforms in addressing internal institutional weaknesses. As Andrews (2016) has argued, many institutional reforms promoted by donors fail because they are introduced as signals to satisfy external actors rather than as problem-driven solutions. This critique resonates with the wider literature on aid conditionality, which has often struggled to reduce corruption or strengthen institutions, since external standards cannot substitute for domestic political will (Collier, 1997; Killick, 1997; Mosley et al., 1995). In this sense, EITI risks becoming a compliance exercise if governments adopt it primarily to demonstrate credibility to

international stakeholders rather than to strengthen accountability at home. Scholars such as [Van Alstine \(2017\)](#) have described this as the "transparency-accountability gap" where disclosure alone does not guarantee improved governance. Case studies, including [Traoré and Touré \(2025\)](#), have illustrated that transparency improvements may coexist with persistent accountability challenges. These critiques, therefore, serve as a reminder that while EITI can generate positive effects (like attracting investment, improving revenue mobilization, and fostering trust), its long-term impact depends on how well transparency is embedded into broader institutional reforms.

0.4 Contributions and results of the thesis

While the existing literature has provided strong contributions, important gaps remain. Indeed, there is a lack of research in the literature that directly evaluates the success of the EITI in achieving its primary objective through a specific direct analysis of its effects on resource revenue mobilization, as well as its possible effects on the promotion of economic growth. Furthermore, the lack of research regarding its effects on public debt represents a gap because extractive revenues play a central role in shaping borrowing decisions and debt sustainability in natural resource-dependent developing countries. By focusing on the EITI as a concrete and internationally recognized governance reform, this thesis contributes to filling this gap by examining how improvements in transparency and accountability in natural resource management affect fiscal capacity, economic growth, and public debt dynamics in developing countries. Moreover, there is a gap in the literature regarding the identification of episodes of debt stabilization and consolidation in African countries and the exploration of their correlates, which this thesis seeks to address.

This thesis contributes to the literature on natural resource governance, development financing, and public debt in developing countries in several important ways.

First, it contributes to the literature on the resource curse by analyzing how improving governance in natural resources affects fiscal capacity, economic growth, and public debt (Chapters 1, 2, and 3). Moreover, the analysis of the transmission channels of EITI implementation in development financing highlights how EITI implementation concretely affects development outcomes and thus helps mitigate the negative effects of the resource curse.

The choice to include in the thesis three chapters that share the same interest variable (the implementation of the EITI) is motivated by the objective to provide a comprehensive and integrated analysis that has been largely absent from the literature. By analyzing resource revenue, economic growth, and public debt side by side, the thesis offers an assessment of how transparency reforms shape developing economies. This design enhances originality in three ways. Firstly, it acknowledges the diversity of perspectives in the literature as well as the complementarity of outcomes, and it systematically investigates how these perspectives can be connected. Secondly, it explores the interactions across dimensions, recognizing that transparency in resource revenues may foster growth or reduce debt under certain conditions, but may also fail to deliver if institutional weaknesses persist. By structuring the thesis in this way, the analysis demonstrates that EITI's effects are multidimensional. Thirdly, the originality of the thesis lies in its integrated approach. Rather than treating EITI as a narrow intervention with a single measurable effect, the study positions it as a governance reform with fiscal, economic, and financial implications. This multidimensional design provides coherence across chapters while also offering new insights into how transparency initiatives interact with broader development challenges. In doing so, the thesis contributes not only to the literature on the EITI but also to broader debates on governance and institutional reform in developing countries in general and in natural resource-dependent economies in particular.

The empirical analyses in this thesis use different country samples, reflecting the specific research questions addressed in each chapter. Chapters 1 and 2 examine the effects of EITI adoption on resource revenue mobilization and economic growth, respectively, using a sample of developing countries. This broader sample allows assessment of whether EITI adoption is associated with improvements in revenue mobilization and economic performance across developing countries, including those not classified as resource-dependent. Chapter 3, by contrast, focuses on resource-dependent countries to investigate the effect of EITI adoption on public debt. Public debt reduction is not an explicit objective of the EITI; rather, it is an indirect fiscal outcome that may be influenced by improvements in transparency and accountability in the extractive sector. This question is particularly relevant for resource-dependent countries, where extractive revenues can play an important role in public finances and where greater transparency may contribute to improved fiscal management and borrowing decisions. The narrower sample in Chapter 3 therefore reflects the specific relevance of this research question to resource-dependent countries.

Second, the thesis makes a methodological contribution to the empirical evaluation

of governance reforms, particularly in the context of the Extractive Industries Transparency Initiative (EITI). The empirical chapters employ recent panel-data methods that explicitly account for heterogeneous and dynamic treatment effects associated with staggered policy implementation (Chapters 1, 2, and 3). By addressing key methodological challenges highlighted in the EITI literature (including treatment heterogeneity across countries and delayed reform effects), the thesis provides more credible and nuanced estimates than traditional difference-in-differences approaches. The use of the dynamic heterogeneity-robust Difference-in-Differences (DID) estimator as the main econometric method across the first three chapters of the thesis ensures methodological consistency and analytical rigor. Indeed, analyzing the effects of implementing the Extractive Industries Transparency Initiative (EITI) on various outcomes in each chapter requires a methodology that allows us to advance in capturing causal effects comparably and consistently. Employing the same estimator across chapters allows the thesis to maintain internal consistency, making the results directly comparable and strengthening the overall contribution of the study. Moreover, using the same estimator across chapters also reflects the complementarity of the outcomes under study, and a unified econometric approach ensures that the relationships with different outcomes are examined within a coherent framework, avoiding methodological fragmentation.

Furthermore, the dynamic heterogeneity-robust DID estimator is particularly well suited to this research design for several reasons. Indeed, it addresses the limitations of traditional DID approaches by allowing for heterogeneous treatment effects across countries and over time (this is crucial in the context of EITI, where implementation dates vary, and the intensity of reform differs across member countries). Moreover, the dynamic specification enables the analysis of both short-term and long-term effects, which is essential when studying outcomes such as revenue mobilization, growth trajectories, and debt sustainability that may evolve gradually rather than instantaneously. The estimator's robustness to heterogeneity also ensures the results are not driven by restrictive parallel-trends assumptions, enhancing the credibility of the findings. Finally, the choice of a single robust estimator underscores the thesis's originality. While existing studies often rely on simpler DID models or cross-sectional regressions, this thesis applies a dynamic heterogeneity-robust DID across multiple outcomes, thereby extending the methodological frontier in the study of transparency reforms (like the EITI). The consistency of the approach enhances the comparability of results, while the robustness of the estimator strengthens the validity of the results. Therefore, this methodological choice contributes both to the

coherence of the thesis and to the broader body of literature on governance and institutional reform.

Third, the thesis contributes to the public finance and debt literature by extending the analysis of natural resource governance beyond revenues and growth to public debt dynamics in resource-dependent developing countries. It provides novel evidence that governance reforms in the extractive sector influence borrowing behavior and debt trajectories, complementing existing work that emphasizes exogenous commodity price shocks and political institutions (Chapter 3). Furthermore, by explicitly analyzing debt consolidation episodes in Sub-Saharan Africa, the thesis identifies the macroeconomic conditions under which improvements in governance and fiscal performance could translate into sustained reductions in public debt (Chapter 4).

Finally, by combining policy-specific impact evaluation with broader macroeconomic analysis, the thesis contributes to the political economy of the resource curse. Across its empirical chapters, it shows that natural resource abundance does not inevitably lead to fiscal fragility or debt accumulation; instead, outcomes depend critically on governance structures and macro-fiscal conditions.

[Chapter 1](#) evaluates the effects of implementing the EITI on resource revenues in developing countries. Despite the importance of domestic revenue mobilization, the literature shows that it remains weak in developing countries. Nevertheless, many developing countries are endowed with natural resources that could be exploited to increase national income for development financing. Moreover, as mining and oil resources are non-renewable, it is essential to maximize their benefits from the extraction of these resources. One of the objectives of the EITI is to improve resource collection in member countries. This paper contributes to the literature by evaluating the EITI's capacity to achieve its main objective by applying the dynamic heterogeneity-robust DID estimator proposed by [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#). This analysis is based on a sample of 83 developing countries from 1995 to 2019. This study analyzes the dynamic treatment effects of the EITI implementation on resource revenues in developing countries, taking into account the heterogeneous effects of the EITI implementation. First, the main findings show that implementing the EITI increases, on average, the share of natural resource revenues in the gross domestic product (GDP) of developing member countries compared to non-members by 1.72 percentage points, with a statistically significant effect at the 1% threshold. These findings are robust to several robustness checks. Second, the results show positive and increasing post-treatment effects of

the EITI implementation on resource revenues. While the EITI's effect on resource revenues is immediate following the introduction of the EITI, it remains significant up to 10 years after EITI membership. Third, the analysis of the transmission channels suggests that the EITI's effects are achieved through improvements in the investment climate and increases in foreign direct investment and extractive resource exports. This study highlights the significant contribution of the EITI implementation to domestic revenue mobilization and the necessity to improve transparency in natural resources management, especially as international demand for critical mineral resources is expected to grow strongly.

[Chapter 2](#) analyzes how implementing the EITI affects economic growth in developing countries. Although there is no consensus on the relationship between natural resource abundance and economic growth, much of the economic literature suggests that natural resource abundance negatively affects economic growth in developing countries, leading to the resource curse theory. The final goal of the EITI is to favor an efficient contribution of natural resources to economic growth in member countries, through its process involving governments, extractive industries, and civil society. This study considers 99 developing countries from 1995 to 2019 and applies heterogeneity-robust difference-in-differences (DID) estimators. First, the findings show a positive and statistically significant relationship between EITI implementation and economic growth. More concretely, implementing the EITI increases the GDP per capita growth rate by 0.69 percentage points in developing member countries compared to non-member countries, with a statistically significant effect at the 5% threshold. Several robustness checks support this result. Second and most interestingly, the analysis of EITI's dynamic effects reveals that these effects occur only in the short and medium terms, while the effects remain non statistically significant in the long term. Third, we tested several potential transmission channels, and the analysis suggests that the increase in foreign direct investment and the rise in resource revenues represent the main transmission channels. Fourth, we postulate and investigate four possible explanations behind the EITI's mixed results on long-term growth: the lack of evidence of a negative relationship between natural resource abundance and long-term economic growth over the study period, a possible increasing reliance on non-resource taxes, a possible signaling effect targeted by member countries, and the lack of effect of EITI implementation on reducing corruption. Finally, the document provides economic policy recommendations for better governance in the management of natural resources in order to increase their contribution to development financing. Furthermore, improving governance in

managing critical minerals is vital to avoid a "new curse of critical minerals".

[Chapter 3](#) examines the relationship between EITI implementation and debt-to-GDP ratios. Over the last decade, debt-to-GDP ratios rose in developing countries, particularly in natural resource-dependent developing countries. To reduce the debt overhang, the economic literature has highlighted the necessity to implement efficient policies that allow better revenue mobilization and promote private investment inflows. By improving transparency and accountability in natural resources management, we hypothesize that the implementation of the EITI should foster access to diversified sources of financing, thus limiting development financing through government public debt. This study contributes to the literature by analyzing the dynamic treatment effects of the EITI implementation on the government's public debt-to-GDP ratio in natural resource-dependent developing countries while identifying the main transmission channels. Using a sample of 69 natural resource-dependent developing countries over the period 1995 to 2021, the empirical strategy relies on an event study approach, applying the dynamic heterogeneity-robust difference-in-differences estimator. First, the main findings show that EITI implementation is associated with an average decrease in the logarithm of the public debt-to-GDP ratio of 0.25, statistically significant at the 1% threshold. These effects remain robust to several robustness checks. Second, the effect persists over time. Third, we analyze the transmission channels, and the results suggest that the improvement in the investment climate, the rise in government resources and total revenues, and increases in foreign direct investment and domestic private investment (by providing diversified sources of financing and fostering robust economic growth) may represent the main transmission channels through which EITI implementation reduces debt-to-GDP ratios. Although the EITI is not a panacea for breaking the debt overhang, this study provides evidence that the EITI is an effective policy for reducing indebtedness vulnerabilities in natural resource-dependent developing countries.

[Chapter 4](#) explores the evolution of public debt in Africa between 2000 and 2023. Public debt ratios in sub-Saharan Africa have broadly stabilized in recent years, but after a period of sharp increase, and they remain elevated compared with the pre-COVID period and the early 2010s. At the same time, the ratio of interest payments over revenues (excluding grants) is already high in the region (at about 12%, three times higher than in advanced economies) and continues to increase. These high debt ratios and interest payments constrain countries' ability to meet urgent development needs. This trend has also led to questions about the ability

of sub-Saharan African countries to stabilize their debt-to-GDP ratios. This paper explores the conditions needed for debt consolidation to happen in 39 Sub-Saharan African countries. First, the main finding shows that episodes of debt stabilization and consolidation have not been as uncommon in the region as we might think, even outside debt restructuring episodes. Second, borrowing the accounting approach of the International Monetary Fund (IMF) to decompose public debt dynamics during these episodes into six contributors, the results suggest that macroeconomic stability is important for debt consolidation, characterized by high growth, sound public finances, a relatively stable and well-aligned exchange rate, and limited stock-flow adjustments. Third, a logistic regression framework is employed to explore potential correlates of debt stabilization and consolidation episodes in the region, and the results suggest that both a supportive external environment and domestic public policies seem to contribute to the occurrence of debt consolidation episodes.

CHAPTER 1

Does implementing the Extractive Industries Transparency Initiative (EITI) increase resource revenue in developing countries?

A version of this chapter is a United Nations University World Institute for Development Economics Research (UNU-WIDER) working paper.¹

Abstract

The need for developing countries to increase their domestic revenue has always been relevant, especially after the COVID-19 pandemic, which weakened their public finances. This paper analyses the dynamic treatment effects of the Extractive Industries Transparency Initiative (EITI) implementation on resource revenue mobilization. We use a sample of 83 developing countries from 1995 to 2019, and our empirical strategy relies on the dynamic heterogeneity-robust difference-in-differences estimator. Our results show that implementing the EITI increases resource revenue in member countries through improved governance from greater transparency, increased foreign

¹<https://doi.org/10.35188/UNU-WIDER/2026/684-1>

The initial versions of this work were presented at the Clermont Auvergne University (CERDI) Ph.D. seminar (2023), at the 2023 Theory and Evaluation of Public Policies (TEPP) Conference hosted by the Université de Poitiers, and at United Nations University (UNU) — World Institute for Development Economics Research (WIDER) June 2025 Workshop on ‘The Political Economy of Taxation. I appreciate all comments, suggestions and feedback received.

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direct investment, and extractive resource exports. These findings are robust to several robustness checks. This study highlights the significant contribution of the EITI implementation to domestic revenue mobilization and the necessity to improve transparency in natural resources management, especially as international demand for critical mineral resources is expected to grow strongly.

Keywords: • Political economy of taxation • Natural resources • Extractive industries transparency • Resource revenue • Heterogeneous and dynamic treatment effects • Developing countries

JEL Classification: H71, O11, O19, P28, Q38

1.1 Introduction

Domestic revenue mobilization has always constituted a vital challenge for developing countries. At the International Conference on Financing for Development in June 2015, the need to increase domestic revenue collection to finance the Sustainable Development Goals (SDGs) was highlighted ([Chauvet and Ferry, 2021](#)). The first target of Goal 17 of the SDGs also emphasizes the necessity to increase revenue collection.

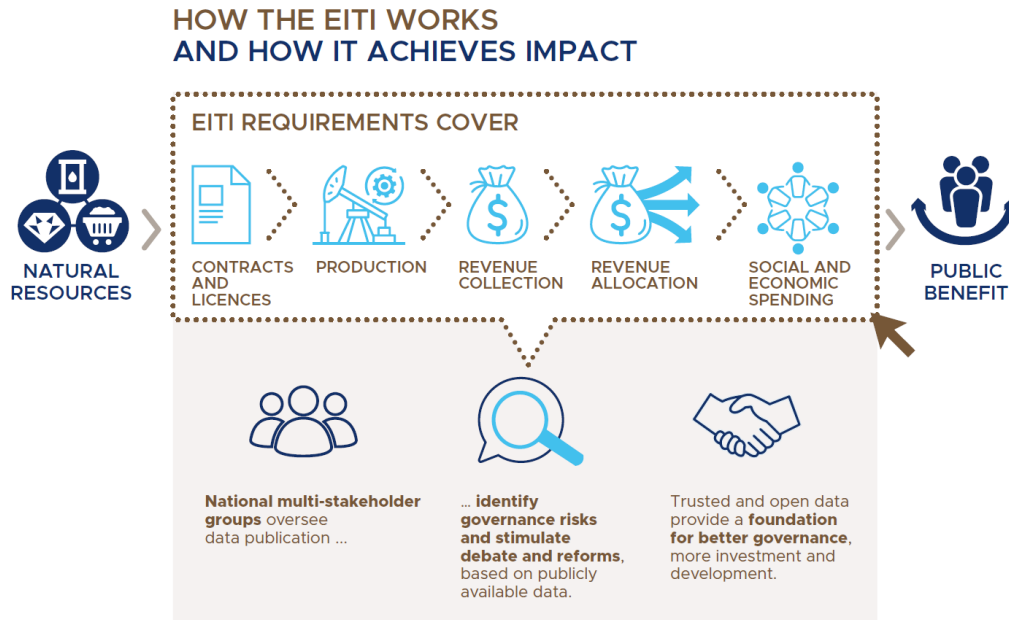
Despite the importance of domestic revenue mobilization, the literature shows that it remains weak in developing countries ([Knack, 2009](#); [Gordon and Li, 2009](#); [McGuirk, 2013](#); [Besley and Persson, 2014](#); [Mascagni and Nell, 2022](#)). Nevertheless, many developing countries are endowed with natural resources that could be exploited to increase national income for development financing. However, many developing countries fail to use these revenues to finance their development. Some authors found a negative and significant association between natural resources and economic growth, leading to the "resource curse" theory ([Sachs and Warner, 1995](#)). The literature has shown considerable interest in analyzing resource curse determinants. First, an economic explanation for the poor performance of resource-rich countries is the "Dutch disease". Indeed, the exploitation of extractive resources increases resource exports, generating a boom in foreign exchange earnings and leading to the appreciation of a country's exchange rate ([Corden and Neary, 1982](#)). This appreciation leads to a loss of external competitiveness in the agricultural and industrial sectors, as exports from these two sectors are penalized in favor of the emerging extractive sector that attracts production factors ([Sachs and Warner, 1995](#)). In addition, this will have a structural effect by hampering the manufacturing sector, as the size of the tradable sector becomes sub-optimal. Second, the resource curse can be manifested through conflicts ([Collier and Hoeffler, 1998](#); [Berman et al., 2017](#)). Third, institutional and governance matters have been identified as initial conditions ([Mehlum et al., 2006](#); [Robinson et al., 2006](#)) and determinants ([Bhattacharyya and Hodler, 2010](#); [Sala-i Martin and Subramanian, 2013](#)) of the resource curse. In countries with low institutional quality, rent-seeking diverts agents from productive activities like entrepreneurship ([Mehlum et al., 2006](#)), and political elites practice patronage, using resource rents to allocate administrative positions inefficiently to gain political support ([Robinson et al., 2006](#)). This appropriation of resource revenue by political elites and corrupt agents prevents resource revenue from effectively contributing to the national income needed to support productive public spending to achieve economic growth and reduce income inequalities and

poverty.

Due to all these consequences, and as mining and oil resources are non-renewable, it is essential for developing countries to maximize their benefits from the extraction of these resources. Policies that promote transparency and accountability increase the cost of corruption episodes and are a tool for tackling bad governance (Kolstad and Wiig, 2009). They also increase the accountability of governments to their citizens in managing extractive industries' revenues (Mejía Acosta, 2013). As mentioned by Bornhorst et al. (2009) and Kolstad and Wiig (2009), widespread concern about the inefficient use of natural resources, the resulting institutional and governance problems, and other dysfunctions of resource-rich developing countries has led to the creation of initiatives aimed at promoting transparency and accountability in resource management to reduce corruption and conflict and channel revenues into sectors promoting economic growth and reducing poverty. Similarly, Busse and Gröning (2013) argue that greater transparency regarding the use of revenues by national governments and international investors could help mitigate the resource curse. They identify the Extractive Industries Transparency Initiative (EITI) as an example of an initiative designed to promote transparency in resource-rich countries.

The EITI was first publicly announced at the World Summit on Sustainable Development in Johannesburg in 2002 before being formally launched in London in June 2003 (Lujala, 2018). The EITI is headquartered in Oslo (Norway), with national committees in each member country, and is considered the most broadly implemented and supported transparency initiative in natural resource governance. It has been endorsed and supported by the United Nations, G8 and G20 countries, and many international organizations such as the International Monetary Fund and the World Bank (David-Barrett and Okamura, 2016). The EITI Standard provides a global standard that aims to improve national governance in developing countries by enhancing transparency and accountability in resource revenue collection. The EITI Standard emphasizes the necessity for payments and revenues from extractive resources (oil, gas, and mining) from extractive sector companies (public and private) to be published regularly (for a broad audience) in an accessible, comprehensive, and understandable manner, after reconciliation and a "credible independent audit" in line with international auditing standards, and carried out by an independent and trusted external auditor. As shown in Figure 1.1, the main objective is to promote better resource revenue collection, which can be used to finance productive public spending to promote sustainable economic growth and increase the well-being of populations.

Figure 1.1: The EITI process



Source: reused from [EITI \(2019\)](#), under EITI copyright.

The EITI literature has received considerable scholarly attention in recent years. A large part of this literature has focused on examining the determinants of EITI membership (see, e.g., [Kasekende et al., 2016](#); [Öge, 2016a](#); [Lujala, 2018](#)), while another part of the literature has analyzed its effects on institutional and economic variables. On the one hand, the literature does not reach a consensus regarding the analysis of the effectiveness of the EITI in reducing corruption in member countries. Indeed, [Papyrakis et al. \(2017\)](#) and [Villar \(2022\)](#) have found that the EITI implementation improves corruption control, while [Sovacool et al. \(2016\)](#) and [Kasekende et al. \(2016\)](#) have found that it has not been successful in reducing corruption in member countries. Moreover, [Villar \(2020\)](#) has highlighted a positive relationship between EITI membership and trust in politicians. On the other hand, [Mawejje \(2019\)](#) has found that the EITI has partially mitigated the negative effect of extractive rents on non-oil revenue mobilization, while [Kinda \(2025\)](#) has found that the EITI increases non-resource revenue. [Sovacool et al. \(2016\)](#) have shown that the EITI has enhanced foreign direct investment (FDI) attractiveness, while [Okada and Shinkuma \(2022\)](#) have found that the implementation of the EITI increases total resource rents and mineral rents.

The EITI Board ([EITI, 2016](#)) defines the process for countries seeking to join

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the institution and implement the EITI Standard (Appendix A.1 provides more details on the EITI's membership and implementation process). EITI membership is voluntary on the part of the government, and member countries must publish annual reports with information on all the key stages of the extractive sector value chain, including disclosure of information about exploration activities, awarding of licenses and contracts, data on production and exports, and disclosure of information about resource revenue collected and their allocation (EITI, 2019). Furthermore, during the EITI implementation, member countries must follow the EITI implementation rules to avoid sanctions. Indeed, sanctions can be taken by the EITI Board against countries that can be suspended from the organization for four main reasons: (1) when the country does not meet the deadline for the publication of EITI reports (e.g., Gabon, which left the organization following its suspension from February 2012 to October 2021); (2) when the country does not demonstrate significant progress, such as Niger, which left the organization in October 2017 following its suspension before rejoining in January 2019; (3) when the country does not comply with the EITI principles; and (4) when the country faces political instability that prevents it from implementing the EITI Standard (this was the case for Guinea from December 2009 to March 2011).² However, the suspension can be lifted when the conditions for lifting the suspension are met, depending on the suspension type.³

This study provides a quantitative analysis of the dynamic treatment effects of the EITI implementation on resource revenue in developing countries, taking into account the heterogeneous effects of the EITI implementation (caused by countries joining at different times and by suspensions during implementation experienced by some countries), an analytical challenge faced by the previous literature on the analysis of the EITI effects. Concretely, this paper aims to answer the following questions: Does implementing the EITI increase resource revenue in developing member countries? If so, what are its dynamic effects? What are the transmission channels through which implementing the EITI increases resource revenue? The conceptual framework developed in Section 1.2 suggests that implementing the EITI should increase resource revenue through the investment climate, FDI, and extractive resource exports.

Considering a sample of 83 developing countries from 1995 to 2019, we evaluate

²The reasons for EITI countries' possible suspension can be found on the EITI website at the following link: <https://eiti.org/countries>.

³The period of suspension and exclusion from the EITI for each country concerned is shown in column (6) of Table A2 in the Appendix.

the effects of implementing the EITI on resource revenue. Our dependent variable is resource revenue from the UNU-WIDER Government Revenue Dataset (UNU-WIDER 2022), which provides the most comprehensive, reliable, and comparative (across countries and time) data on resource revenue to date (Prichard et al., 2014). Our analysis exploits a difference-in-differences (DID) set-up that compares countries implementing the EITI and those not implementing the EITI. However, member countries adhere to the EITI at different times over the study period. Most importantly, some treatment units go in and out of treatment status due to suspension, creating breakdowns in the implementation process. Consequently, the effects of the EITI implementation may vary across countries and over years. As a result, the ordinary DID estimation method could be biased, as highlighted by several studies (De Chaisemartin and d’Haultfoeuille, 2020; De Chaisemartin and d’Haultfoeuille, 2024; Sun and Abraham, 2021; Goodman-Bacon, 2021; Callaway and Sant’Anna, 2021). Therefore, we apply the dynamic heterogeneity-robust DID estimator (DID_M estimator) proposed by De Chaisemartin and d’Haultfoeuille (2020; 2024).⁴ Our results indicate positive, statistically and economically significant effects of the EITI implementation on resource revenue. More concretely, implementing the EITI increases, on average, the share of natural resource revenue in the gross domestic product (GDP) of developing member countries compared to non-members by 1.72 percentage points. These findings are robust to several robustness checks, such as using alternative estimation samples, including additional control variables, exploring alternative dependent variables, and employing alternative estimation methods like the ordinary DID estimation, panel instrumental variables (IV), and entropy balancing methods. Finally, we analyze three transmission channels and provide evidence that improvements in the investment climate and increases in FDI and extractive resource exports are the main channels through which the EITI implementation increases resource revenue in developing countries.

This study contributes primarily to three strands of literature. First, it contributes to the literature on the EITI’s impact evaluation and the methodological challenges highlighted in the EITI literature (Kasekende et al., 2016; Sovacool et al., 2016; Lujala, 2018; Pafadnam, 2024). We apply a new analysis method that addresses the heterogeneous treatment effects over the EITI implementation process and between countries and, more interestingly, provides the evaluation of dynamic treatment effects. The second strand of the literature to which this paper contributes is the literature on strategies for enhancing domestic revenue mobilization, which

⁴We also provide the ordinary DID estimation results for robustness.

remains relatively weak in developing countries ([Knack, 2009](#); [Gordon and Li, 2009](#); [McGuirk, 2013](#); [Besley and Persson, 2014](#); [Mascagni and Nell, 2022](#)). Increasing domestic revenue in developing countries is crucial to provide those countries with the capacity to finance their development and better cope with future economic shocks. By increasing resource revenue, this study shows that the EITI implementation allows the extractive sector to participate in better domestic revenue mobilization. The third and final strand of the literature this paper contributes to is the resource curse, especially rent-seeking and resource misappropriation ([Bhattacharyya and Hodler, 2010](#); [Mehlum et al., 2006](#); [Arezki and Brückner, 2011](#); [Okada and Shinkuma, 2022](#)). Indeed, this study highlights that EITI can help reduce corrupt agents' capacity to misappropriate resource revenue.

The rest of this paper proceeds as follows. Section 1.2 provides a conceptual framework for the EITI implementation and highlights different channels through which the EITI can affect resource revenue mobilization. Section 1.3 presents data and descriptive statistics. In Section 1.4, we develop the empirical strategy. The main results are presented in Section 1.5, followed by a robustness analysis in Section 1.6. Section 1.7 provides evidence of the analysis of transmission channels. Finally, Section 1.8 concludes.

1.2 Conceptual framework

Some authors have found that the political elite's rent-seeking and patronage are important factors leading to the resource curse ([Mehlum et al., 2006](#); [Robinson et al., 2006](#)). On the one hand, rent-seeking diverts agents from productive activities, which leads the economy to a grabber equilibrium when the quality of institutions is low ([Mehlum et al., 2006](#)). On the other hand, the liberty of political elites to dispose of resource rents and their lack of accountability leads them to patronage in the sense that they use these rents to obtain political support to limit the public's ability to demand accountability ([Robinson et al., 2006](#)). [Acemoglu et al. \(2004\)](#) have shown that corruption is a widespread evil in most developing countries, where leaders appropriate extractive rents and use them to 'influence' opponents, applying the 'divide and rule' strategy.

The major consequence of these resource-rent appropriation activities by political elites and corrupt agents is limited resource revenue collection by public administration, which prevents a social and equitable redistribution of these revenues. In addition, transparency is a key factor for better resource revenue collection. Indeed,

transparency is an essential component of good governance. A lack of transparency makes corruption less risky and more attractive while reducing trust between the population and its leaders, as well as between financial institutions, foreign investors, and governments. Corruption between extractive companies and corrupt agents or politicians can lead these companies to under-report their production, thus reducing the payment of taxes and royalties owed by these extractive companies (Okada and Shinkuma, 2022). Therefore, implementing the EITI can improve resource revenue collection by making public the awarding of contracts and licenses as well as exploitation activities, making corruption more costly and increasing detour and extractive revenue capture costs (Kolstad and Wiig, 2009; Bhattacharyya and Hodler, 2010; Mejía Acosta, 2013).

There exist several potential transmission channels through which the EITI implementation can increase resource revenue. First, Arezki and Brückner (2011) have found that natural resource revenue tends to increase corruption, while Mehlum et al. (2006) and Bhattacharyya and Hodler (2010) have shown that this effect depends on institutional quality. Moreover, Bhattacharyya and Hodler (2010) have found that solid democratic institutions make politicians accountable to their citizens, thus increasing resource revenue appropriation costs. Therefore, through its incentive and enforcement mechanisms, the EITI implementation can help reduce the misappropriation of extractive rents and limit rent-seeking and patronage. This effect will favor an improvement of governance and accountability in public management, leading to an improvement in the investment climate. Along the same line, Öge (2016b) has provided evidence that the EITI implementation is associated with better transparency by improving overall aggregate data disclosure in member countries.

Second, while Lucke and Rehfeldt (2023) have explained that exploiting natural resources requires significant investments and specific advanced technologies, developing countries do not possess sufficient resources to carry out these investments, highlighting the necessity to attract FDI inflows. Busse and Gröning (2013) have noted that improved institutions allow countries to attract more FDI inflows. Thus, by improving trust in politicians and their accountability in extractive resources governance (Villar, 2020), enhancing the mining investment climate, and sending a signal to international investors about member countries' commitment to promote transparency and combat corruption in the extractive sector (Öge, 2016a; Lujala, 2018), the EITI implementation should enhance the attractiveness of FDI inflows (Sovacool et al., 2016; Öge, 2016a).

Third, the EITI implementation can increase resource revenue by improving disclosure of real extractive companies' production, therefore increasing the value of extractive sector exports. [Okada and Shinkuma \(2022\)](#) have developed a model that shows that the under-reporting of production by extractive companies reduces the payment of taxes and royalties owed by these extractive companies (which decreases resource revenue collected by the government). Their model also concludes that implementing the EITI can increase tax revenue from the extractive sector through limited under-reporting (contributing to revealing real production). More concretely, implementing the EITI will increase the level of enforcement of laws imposed on extractive companies and political elites (thus increasing the concealment costs of companies' real production), which will reduce under-reporting of production and thus lead to higher value of exports from the extractive sector. It would have been ideal to use data on the total value of production from the extractive sector to test the hypothesis that the EITI should increase resource revenue through an increase in reported natural resource production (resulting from limited under-reporting of production volume, in line with the result of the model developed by [Okada and Shinkuma \(2022\)](#)). However, due to the lack of data on production value from the extractive sector for a large set of countries, we use data on the value of the extractive sector exports (available on UNCTADstat) to test the extractive sector exports value channel. We have chosen to use the value of extractive sector exports as a potential channel (instead of those of extractive sector production value) because in developing countries, most (if not all) of the extractive sector's production is exported (see, e.g., the work of [Bouterige and Pafadnam \(2024\)](#) on the wealth of data published in the EITI reports by some member countries).

In summary, the conceptual framework suggests that the EITI implementation can affect resource revenue mobilization through three potential channels: (1) improving the investment climate, (2) increasing FDI, and (3) increasing the value of extractive sector exports. In Section 1.7, we provide evidence of the validity of these channels.

1.3 Data and descriptive statistics

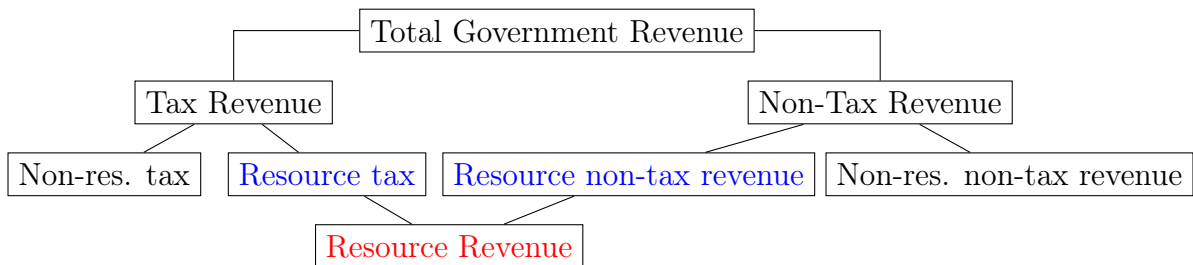
1.3.1 Data

To evaluate the treatment effects of the EITI implementation on resource revenue mobilization, we use available data on a panel of 83 developing countries from 1995 to 2019. The analysis sample and time horizon are mainly determined by data availability. We focus on developing countries because the EITI implementation is

more specific to this group of countries. The treatment variable (*EITI*) is based on information available on the EITI website⁵ and from Lujala (2018). *EITI* is defined as equal to 1 for each year t in which country i is a member of the EITI and 0 otherwise. The study sample includes 36 countries that joined the EITI during the study period and 47 non-member countries. The complete list of countries in the sample is available in Table A1 in Appendix A.4, and details on important dates in the EITI implementation process of the sample EITI countries are provided in Table A2.

Our main dependent variable (outcome) is resource revenue, the share of total revenue collected in the extractive sector expressed as a percentage of GDP (as considered by Bornhorst et al. (2009) and Crivelli and Gupta (2014)). This variable is from the GRD (UNU-WIDER 2022). The main advantage of the GRD is that it provides data on government domestic revenues, distinguishing between resource and non-resource revenues.⁶ This dataset provides the most comprehensive, reliable, and comparative (across countries and time) data on natural resource revenue to date (Prichard et al., 2014; Prichard, 2016). As described in Figure 1.2, resource revenue includes resource tax revenue (extractive industries' corporate income taxes and indirect resource taxes) and resource non-tax revenue (royalties, export taxes, profit sharing, and the profits of state-owned enterprises). We use resource revenue as our main dependent variable since the EITI Standard promotes transparency in collecting and disclosing all types of resource revenue, and its requirements cover all extractive sector revenue.

Figure 1.2: Government revenue structure according to the UNU-WIDER GRD definition



Source: Author's construction based on GRD (UNU-WIDER 2022).

Following the literature on EITI membership and the determinants of resource

⁵EITI website: <https://eiti.org/countries>.

⁶This disaggregation is based on data available in existing databases, including, among others, the IMF Government Financial Statistics (GFS) and the OECD Tax Statistics (Prichard, 2016).

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revenue, we use the following control variables: real GDP per capita, net official development assistance, corruption level, *polity2* score, and commodity price index.

First, the real GDP per capita is included to capture the country's development level. Indeed, countries with a low level of development are more likely to join the EITI because they are considered to benefit most from the EITI, and they are also exposed to external pressures due to their high dependence on aid from the international community (Pitlik et al., 2010; David-Barrett and Okamura, 2016; Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). The development of the economy is also positively correlated with domestic revenue mobilization since it improves the capacity to collect public revenue (Sen Gupta, 2007; Bornhorst et al., 2009; Crivelli and Gupta, 2014).

Second, Official Development Assistance (ODA) measures a country's dependence on international aid and assistance. Countries more dependent on ODA are more likely to implement the EITI (David-Barrett and Okamura, 2016; Kasekende et al., 2016; Lujala, 2018). Indeed, the international community perceives the commitment to join the EITI positively and can reward these countries with increased ODA flows. However, the relationship between aid and domestic revenue is ambiguous (Benedek et al., 2014; Mawejje, 2019). Sen Gupta (2007) found a weaker positive effect of foreign aid on resource mobilization.

Third, implementing the EITI lends credibility to reforms aimed at improving institutional quality (Pitlik et al., 2010). The most corrupt countries are thus the most likely to implement the EITI. The level of democracy is also positively correlated with the likelihood of joining the EITI (Pitlik et al., 2010; Öge, 2016a; Lujala, 2018). In addition, membership in the EITI is an opportunity for countries perceived to have low institutional quality to send a signal about their commitment to promoting transparency and good governance in resource management and combating corruption to improve their reputation within the international community (David-Barrett and Okamura, 2016; Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). Governments with popular support and higher 'law and order' are more likely to initiate reforms towards greater transparency. Moreover, the literature has shown that poor institutional quality negatively affects revenue mobilization (Bornhorst et al., 2009; Mawejje, 2019).

Finally, we include the commodity price index to account for global changes in commodity prices. It captures the effects associated with changes in world commodity prices. We expect a positive relationship between the commodity price index and

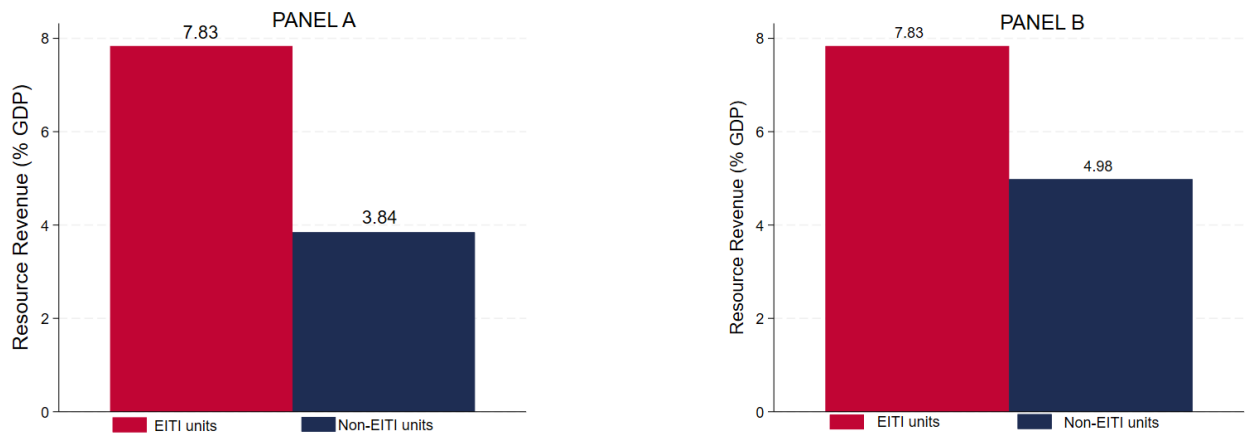
resource revenue.

Data on real GDP per capita and ODA come from the World Development Indicators (WDI) database. Our corruption index is from the International Country Risk Guide (ICRG) dataset, and the democracy index comes from the Polity IV dataset. The commodity price index is drawn from the International Monetary Fund (IMF) Commodity Terms of Trade database. Tables A9 and A10 describe the complete list of data and their sources. In line with the literature on the EITI determinants (Lujala, 2018), we lag all control variables by one year.

1.3.2 Descriptive statistics

In this subsection, we present some statistics between the EITI implementation and the average resource revenue in our sample countries over the study period (1995–2019).

Figure 1.3: Average resource revenue (% GDP) in EITI units and non-EITI units



Source: Author's construction based on data from GRD (UNU-WIDER 2022).

Figure 1.3 provides some interesting stylized facts about the relationship between the EITI implementation and resource revenue. Panel A compares the average resource revenue in EITI and non-EITI observations in the whole sample, while panel B restricts the sample to EITI member countries and compares the average resource revenue before and after the EITI implementation. The results reveal higher resource revenue in treated units (7.83%) compared to non-treated units (3.84% for the entire sample and 4.98% for the member countries group). Furthermore, the difference between the two groups is statistically significant (t-test = 3.9892, p-value = 0.000 for the whole sample; and t-test = 2.8525, p-value = 0.000 for the member countries group). Even if these stylized facts indicate a positive relationship between

the EITI implementation and resource revenue, these statistics are only correlations, not causal effects. This does not allow us to conclude a causal relationship between the EITI implementation and resource revenue. To do so, we conduct an impact evaluation analysis, as described in Section 1.4. Additional descriptive statistics for the dependent and control variables are provided in Table A6 in Appendix A.4.

1.4 Empirical strategy

This study evaluates the dynamic treatment effects of the EITI implementation on resource revenue mobilization in developing countries. We exploit variations in the EITI adherence and implementation timing across countries, resulting in the following equation:

$$RR_{it} = \beta EITI_{it} + \alpha_i + \mu_t + \delta X_{it} + \epsilon_{it} \quad (1.1)$$

where RR_{it} is the share of resource revenue in GDP of country i in year t ; $EITI_{it}$ is a dummy variable representing the treatment and indicates whether country i implements the EITI in year t (it is equal to 1) or not (it is equal to 0); α_i represents country fixed effects that capture time-invariant country-specific effects; and μ_t represents year fixed effects that capture time-specific factors affecting sample countries. X_{it} is a set of control variables, and ϵ_{it} is the random error term.

Equation 1.1 represents an ordinary DID specification with additional controls, a method generally used in the literature to analyze treatment effects. However, several studies have shown that the existence of heterogeneous treatment effects (meaning that the same treatment has different effects on different samples or at different times) may induce bias in traditional DID estimation if treatments are phased in at different times over a long panel and, in some extreme scenarios, even reversing the sign of the effect because it may give negative weights to some of the underlying treatment effects (De Chaisemartin and d'Haultfoeuille, 2020; De Chaisemartin and d'Haultfoeuille, 2024; Sun and Abraham, 2021; Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021; Borusyak et al., 2024). In the EITI membership process, member countries adhere to the EITI on different dates. Most importantly, some treatment units go in and out of treatment status. Table A3 (in the Appendix) describes the timeline in the EITI implementation process for all EITI countries in our sample and shows that some countries were suspended at different times before rejoining the EITI. One of the consequences of the interruptions in EITI implementation in some countries is that past treatments may influence the treatment outcome at time

t . More concretely, a unit not treated in $t-1$ and t may have been treated in $t-2$ or $t-3$, and these treatments can influence the estimate of the treatment effect in t . It is thus legitimate to think that the effects of the EITI implementation could be heterogeneous over time and between countries.

To take into account these identification threats and address such bias, we implement the dynamic heterogeneity-robust DID estimator (denoted by ' DID_M estimator' in the rest of the analysis), developed by [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#). The intuition behind this estimator is that it compares the first-time switchers to the not-yet switchers. Specifically, it compares groups whose treatment changes for the first time at t to groups whose treatment has not changed yet at t (only these units can be considered valid controls according to [De Chaisemartin and d'Haultfoeuille \(2023\)](#)). That ensures that this estimator relies only on the identification assumption of parallel trends rather than the assumption of a constant treatment effect. We thus estimate the following equation:

$$RR_{it} = \sum_{j=-K, j \neq -1}^L \beta_j EITI_{it}^j + \alpha_i + \mu_t + \delta X_{it} + \epsilon_{it} \quad (1.2)$$

where RR_{it} is the share of resource revenue in GDP of country i in year t ; α_i represents country fixed effects; μ_t represents year fixed effects; X_{it} is a set of control variables; and ϵ_{it} is the random error term. Let us consider u_i as the year when country i adheres to the EITI, K the largest number of years tested before u_i , and L the largest number of years tested after u_i . Thus, as mentioned earlier, $EITI_{it}^j$ is equal to 1 if $t-u_i=j$ and 0 otherwise for $-K \leq -j \leq L$ and $j \neq -1$. In other words, the year immediately before the membership to the EITI ($t-u_i=-1$) is taken as the reference, and we calculate the coefficients for all other years relative to this base. So, the DID_M estimator provides an evaluation of the EITI's treatment effect over time (β_j for $j \geq 0$). In addition, it allows us to test the validity of the parallel trends assumption between the group of treated and untreated units by comparing the $t-2$ to $t-1$ outcome evolution of $t-1$ to t switchers and non-switchers. Intuitively, this placebo assesses if switchers and non-switchers were on parallel trends before the switch. Therefore, the average effect of the EITI can be determined by averaging the yearly treatment effects. Finally, we set $K = 5$ and $L = 14$.

1.5 Main results

Employing the dynamic heterogeneity-robust DID_M estimator developed in Section 1.4, we estimate the treatment effects of implementing the EITI on resource revenue in developing countries over the period 1995–2019.

Table 1.1: EITI and resource revenue

	Baseline main results	Excluding recent member countries	Excluding long- term suspended countries	Excluding the pre-EITI period	Resource-dependent countries sample
Dependent variable:					
Resource revenue	(1)	(2)	(3)	(4)	(5)
DID_M	1.7181*** (0.6263)	1.8417*** (0.7004)	1.9809*** (0.6967)	2.4200*** (0.7239)	2.6620*** (0.9045)
Control variables	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Mean in control group	3.84	3.88	3.63	3.97	5.9673
Placebo joint test p-value	0.6400	0.6205	0.8669	0.6711	0.4511

Note: Results are obtained using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications and five placebo years. Robust standard errors are in parentheses. EITI membership is the treatment variable, and unreported constant is included. Control variables: real GDP per capita (log), ODA, corruption index, democracy index, and commodity price index. All of these variables are lagged by one year. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

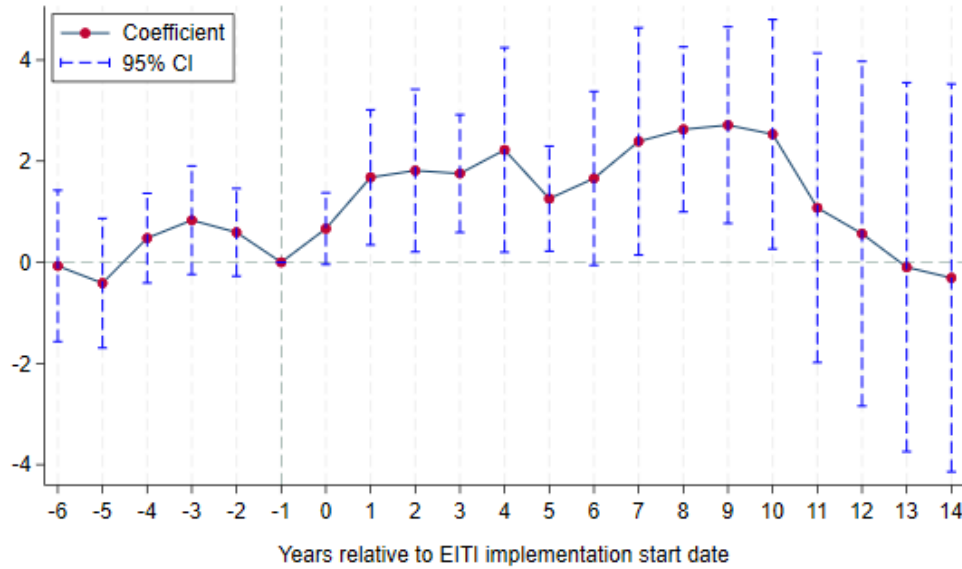
Source: Author's construction.

Column (1) of Table 1.1 presents our main result of the treatment effects of the EITI implementation on resource revenue based on the dynamic heterogeneity-robust DID estimation (DID_M estimator). This column reports the result for the post-average treatment effect of the EITI implementation on resource revenue. DID_M is the estimated post-average effect of implementing the EITI, based on the effects over the first 14 years ($t + 14$) following membership to the EITI. The results show that implementing the EITI, on average and over the study period, increases resource revenue by 1.72 percentage points in developing member countries compared to non-members, with a statistically significant effect at the 1% threshold.⁷

Furthermore, Figure 1.4 plots both pre-treatment and post-treatment trends. The

⁷Moreover, the placebo joint test performed by this estimator (which are the p-values of a joint test that all placebos are equal to zero) is not statistically significant, attesting to the credibility of the parallel trend and the non-anticipation assumptions.

Figure 1.4: Representation of the EITI dynamic (annual) effects on resource revenue with the dynamic heterogeneity-robust DID estimator of De Chaisemartin and d'Haultfoeuille (2020; 2024)



Note: We apply 100 bootstrap replications, and bars represent the 95% confidence intervals around long differences effects and placebo tests. The placebo joint test is not significant.
Source: Author's construction.

post-treatment effects represent the estimated dynamic (annual) effects of the EITI implementation. Since De Chaisemartin and d'Haultfoeuille (2020; 2024) consider $t = 1$ as the reference year, this graph shows pre-treatment estimators corresponding to one up to five years before the EITI implementation and 14 years of post-treatment estimates. First, the results reveal that all pre-treatment estimators are small and not significantly different from zero, which validates the parallel trends and no anticipation assumptions. More concretely, this means that before implementing the EITI, EITI member countries did not experience significant changes in the level of resource revenue compared to those that never implemented the EITI. Second, the results show positive, statistically significant, and increasing post-treatment effects of the EITI implementation on resource revenue. We observe an immediate significant effect following the introduction of the EITI (by 0.67 percentage points), which remains significant up to 10 years after EITI membership (by 2.53 percentage points).⁸

⁸The lack of EITI effects 10 years after initial EITI membership can be explained by the limited proportion of untreated units compared to treated units from that point onwards, which may weaken the identification of treatment effects.

Our results provide evidence that EITI membership and implementation of the Standard offer a real opportunity for the extractive sector to contribute to better resource revenue mobilization in member developing countries. These results demonstrate the effectiveness of the EITI in increasing resource revenue, the institution having been considered at its creation as the most influential and promising international organization for promoting transparency, accountability, and better governance in the extractive sector.

1.6 Robustness analysis

1.6.1 Alternative specifications

To start with, we test the robustness of our findings by considering alternative samples obtained by excluding some countries or periods. First, we remove countries that are not long-time members of the EITI.⁹ Second, we remove countries suspended/excluded from the EITI for a long period.¹⁰ Third, we exclude the period before the creation of the EITI (the period before 2003). Finally, although some EITI member countries are not resource-dependent countries, the institution is primarily intended for resource-dependent countries (because they have a higher motivation to join). For this reason, we consider a specification in which we retain only countries highly dependent on natural resources in the sample. Based on the literature (see, e.g., Haglund, 2011; Baunsgaard et al., 2012; Lundgren et al., 2013; Dobbs et al., 2013; Coutinho et al., 2022), we use different criteria to retain the sample of resource-dependent countries. Specifically, we define resource-dependent countries as those whose ratio of resource exports to total exports is equal to or greater than 20%, whose ratio of resource exports to GDP is equal to or greater than 8%, whose ratio of extractive rents to GDP is equal to or greater than 10%, or whose ratio of resource revenues to total government revenues is equal to or greater than 20%. The results of these respective specifications are represented in Figure A1, and we report the respective post-average treatment effects using these alternative sub-samples in columns (2)–(5) of Table 1.1. These results are consistent

⁹We exclude from the sample countries that joined the EITI during the five years before the end of the study period. These include Mexico and Suriname, which joined in April 2015 and February 2016, respectively (see Table A2).

¹⁰We exclude countries suspended from the EITI for more than one year. These include Gabon, Equatorial Guinea, Honduras, Liberia, Madagascar, Niger, and Sao Tome and Principe (see Tables A2 and A3).

with our main findings and show positive and statistically significant effects of the EITI implementation on resource revenue, with treatment effects ranging from 1.84 to 2.66 percentage points.

Next, we test the robustness of our results using additional control variables that are likely to influence the decision to implement the EITI and resource revenue. Referring to the literature, we identified four main groups of additional control variables¹¹: **A- Membership in other international organizations in the field of natural resources management**: dummy variables indicating membership in the Kimberly Process (KP), membership in the International Conference on the Great Lakes Region (ICGLR), membership in the Organization of Petroleum Exporting Countries (OPEC), and membership in the Organization of Petroleum Exporting Countries + (OPEC+). **B- Additional socio-economic variables**: public debt (% of GDP), trade openness (% of GDP), inflation rate, exchange rate, the share of agriculture in value-added, financial development, domestic public investment (% of GDP), government total expenditure (% of GDP), population growth, and human capital index. **C- Conflicts and geographic variables**: internal and external conflict indicators and dummy variables for sub-Saharan African and Latin American countries. **D- National reforms and major international events**: fiscal rules implementation, IMF programs, and dummy variables characteristic of the global financial crisis and corresponding to the commodity super-cycle period. To avoid a potential bias due to reverse causality, these variables are lagged by one year (as the control variables used in the main analysis, except for dummy variables). The results of these specifications are reported in columns (1)–(22) of Table 1.2, while Figures A2, A3, A4, A5, and A6 (in Appendix A.4) plot the pre-treatment and post-treatment effects. These different specifications confirm the robustness of our results to the addition of control variables since these estimations support our conclusion that implementing the EITI increases resource revenue in developing member countries. Moreover, these specifications allow us to address concerns about potential estimation bias from omitting pertinent EITI membership determinants.

¹¹The reasons for the choice of these variables are discussed in Appendix A.2.

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Table 1.2: EITI and resource revenue: additional control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Kimberly Process	ICGLR membership	OPEC membership	OPEC+ membership	Public debt	Trade openness	Inflation	Exchange rate
Resource revenue	membership							
EITI	1.7181*** (0.6263)	1.7181*** (0.6263)	1.7181*** (0.6263)	1.7181*** (0.6263)	1.5028** (0.6970)	1.7488** (0.6992)	1.7181*** (0.6263)	1.6877*** (0.7178)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Placebo joint test p-value	0.6400	0.6400	0.6400	0.6400	0.3061	0.5082	0.6400	0.5305
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable:	Agriculture value-added	Financial development	Domestic public investment	Government total expenditures	Population growth	Human capital	Internal conflicts	External conflicts
Resource revenue								
EITI	1.6683** (0.6596)	1.7584*** (0.6311)	1.7181*** (0.6263)	1.7189*** (0.6263)	1.7181*** (0.6263)	1.8863** (0.7813)	1.7181*** (0.6263)	1.7181*** (0.6263)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Placebo joint test p-value	0.6460	0.5024	0.6400	0.6083	0.6400	0.5692	0.6400	0.6400
	(17)	(18)	(19)	(20)	(21)	(22)		
Dependent variable:	Sub-Saharan region	Latin America region	Fiscal rule	IMF programs	Global financial crisis	Commodity prices super cycle period		
Resource revenue								
EITI	1.7181*** (0.6263)	1.7181*** (0.6263)	1.7181*** (0.6263)	1.7181*** (0.6263)	1.7181*** (0.6263)	1.7181*** (0.6263)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes		
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes		
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes		
Placebo joint test p-value	0.6400	0.6400	0.6400	0.6400	0.6400	0.6400		

Note: Results are obtained using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications and five placebo years. Robust standard errors are in parentheses. EITI membership is the treatment variable, and unreported constant is included. Control variables: real GDP per capita (log), ODA, corruption index, democracy index, and commodity price index. All of these variables are lagged by one year. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Source: Author's construction.

Table 1.3: EITI and resource revenue: alternative dependent variables

Dependent variable:	(1)	(2)	(3)	(4)	(5)
Resource revenue (% total revenue)	3.2109** (1.4774)				
Resource revenue (in logarithm)		0.5781** (0.2740)			
Total government revenue (% GDP)			2.4734*** (0.8254)		
Resource tax revenue (% GDP)				0.8253** (0.3673)	
Resource non-tax revenue (% GDP)					1.3155** (0.6496)
Mean in control group	14.16	25.12	19.13	1.17	2.20
Placebo joint test p-value	0.4481	0.5244	0.6347	0.2598	0.4232
Control variables	Yes	Yes	Yes	Yes	Yes
Country and year fixed effects	Yes	Yes	Yes	Yes	Yes

Note: Results are obtained using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications and five placebo years. Robust standard errors are in parentheses. EITI membership is the treatment variable, and unreported constant is included. Control variables: real GDP per capita (log), ODA, corruption index, democracy index, and commodity price index. All of these variables are lagged by one year. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Source: Author's construction.

Last, we check the robustness of our findings using alternative dependent variables. Specifically, we use the following variables: resource revenue (in percentage of total government revenue), resource revenue (in logarithm), total government revenue (in percentage of GDP), resource non-tax revenue (in percentage of GDP), and resource tax revenue (in percentage of GDP). We thus re-estimate Equation 1.2 using these variables as dependent variables. The results are reported in columns (1)–(5) of Table 1.3 and show positive and statistically significant effects of the EITI implementation on these alternative variables. Therefore, this robustness analysis indicates that using alternative dependent variables does not alter our main results and highlights the effects of the EITI implementation on total revenue mobilization.

1.6.2 Alternative estimation methods

Finally, to verify that our results are not influenced by the analysis method, we test the robustness using three alternative estimation methods. Specifically, we use the ordinary DID, the panel IV, and the entropy balancing estimation methods.

Ordinary DID estimation method. Column (1) of Table A7 presents the results of the effects of EITI implementation on resource revenue using the ordinary DID estimation method. The result indicates that the EITI implementation increases resource revenue (in percentage of GDP) by 1.45 percentage points, statistically significant at the 5% threshold. Applying the validity test¹² of the ordinary DID estimation proposed by [De Chaisemartin and d’Haultfoeuille \(2020\)](#) indicates that, under the assumption of common trends, β estimates a weighted sum of 266 ATTs, 16 of which receive a negative weight, i.e., 6.40% of total estimated ATTs. This result means that the ordinary DID estimates are not completely robust to the heterogeneous treatment effects of the EITI, which reinforces the use of the heterogeneous DID method as the main method in this study.

Panel IV method. To deal with the potential self-selection bias in the EITI membership ([Lujala, 2018](#)), some studies in the literature used the panel IV method. In our analysis, we have already controlled for the determinants of the EITI membership. In addition, in all our estimates using the DID_M estimator, we tested the parallel trend and non-anticipation assumptions. Following the literature ([Villar, 2020](#); [Okada and Shinkuma, 2022](#)), we complete this robustness analysis using an IV

¹²This test consists of calculating the number of estimated ATTs attached to negative weights. The higher the percentage of ATTs attached to estimated negative weights in the total number of ATTs estimated by the ordinary DID method, the higher the probability of these results being biased.

estimation approach. As an instrumental variable, we use the number of neighboring countries (with common borders) that are EITI members. The use of this neighborhood variable as an instrumental variable comes from studies on the geographic diffusion of public policies (see, e.g., [Kotera and Okada, 2017](#); [Acemoglu et al., 2019](#); [Gilardi and Wasserfallen, 2019](#); [Caselli and Reynaud, 2020](#)). The intuition is that a country's participation in the EITI is influenced by its neighbors' (exogenous) participation because a country is more likely to participate if its neighboring countries join the EITI. We, therefore, construct our instrument as follows:

$$NeighboursEITI_{it} = \sum_{j \neq i}^N EITI_{jt} \quad (1.3)$$

where j indicates the countries that border country i in year t (its neighboring countries). $EITI_{jt}$ is a dummy variable equal to 1 when the country j is an EITI member in year t . The variable $NeighboursEITI_{it}$ is our first instrument and indicates, for each country in the sample and each year, the number of its neighboring countries that are EITI members.

In addition to this instrument, we use the lagged EITI as a second instrument. Indeed, in addition to the test of the relevance of the instruments, the use of two instruments allows us to perform the tests of exogeneity (exclusion condition) and instrument strength.

The results are presented in columns (2)–(3) of Table [A7](#). Column (2) in panel A presents the results of the first-stage equation, where we regress the treatment variable on our instruments and all control variables of the baseline model. These results indicate that our instruments are positively and significantly correlated with the treatment variable. Column (3) in panel B presents the second-stage estimation result and confirms the positive and statistically significant effects of implementing the EITI on resource revenue in developing countries. The coefficient associated with the treatment variable is 1.37 and is significant at the 1% threshold. In addition, the Kleibergen-Paap F-statistic is significantly higher than the value of the Stock-Yogo test at the 10% critical threshold, and the Hansen p-value is greater than 0.10 (attesting to the relevance and strength of instruments used as well as confirming the exclusion condition).

Entropy balancing method. As an alternative impact evaluation method, we use entropy balancing, which is a non-parametric impact evaluation method based on a matching procedure (for more details on this method and its two-step estimation procedure, see, e.g., [Hainmueller, 2012](#); [Neuenkirch and Neumeier, 2016](#); [Bambe](#)

[et al., 2024](#)). Specifically, entropy balancing allows us to identify the effect of the EITI implementation on resource revenue by comparing EITI member and non-member countries that are similar on observable variables while controlling for country and year fixed effects. The entropy balancing method is implemented in two main stages. First, weights are calculated and assigned to observation units that are not exposed to the treatment but have observable characteristics as similar as possible to the treated units. The computation of these weights satisfies the defined balance constraints concerning the defined characteristics, ensuring that the synthetic control group consists, on average, of observation units not exposed to the treatment that are as similar as possible to the treated units. This method creates a counterfactual group whose difference from the treatment group will be the implementation of the EITI based on the defined observable characteristics. Following [Neuenkirch and Neumeier \(2016\)](#), we choose equilibrium constraints that impose equal covariate means between the treatment and control groups. In other words, we want to ensure that the control group, on average, has untreated units as similar as possible to the treated units. In the second step, to estimate the average treatment effect on the treated (ATT) of the EITI implementation on resource revenue, we use the weights from the first stage in a regression analysis where resource revenue is our dependent variable and the EITI implementation dummy is the main interest variable. We also control for year and country-specific effects and include the entropy balancing covariates (used in the first stage) to improve the estimation efficiency because it is equivalent to including control variables in a randomized experiment ([Neuenkirch and Neumeier, 2016](#)).

After verifying the effectiveness of the entropy balancing method in constructing the counterfactual group (see Appendix [A.3](#) and Table [A8](#)), the results of the estimations performed in the second step are reported in column (4) of Table [A7](#). Once again, the results remain consistent with our main findings and indicate a robust, positive, and statistically significant effect of EITI implementation on resource revenue.

Based on the results of these different specifications, we can conclude that our results are robust to the choice of estimation method since the change in methods confirms our conclusions concerning the estimated effect of EITI implementation on resource revenue.

1.7 Transmission channels

As explained earlier, we assumed that the improvement of the investment climate, the increase in FDI inflows, and the increase in extractive resource exports are the main channels through which the EITI implementation may affect resource revenue.

Table 1.4: EITI and resource revenue: validity of transmission channels

Panel A: Relationship between			
the channel and resource revenue	(1)	(2)	(3)
Investment climate	2.1564*** (0.6206)		
Foreign direct investment		0.4632*** (0.1018)	
Extractive resources exports			0.2988*** (0.0159)
Control variables	Yes	Yes	Yes
Country & year fixed effects	Yes	Yes	Yes
Observations	985	1,140	1,141
R ²	0.1747	0.1695	0.3648
Panel B: Effect of the EITI			
implementation on the channel	(1)	(2)	(3)
	Investment climate	Foreign direct investment	Extractive resources exports
<i>DID_M</i>	0.1104** (0.0545)	0.5194** (0.1751)	3.4669** (1.4336)
Control variables	Yes	Yes	Yes
Country & year fixed effects	Yes	Yes	Yes
Placebo joint test p-value	0.3751	0.8782	0.6498

Note: Results of the main channels through which EITI implementation should affect resource revenue. Panel A presents the relationship between each potential channel and resource revenue based on panel fixed effects estimations. Panel B reports the effect of EITI implementation on the potential channels based on the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#). Robust standard errors are in parentheses. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

This section tests these three potential transmission channels by adopting a two-step approach.¹³ In the first step, we test the relationship between the potential channel

¹³[Gutmann et al. \(2021\)](#) and [Pafadnam \(2024\)](#), for instance, have also implemented a similar

and resource revenue by performing a panel fixed effects estimation, controlling for country and year fixed effects (Panel A of Table 1.4). In the second step, we analyze the effect of the EITI implementation on channels using the dynamic heterogeneity-robust DID estimator (Panel B of Table 1.4). Gutmann et al. (2021) noted that evaluating the transmission channels based on a uniform empirical framework compared to those employed in the main analysis ensures a reasonable identification of causal effects, which are comparable and cannot result from carefully selected model specifications. Our intuition is that, if the potential channel positively (respectively negatively) and significantly affects resource revenue and implementing the EITI has a positive (respectively negative) and significant effect on this channel, the channel represents a valid channel through which transits the effect of the EITI implementation on resource revenue.

The results in Panel A indicate that investment climate, FDI, and extractive resource exports are positively correlated with resource revenue. Furthermore, the results in Panel B (columns (1)–(3)) show the average effects of EITI implementation on these three channels and indicate a positive and statistically significant effect of implementing the EITI on these variables. In summary, these results provide evidence that the improvement of the investment climate and the increase in FDI and extractive resource exports are the main channels through which the EITI implementation increases resource revenue in developing countries.

1.8 Conclusion

This study evaluates the dynamic treatment effects of the implementation of the EITI on resource revenue, using a sample of 83 developing countries from 1995 to 2019. Our empirical strategy relies on the dynamic heterogeneity-robust DID estimation method to properly account for the design in the implementation of the EITI with units moving in and out of treatment status. Our results show that, overall, implementing the EITI increases resource revenue in member developing countries compared to non-member countries. In addition, we show that the effects of the implementation of the EITI are positive and significant during the first 10 years of implementation.

Our findings are robust to several robustness checks, such as considering alternative estimation samples, including additional control variables, exploring alternative

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dependent variables, and employing alternative estimation methods like the ordinary DID estimation, IV identification, and the entropy balancing methods. Finally, we provide evidence that an improvement in the investment climate and an increase in FDI inflows and exports of extractive resources are valid transmission channels through which the implementation of the EITI increases resource revenue in developing member countries.

This paper has clear economic policy implications. On the one hand, the EITI Standard is an instrument that can be used by developing countries to benefit from better collection of resource revenue and thus better domestic revenue mobilization. Indeed, implementing the EITI allows countries to increase transparency in resource management by extractive industries and governments, leading to improved governance in the extractive sector. Another positive effect of the implementation of the EITI is that it limits rent-seeking by increasing detour and extraction revenue capture costs, leading to higher resource exports. In addition, the implementation of the EITI has an indirect positive effect because it favors the attractiveness of FDI. On the other hand, the EITI Board should increase requirements for disclosure of resource revenue allocated to the national budget to ensure that these additional revenues are used to foster sustainable development and reduce poverty in developing member countries. Moreover, while natural resource-dependent developing countries need to mobilize more domestic revenue, international demand for critical mineral resources is expected to grow strongly. Through its positive effects on the extractive sector's revenue mobilization, the effective implementation of the EITI represents a great opportunity for countries endowed with extractive resources in general and critical mineral resources in particular to gain maximum benefit from their exploitation. Future research avenues include analyzing the effects of the implementation of the EITI on public debt, the efficiency of public spending, and income inequality.

A Appendix

A.1 EITI membership process

The EITI Board defines the process for countries seeking to join the institution and implement the EITI Standard (EITI, 2016). First, the government of a country seeking to implement the EITI Standard must publicly announce its commitment to joining the EITI. It must thus appoint a government official to lead the membership process, establish a national EITI secretariat, and form an independent and active multi-stakeholder group (MSG). The MSG must include representatives from government, civil society, and extractive companies, with the task of monitoring the implementation of the Standard and drawing up a work plan detailing the country's objectives with national reforms and development priorities. Sovacool et al. (2016) have indicated that the key to the EITI is its "multi-stakeholder" transparency approach. Thus comes the candidate stage, in which the country submits a formal application to the EITI Board (EITI, 2019). If the EITI Board determines that the Standard's implementation requirements have been satisfied, the country's application is validated. To become a fully compliant country, the EITI MSG and national secretariat must prepare the required documents and data on the extractive sector. After this, an independent consultant prepares a validation report, which is submitted to the EITI Board within two and a half years. The EITI Board, after reviewing the documents, decides whether the country is compliant or not. When the country is declared compliant, it will have to publish regular reports according to the deadlines fixed by the EITI Board. In practice, however, the deadline for achieving compliance status is not always met. Most countries achieve compliance late in the engagement process but publish their EITI reports annually and comply with the Standard's requirements.

A.2 Additional control variables in the robustness analysis

First, membership in a global organization promoting better governance could influence the decision to join the EITI and, thus, the effects of its implementation. We control four other organizations that promote better governance in the extractive sector at the state level. These are the Kimberly Process (KP), the International Conference on the Great Lakes Region (ICGLR), and the Organization of Petroleum Exporting Countries (OPEC and OPEC+). The KP, created in 2003, is a major initiative for better global governance in the diamond sector. The ICGLR comprises 12 African countries and aims to promote peace, security, democracy, and development

in the Great Lakes Region. OPEC brings together the world's major oil producers. These countries are traditionally associated with the resource curse ([Sovacool et al., 2016](#)). OPEC membership reduces the likelihood of EITI membership ([Pitlik et al., 2010](#)). This could be explained either by the fact that OPEC members consider that they already have a common system of transparency, notably through the publication of their crude oil production, or by the more restrictive nature of the EITI, which would strongly limit the incentives for under-reporting and would avoid any "free-riding" behavior ([Pitlik et al., 2010](#)). OPEC+ is an alliance between OPEC member countries and 10 other oil-producing countries, formed in 2016. The lists of KP, ICGLR, OPEC, and OPEC+ member countries are available in Appendix B (Tables [A4](#) and [A5](#)).

Second, the influence of additional economic variables must be considered in our analysis. Public debt can influence a country's decision to join the EITI. Countries with high levels of external debt are likely to face external pressure from their creditors to carry out reforms aimed at improving governance. These countries may see EITI membership as a way of signaling their commitment to greater transparency in public finances to the international community, thus gaining favors from creditors in return. The economic literature has provided evidence of the influence of trade openness as a mechanism of the natural resource curse. The willingness to improve trade openness through EITI membership could influence a country's decision to join the institution. In addition, [Sen Gupta \(2007\)](#) found a positive relationship between trade openness and tax mobilization. The inflation level is also included to capture macroeconomic stability, a precondition for the successful implementation of reforms. The literature shows that countries exploiting natural resources may experience real exchange rate appreciation, which can hinder economic diversification ([Corden and Neary, 1982](#)). We therefore include the exchange rate as an additional control variable in our robustness checks. We also control for agricultural sector development since this sector is more complicated to tax ([Sen Gupta, 2007](#); [Crivelli and Gupta, 2014](#)). A higher share of the agriculture sector in value-added could affect the revenue collection of other sectors. Solid financial institutions facilitate a transparent economic system by promoting better governance and information availability ([Dutta and Mukherjee, 2018](#)). The level of financial development could thus influence a country's domestic capacity to implement the EITI. We also consider government domestic public investment and government total expenditures. Indeed, the level of domestic public investment and public spending depends on the availability of public revenues and can influence governments' ability to mobilize domestic revenue.

Finally, we also control for total population growth and human capital. These variables could influence a country's decision to join the EITI because a large and better-educated population is more likely to hold leaders accountable and, therefore, to call for anti-corruption and governance improvement policies.

Third, conflicts may influence the EITI implementation and domestic revenue. A country's experience of conflict is a crucial determinant of EITI membership (Lujala, 2018), mainly when these conflicts are centred around natural resources. Conflict-affected countries can be encouraged to undertake reforms in the extractive sector through the presence and influence of international organizations that provide development assistance (Lujala, 2018). Berman et al. (2017) have found that implementing the EITI helps mitigate the negative effect of rising mineral prices on conflict. Political stability could also influence governments' ability to collect domestic revenue. A geographic diffusion mechanism for the EITI seems to exist in sub-Saharan Africa. Indeed, the fact that a country is located in sub-Saharan Africa positively influences the decision to join the EITI (Öge, 2016a), which could be explained by the high dependence of these countries on foreign investment and international aid. As explained by Sen Gupta (2007), geographic factors like being a sub-Saharan African or a Latin American country influence the performance in revenue collection.

Fourth, other country-level policies and major international events can also influence resource revenue mobilization. Indeed, we control for fiscal rules implementation and IMF programs that can affect public administration effectiveness in mobilizing revenue. Moreover, transparency and accountability in the extractive sector have received increasing international attention and have been identified as a mechanism to mitigate the adverse effects of the global financial crisis (Mejía Acosta, 2013). Some countries made significant progress in implementing the EITI during the economic crisis between 2008 and 2009. The period 2003–08 was also marked by a generalized rise in world mineral prices, qualified as a "commodity super-cycle" (Chávez and Rodríguez-Puello, 2022), and membership of most of the EITI countries in the sample, so it is important to control for a dummy variable that is characteristic of this period.

A.3 Entropy balancing results in constructing the counterfactual

The descriptive statistics on the control variables considered in the analysis are presented in panel A of Table A8. This panel provides information on the sample means before weights for all control variables between country-year observations with the EITI implemented, which represent the treatment group (column (1)), country-year observations without the EITI implemented, and the potential synthetic control group (column (2)). Column (3) shows the differences in means between these two groups. The t-test values and corresponding p-values (columns (4) and (5)) indicate that the differences between the treatment and control groups are significant at the 1% level for the majority of the considered variables. From the first stage of the entropy balancing method, we construct a synthetic control group that is as comparable as possible to the treatment group concerning all control variables considered. This is achieved by reweighting the untreated observations using these control variables. Panel B of Table B8 shows the results. Columns (1) and (2) summarize the results for the sample means of the control variables for the treated and untreated groups, respectively. Columns (4) and (5) indicate that entropy balancing eliminated differences between the means of variables for the treatment and control groups because no differences between the variables are significant.

A.4 Study sample and descriptive statistics

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Table A1: List of countries in the study sample

Angola	Cabo Verde	India	Malaysia	Syrian Arab Republic
Burkina Faso	Costa Rica	Iran. Islamic Rep.	Namibia	Chad
Bangladesh	Djibouti	Iraq	Niger	Togo
Bulgaria	Dominica	Jamaica	Nigeria	Thailand
Bosnia and Herzegovina	Dominican Republic	Jordan	Nepal	Tajikistan
Belarus	Algeria	Kazakhstan	Pakistan	Turkmenistan
Belize	Egypt, Arab Rep.	Kenya	Papua New Guinea	Timor-Leste
Bhutan	Ethiopia	Lao PDR	Paraguay	Trinidad and Tobago
Botswana	Gabon	Liberia	Russian Federation	Tunisia
Chile	Georgia	Libya	Rwanda	Tanzania
China	Ghana	Madagascar	Sudan	Uganda
Cote d'Ivoire	Guinea	Mexico	Sierra Leone	Venezuela. RB
Cameroon	Guinea-Bissau	Mali	El Salvador	Vietnam
Congo. Dem. Rep.	Equatorial Guinea	Myanmar	Serbia	Zambia
Congo. Rep.	Honduras	Mongolia	Sao Tome and Principe	Zimbabwe
Colombia	Haiti	Mauritania	Suriname	
Comoros	Indonesia	Mauritius	Eswatini	

Source: Author's compilation.

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Table A2: EITI members with important dates and their status at the end of the study period

EITI country	Commitment	Creation of the multi-stakeholder group	Candidate validation	Compliance	Suspension/withdrawal period	Status at 31/12/2019
Burkina Faso	July 2007	December 2008	May 15, 2009	February 2013	-	Compliant
Cote d'Ivoire	May 2007	February 2008	May 12, 2008	May 2013	-	Compliant
Cameroon	March 2005	June 2005	September 27, 2007	October 2013	-	Compliant
Congo, Dem. Rep.	January 2005	November 2005	September 2007	July 2014	April 18, 2013–July 2, 2014	Compliant
Congo, Rep.	June 2004	October 2006	September 27, 2007	February 2013	-	Compliant
Colombia	May 2013	February 2014	October 15, 2014	-	-	Candidate validated
Dominican Republic	July 2015	December 2015	February 23, 2016	-	-	Candidate validated
Ethiopia	August 2009	July 2009	March 19, 2014	-	-	Candidate validated
Gabon	May 2004	July 2005	September 2007	-	February 2013–October 2021	Suspended
Ghana	June 2003	February 2005	September 27, 2007	October 2010	-	Compliant
Guinea	April 2005	February 2012	September 27, 2007	July 2014	December 2009–March 2011	Compliant
Equatorial Guinea	January 2005	July 2007	February 22, 2008	-	April 2010	Suspended
Honduras	January 2013	February 2013	May 22, 2013	-	February–July 2018 & April 2019–	Candidate validated
Indonesia	December 2008	June 2010	November 24, 2010	October 2014	February–December 2015	Compliant
Iraq	March 2009	September 2010	February 10, 2010	December 2012	-	Compliant
Kazakhstan	June 2005	October 2005	September 27, 2007	October 2013	-	Compliant
Liberia	May 2007	April 2007	September 27, 2008	October 2009	2018–March 2020	Compliant
Madagascar	January 2006	January 2008	February 22, 2008	-	October 25, 2011–June 6, 2014	Candidate validated
Mexico	April 2015	November 2016	October 25, 2017	-	-	Candidate validated
Mali	August 2006	June 2007	September 22, 2007	August 2011	-	Compliant
Myanmar	December 2012	February 2014	July 02, 2014	-	-	Candidate validated
Mongolia	April 2006	January 2006	September 2007	October 2010	-	Compliant
Mauritania	September 2005	December 2006	September 27, 2007	February 2012	-	Compliant
Niger	March 2005	July 2005	September 2007	March 2011	October 2017–January 2019	Re-commitment
Nigeria	November 2003	February 2004	September 27, 2007	March 2011	-	Compliant
Papua New Guinea	April 2013	November 2013	March 19, 2014	-	-	Candidate validated
Sierra Leone	October 2007	June 2007	February 22, 2008	April 2014	-	Compliant
Sao Tome and Principe	December 2004	December 2007	February 22, 2008	-	2010–2011	Candidate validated
Suriname	February 2016	December 2016	May 24, 2017	-	February–June 2019	Candidate validated
Chad	September 2007	February 2010	April 16, 2010	October 2014	-	Compliant
Togo	December 2009	March 2010	October 10, 2010	May 2013	-	Compliant
Tajikistan	August 2012	August 2012	February 26, 2013	-	-	Candidate validated
Timor-Leste	May 2007	May 2007	February 22, 2008	July 2010*	March–June 2017	Compliant
Trinidad and Tobago	September 2010	September 2010	March 2011	January 2015	-	Compliant
Tanzania	November 2008	November 2009	February 16, 2009	December 2012	September–December 2015	Compliant
Zambia	July 2008	September 2008	May 15, 2009	September 2012	-	Compliant

Source: Author's compilation based on data from <https://eiti.org/countries>. Information on suspension causes is available on request.

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Table A3: Timeline in the EITI implementation

Country/year →	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
↓																	
Burkina Faso					•	•	•	•	•	•	•	•	•	•	•	•	•
Cote d'Ivoire					•	•	•	•	•	•	•	•	•	•	•	•	•
Cameroon			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Congo, Dem. Rep.			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Congo, Rep.		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Colombia											•	•	•	•	•	•	•
Mexico													•	•	•	•	•
Ethiopia							•	•	•	•	•	•	•	•	•	•	•
Gabon		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Ghana	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Guinea			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Equatorial Guinea			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Honduras											•	•	•	•	•	•	•
Indonesia						•	•	•	•	•	•	•	•	•	•	•	•
Iraq							•	•	•	•	•	•	•	•	•	•	•
Kazakhstan			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Liberia					•	•	•	•	•	•	•	•	•	•	•	•	•
Madagascar				•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mexico													•	•	•	•	•
Mali				•	•	•	•	•	•	•	•	•	•	•	•	•	•
Myanmar										•	•	•	•	•	•	•	•
Mongolia				•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mauritania			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Niger			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Nigeria	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Papua New Guinea											•	•	•	•	•	•	•
Sierra Leone					•	•	•	•	•	•	•	•	•	•	•	•	•
Sao Tome and Principe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Suriname														•	•	•	•
Chad					•	•	•	•	•	•	•	•	•	•	•	•	•
Togo							•	•	•	•	•	•	•	•	•	•	•
Tajikistan										•	•	•	•	•	•	•	•
Timor-Leste					•	•	•	•	•	•	•	•	•	•	•	•	•
Trinidad and Tobago							•	•	•	•	•	•	•	•	•	•	•
Tanzania						•	•	•	•	•	•	•	•	•	•	•	•
Zambia						•	•	•	•	•	•	•	•	•	•	•	•

Note: • EITI implementation period • Breaking points in EITI implementation.
Source: Author's construction based on information from the EITI website.

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Table A4: List of KP and ICGLR members

Kimberley Process members				ICGLR members
Country	Membership date	Country	Membership date	Country
Angola	2003	Liberia	2007	Angola
Bangladesh	2006	Lesotho	2003	Burundi
Belarus	2003	Mexico	2008	Central African Republic
Botswana	2003	Mali	2013	Congo, Dem. Rep.
China	2003	Malaysia	2003	Congo, Rep.
Cote d'Ivoire	2003	Mauritius	2003	Kenya
Cameroon	2012	Namibia	2003	Rwanda
Congo, Dem. Rep.	2003	Russian Federation	2003	Sudan
Congo, Rep.	2003	Sierra Leone	2003	Tanzania
Gabon	2018	Eswatini	2011	Uganda
Ghana	2003	Togo	2003	Zambia
Guinea	2003	Tanzania	2003	
Indonesia	2005	Thailand	2003	
India	2003	South Africa	2003	
Kazakhstan	2012	Vietnam	2003	
Lao PDR	2003	Zimbabwe	2003	

Source: Author's construction based on information from <https://www.kimberleyprocess.com/en> and <https://www.icglr.org/index.php/fr/>.

Table A5: List of countries in the sample that are OPEC and OPEC⁺ members

Country	Membership date	Withdrawal date	Status in 2019
Angola	2007	-	Member
Congo, Rep	2018	-	Member
Ecuador	1973 and 2007	1992 and 2020	Member
Equatorial Guinea	2017	-	Member
Gabon	1975 and 2016	1995	Member
Indonesia	1962 and 2016	2008 and 2016	Retired
Iran, Islamic Rep.	1960	-	Member
Iraq	1960	-	Member
Kazakhstan ⁺	2016	-	Member
Libya	1962	-	Member
Malaysia ⁺	2016	-	Member
Mexico ⁺	2016	-	Member
Nigeria	1971	-	Member
Russian Federation ⁺	2016	-	Member
Sudan ⁺	2016	-	Member

Source: Author's construction based on information from https://www.opec.org/opec_web/en/about_us/25.htm.

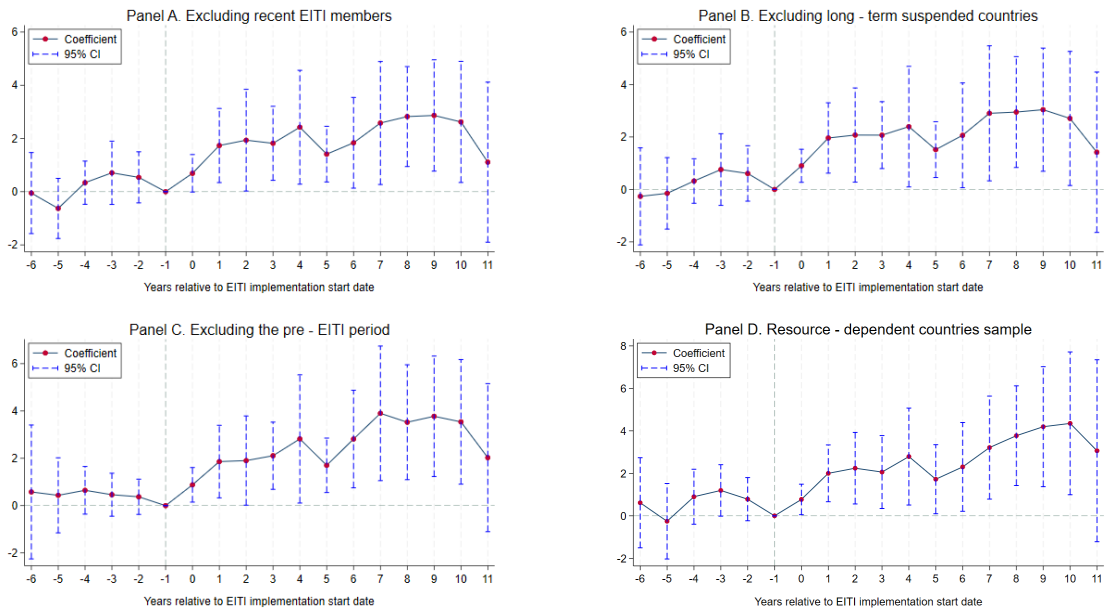
Table A6: Descriptive statistics for the study sample

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Natural resource revenue	1,749	4.6274	9.4737	0	79.1104
Real GDP per capita in logarithm	1,956	7.6006	0.9542	5.3632	9.7074
Official development assistance	1,935	5.9744	8.7317	-0.6163	94.4421
Corruption index	1,529	2.1992	0.8692	0	6
Polity2	1,949	1.6747	5.9715	-10	10
Commodity price index	2,027	110.5372	42.3983	18.4123	314.0317

Source: Author's compilation.

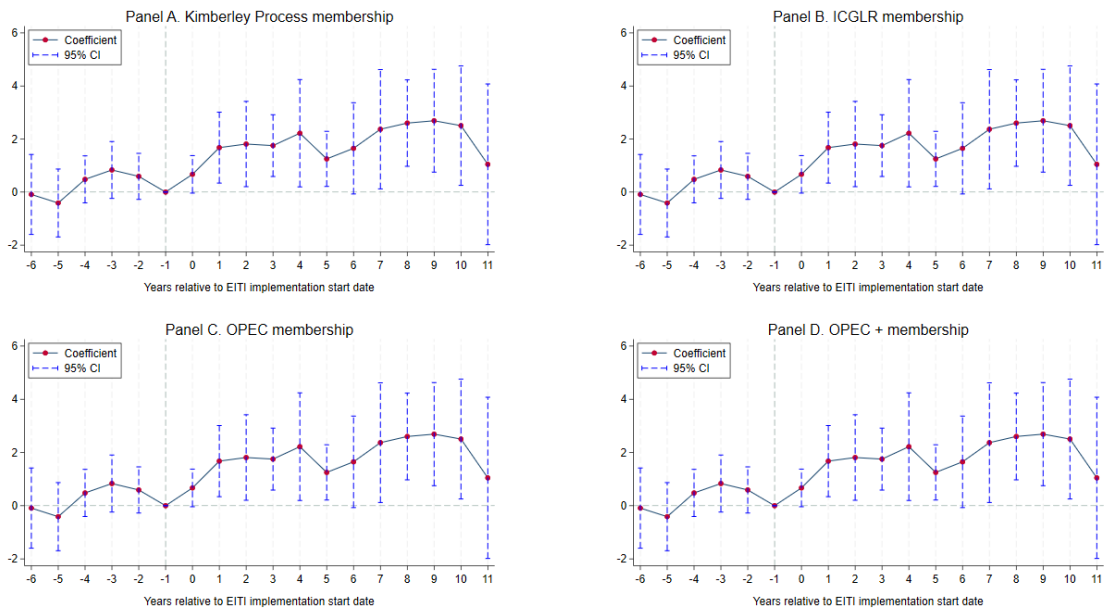
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Figure A1: Representation of the EITI dynamic effects on resource revenue on alternative samples



Note: Bars represent the 95% confidence intervals around long differences effects and placebo tests.
Source: Author's compilation.

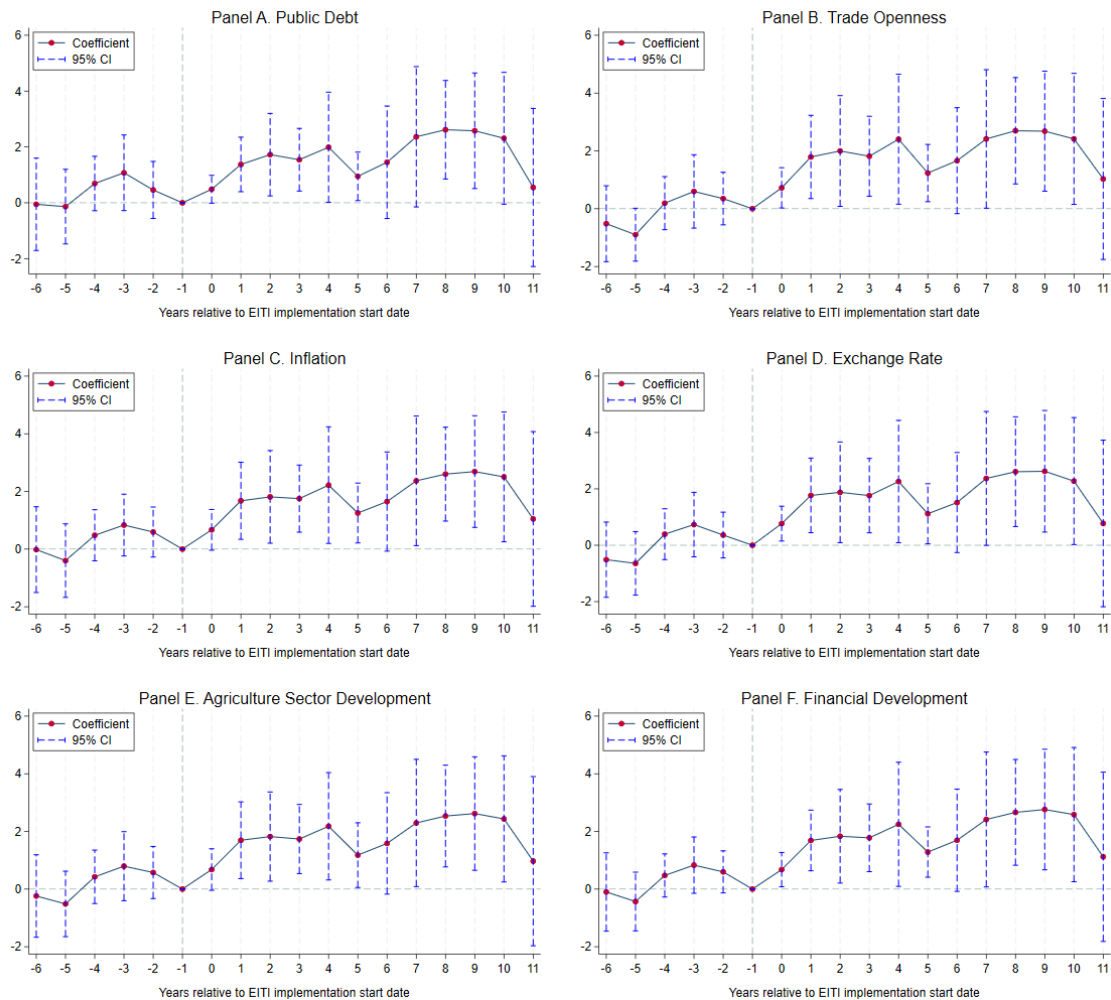
Figure A2: EITI dynamic effects on resource revenue with additional control variables



Note: Control variables are also included. The placebo joint test is not significant.
Source: Author's compilation.

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Figure A3: EITI dynamic effects on resource revenue with additional control variables

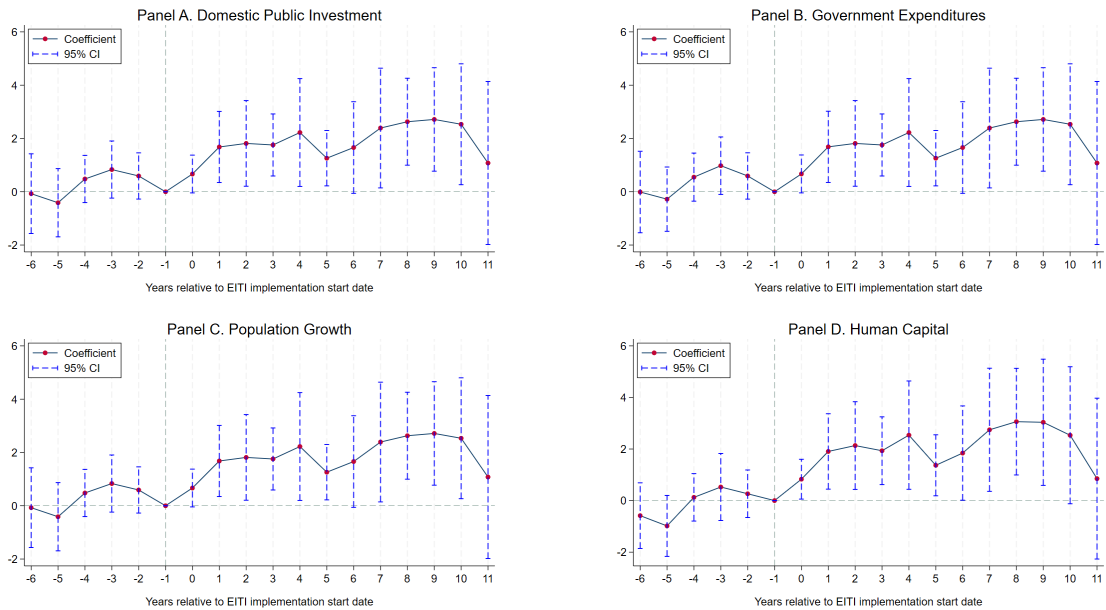


Note: Control variables are also included. The placebo joint test is not significant.

Source: Author's compilation.

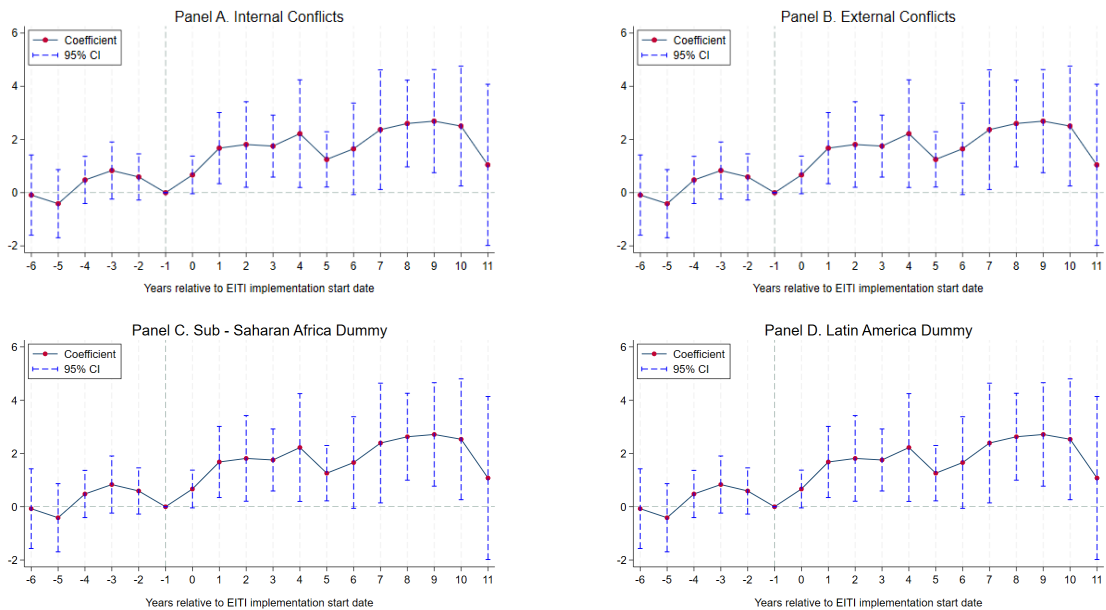
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Figure A4: EITI dynamic effects on resource revenue with additional control variables



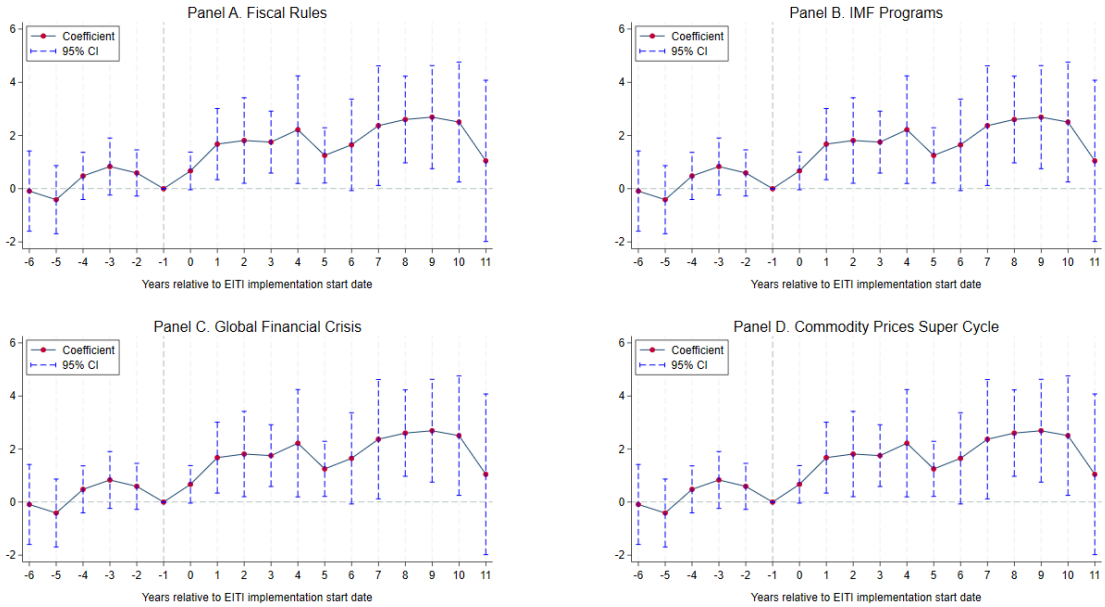
Note: Control variables are also included. The placebo joint test is not significant.
Source: Author's compilation.

Figure A5: EITI dynamic effects on resource revenue with additional control variables



Note: Control variables are also included. The placebo joint test is not significant.
Source: Author's compilation.

Figure A6: EITI dynamic effects on resource revenue with additional control variables



Note: Control variables are also included. The placebo joint test is not significant.
Source: Author's compilation.

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Table A7: EITI and resource revenue (alternative estimation methods)

	Ordinary DID estimation results	Panel instrumental variables results	Entropy balancing method results	
	(1)	(2)	(3)	(4)
Panel A: First-stage (instruments)				
Neighbour EITI		0.0340*** (0.0093)		
Lagged EITI		0.7707*** (0.0375)		
Dependent variable: resource revenue	(1)	(2)	(3)	(4)
Panel B: Second-stage regression results				
EITI	1.4485** (0.5953)		1.3721*** (0.3950)	0.7947** (0.3984)
Real GDP per capita (log)	2.9794** (1.2434)		-1.9138*** (0.6243)	7.2307*** (1.7677)
Official development assistance	-0.0291 (0.0237)		0.0149 (0.0233)	-0.0974 (0.0868)
Corruption index	-0.5296 (0.3275)		-0.4965** (0.1990)	0.0121 (0.3168)
Polity2	0.0019 (0.0528)		-0.0584 (0.0373)	0.0236 (0.0562)
Commodity price index	0.0030 (0.0080)		0.0007 (0.0034)	0.0180* (0.0100)
Observations	1,141		1,141	1,141
Kleibergen-Paap F-stat	-		519.027	-
Stock-Yogo critical values (10%)	-		19.93	-
Hansen test (p-value)	-		0.5792	-
Control variables	Yes		Yes	Yes
Country and year fixed effects	Yes		Yes	Yes
ATTs with negative weights	6.40%		-	-
R ²	0.8871		0.0239	0.8749

Note: Robust standard errors are in parentheses. Column (2) of panel A presents the first-stage results (with neighbour EITI and lagged EITI used as instruments). Column (1) of panel B presents the estimation results using the ordinary DID estimation method, and column (3) of panel B presents the second-stage results of the IV method (with EITI as the treatment variable). Column (4) shows the results of the entropy balancing method. All control variables are lagged by one year. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Source: Author's compilation.

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Table A8: Entropy balancing method: descriptive statistics before and after weighting

	[1]	[2]	[3] = [2] - [1]	[4]	[5]
	EITI	Non-EITI	Difference	T-test	p-value
Panel A: Descriptive statistics	mean	mean			
Real GDP per capita (log)	7.33	7.66	0.33	5.42	0.00
Lag official development assistance	6.11	4.50	-1.61	-2.89	0.00
Lag corruption index	2.01	2.21	0.20	4.44	0.00
Lag polity2	3.04	1.55	-1.49	-4.59	0.00
Lag commodity price index	101.03	114.94	13.91	7.30	0.00
Observations	311	1,045			
	[1]	[2]	[3] = [2] - [1]	[4]	[5]
	EITI	Non-EITI	Difference	T-test	p-value
Panel B: Covariate balancing	mean	mean			
Real GDP per capita (log)	7.33	7.33	0.00	0.00	1.00
Lag official development assistance	6.11	6.11	0.00	0.00	1.00
Lag corruption index	2.01	2.01	0.00	0.02	0.99
Lag polity2	3.04	3.04	0.00	-0.01	0.99
Lag commodity price index	101.03	100.98	-0.05	-0.03	0.98
Observations	311	1,045			
Total of weights	311	311			

Source: Author's compilation.

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Table A9: Sources and definition of data

Variables	Description	Sources
Dependent variable		
Resource revenue	Total resource revenue in percentage of GDP.	UNU-WIDER Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Treatment variable		
<i>EITI</i>	Dummy variable equals 1 if the country <i>i</i> implements the EITI in year <i>t</i> and 0 otherwise.	Author's construction based on information available at (https://eiti.org/countries) and Lujala (2018).
Control variables in the main analysis		
Real GDP per capita (log)	Natural logarithm of GDP per capita in constant prices.	World Development Indicators (WDI). World Bank.
ODA	All Official Development Assistance (ODA), expressed as a percentage of GDP.	World Development Indicators (WDI). World Bank.
Corruption index	Assessment of corruption within the political system. The index ranges from 0 to 6 (lower scores represent higher levels of corruption).	International Country Risk Guide (ICRG).
Polity2	The polity score is computed by subtracting the p_autocore from the p_democ score; The index ranges from +10 (strongly democratic) to -10 (strongly autocratic).	Polity IV dataset https://www.systemicpeace.org/inscrdata.html .
Commodity price index	Commodity Net Export Price Index (xj-mj) weighted by the ratio of net exports to total commodity trade; defl.; 2012m6=100.	International Monetary Fund (IMF), Gruss and Kebhaj (2019) .
Control variables in robustness, transmission, channels analysis		
Extractive rents	Total of oil, natural gas, coal, mineral, and forest rents (in percentage of GDP).	World Development Indicators (WDI), World Bank.
Resource dependency (% GDP)	Share of mineral and fuel exports in GDP.	Author's construction based on data from UNCTADstat. https://unctadstat.unctad.org/datacentre/ .
Kimberley Process	Dummy variable equals 1 if the country <i>i</i> is a member of Kimberley Process in year <i>t</i> .	Author's construction based on information available at https://www.kimberleyprocess.com/en .
ICGLR	Dummy variable equals 1 if the country <i>i</i> is a member of the International Conference on the Great Lakes Region in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.icglr.org/index.php/fr/ .
OPEC	Dummy variable equals 1 if the country <i>i</i> is a member of the Organization of the Petroleum Exporting Countries in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.opec.org/opec_web/en/about_us/25.htm .
OPEC+	Dummy variable equals 1 if the country <i>i</i> is a member of the Organization of the Petroleum Exporting Countries + alliance in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.opec.org/opec_web/en/about_us/25.htm .
Public debt (% GDP)	General government gross debt as a percentage of GDP.	International Monetary Fund (IMF).
Trade openness (% of GDP)	Trade is measured as a share of GDP.	World Development Indicators (WDI).
Inflation	Inflation, average consumer prices (percent change).	World Economic Outlook (WEO) - International Monetary Fund (IMF).
Exchange rate	Exchange rate, national currency/USD (market + estimated).	Penn World Table, version 10.0, www.ggd.net/pwt .
Agricultural value-added	Agriculture, forestry, and fishing, value added (in percentage of GDP).	World Development Indicators (WDI).
Financial development	Degree of development of financial institutions and financial markets in terms of depth, access, and efficiency.	International Monetary Fund (IMF) https://data.world.imf/financial-development-fd .
Public investments	General government domestic, expressed as a percentage of GDP.	IMF Investment and Capital Stock dataset.
Government total expenditures	General government total expenditure (in percentage of GDP).	World Economic Outlook (WEO) - International Monetary Fund (IMF).
Population growth	Annual population growth rate for year <i>t</i> is the exponential rate of growth of midyear population from year <i>t</i> -1 to <i>t</i> , expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	World Development Indicators (WDI).
Human capital	Human capital index, based on years of schooling and returns to education.	Penn World Table, version 10.0, Feenstra et al. (2015) .

Source: Author's compilation.

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Table A10: Sources and definition of data

Variables	Description	Sources
Internal conflict index	This is an assessment of political violence in the country and its actual or potential impact on governance. A score of 4 points equates to very low risk and a score of 0 points to very high risk.	International Country Risk Guide (ICRG).
External conflict index	An assessment of the risk to the incumbent government from foreign action, ranging from non-violent external pressure to violent external pressure. A score of 4 points corresponds to a very low risk and a score of 0 points to a very high risk.	International Country Risk Guide (ICRG).
Sub-Saharan African region	Dummy variable equals 1 if the country i is in sub-Saharan Africa.	Author's construction.
Latin American region	Dummy variable equals 1 if the country i is in sub-Saharan Africa.	Author's construction.
Fiscal rule	Dummy variable equal to 1 if the country i applies a fiscal rule in year t . A fiscal rule is a long-lasting constraint on fiscal policy through numerical limits on budgetary aggregates. Fiscal rules typically aim to correct distorted incentives and contain pressures to overspend, particularly in good times, to ensure fiscal responsibility and debt sustainability.	International Monetary Fund (IMF).
IMF programs	Dummy variable equals 1 if the country i benefits from an IMF program in year t .	International Monetary Fund (IMF), Dreher (2006) .
Global financial crisis	Dummy variable equal to 1 during the financial crisis years (2007, 2008, and 2009).	Author's construction.
Commodities super-cycle period	Dummy equals 1 for commodity super-cycle years (2003 to 2008).	Author's construction.
Total revenue	Government total domestic revenue (resource revenue and non-resource revenue) in percentage of GDP, excluding grants and social contributions.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Resource tax	Total taxes collected from the extraction of natural resources (extractive industries' corporate income taxes and indirect resource taxes), in percentage of GDP.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Resource non-tax revenue	Total non-tax revenue collected from the extraction of natural resources (royalties, export taxes, profit sharing, and profits of state-owned enterprise), in % of GDP.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Non-resource tax	Total taxes excluding resource taxes and social contributions, in percentage of GDP.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Non-resource non-tax revenue	Total non-tax revenue excluding resource non-tax revenue and social contributions, in percentage of GDP.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
FDI	Foreign direct investment net inflows, expressed as a percentage of GDP.	World Development Indicators (WDI). World Bank.
Regulatory quality	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	World Governance Indicators (WGI), Daniel Kaufmann and Aart Kraay and Massimo Mas-truzzi (2010) .

Source: Author's compilation.

CHAPTER 2

How does implementing the Extractive Industries Transparency Initiative (EITI) affect economic growth? Evidence from developing countries

This chapter is published in the European Journal of Political Economy.¹

Abstract

Although there is no consensus on the relationship between natural resource abundance and economic growth, much of the economic literature suggests that natural resource abundance negatively affects economic growth in developing countries, leading to the resource curse theory. This situation led the international community to create the Extractive Industries Transparency Initiative (EITI) in 2003 to promote the effective contribution of natural resources to economic growth through a process involving governments, extractive industries, and civil society. Considering 99 developing countries from 1995 to 2019 and applying heterogeneity-robust difference-in-differences (DID) estimators, we find a positive and statistically significant relationship between EITI implementation and economic growth. Several robustness checks support this

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result. Most interestingly, the analysis of EITI's dynamic effects reveals that these effects occur only in the short and medium terms. In addition, we tested several potential transmission channels and identified the increase in foreign direct investment and the rise in resource revenue as the main transmission channels. Moreover, we postulate and investigate four possible explanations behind the EITI's mixed results on long-term growth: the lack of evidence of a negative relationship between natural resource abundance and long-term economic growth over the study period, a possible increasing reliance on non-resource taxes, a possible signaling effect targeted by member countries, and the lack of effect of EITI implementation on reducing corruption. Finally, the document provides economic policy recommendations for better governance in the management of natural resources in order to increase their contribution to development financing. Furthermore, improving governance in managing critical minerals is vital to avoid a "new curse of critical minerals".

Keywords: • Governance • Natural resources • Economic growth •
Extractive industries transparency • Resource curse • Heterogeneous and
dynamic treatment effects

JEL Classification: G38, O13, O19, O43, Q32, Q38

2.1 Introduction

The extractive sector is essential for many developing countries. Some economies have relied heavily on extractive resources for years, while others have recently begun or increased their exploitation of extractive resources. Due to the importance of the extractive sector, a large part of the literature has analyzed the link between countries' natural resource endowment and economic growth. However, the literature does not reach a consensus on the efficiency of exploiting natural resources and their contribution to economic growth in countries with abundant natural resources (Havranek et al., 2016).

On the one hand, some authors have found that resource abundance has not always been a blessing for these countries (Gylfason, 2000; Van der Ploeg, 2011). Sachs and Warner (1995), who represent the founding authors of this literature, have highlighted a negative and significant relationship between natural resource abundance and economic growth, which had been qualified as the "resource curse". Since their pioneering work, the economic literature has shown considerable interest in analyzing resource curse determinants. First, governance and institution quality are the main determinants of the resource curse identified in the literature. Institutional quality influences natural resource management (Sala-i Martin and Subramanian, 2013), and resource revenue can be used to enforce corruption (Busse and Gröning, 2013), specifically when the quality of democratic institutions is relatively low (Bhattacharyya and Hodler, 2010; Arezki and Brückner, 2011). Poor institutional quality also favors the appropriation of natural resource revenues by political leaders through rent-seeking and patronage (Mehlum et al., 2006; Robinson et al., 2006), leading to an inability of these countries to use these revenues as an engine for economic growth. Oil resources can also hinder democracy since autocratic leaders in oil-rich countries remain longer in power (Crespo Cuaresma et al., 2011). Morrison (2007) suggests that the simple existence of natural resources in non-democratic countries favors the political resource curse and reduces chances for democratization, while Vasilyeva and Libman (2020) find that beyond the difference between democracies and autocracies, regimes with fragmented elites underperform those with consolidated elites. Second, an economic explanation for the poor performance of resource-rich countries is the "Dutch disease", i.e., the appreciation of a country's exchange rate following a boom in foreign exchange earnings from its natural resource exports (Corden and Neary, 1982). This appreciation leads to a loss of competitiveness in the agricultural and industrial sectors, as exports from these two sectors are penalized in favor of the emerging extractive sector that attracts production factors (Sachs and Warner,

1995). Finally, the resource curse can be manifested through conflicts (Collier and Hoeffler, 1998; Berman et al., 2017), mainly when natural resources are unequally distributed across a country's different ethnic groups since this induces rent-seeking behavior (Lessmann and Steinkraus, 2019). Nevertheless, transferring a large part of the oil wealth can mitigate this issue, mainly if these transfers are direct, meaning unconditional cash transfers to the population (Cordella and Onder, 2020).

On the other hand, other authors have provided evidence of a positive and statistically significant effect of natural resources on long-term economic growth. Indeed, Brunnschweiler (2008) has analyzed the effects of natural resource endowment on economic growth, using cross-country data and new measures of natural resource abundance, namely total natural capital per capita and subsoil wealth per capita. The results reveal a positive direct and statistically significant relationship between natural resource endowment and economic growth. Similarly, Alexeev and Conrad (2009) examine the effects of natural resources on economic growth and find that extractive resources have enhanced rather than inhibited long-term growth. In the same line, Smith (2015) analyzes the impact of major natural resource discoveries since 1950 on GDP per capita and finds that resource exploitation positively affects economic growth, with effects that persist in the long run. A cross-country study by Arin and Braunfels (2018) also fails to find empirical evidence for a "natural resource curse". However, it concludes contrary to a positive and statistically significant robust effect between oil rents and long-term economic growth. Furthermore, despite the positive effect of natural resources highlighted by this part of the literature, these authors emphasize the importance of institutions in the growth process, particularly in the long term (Brunnschweiler, 2008; Apergis and Payne, 2014; Arin and Braunfels, 2018). Therefore, countries with significant natural resources must manage their resources efficiently and responsibly.

Institutional quality is a major determinant of economic development (Acemoglu et al., 2001). The government's preference for the present explains the over-exploitation of natural resources, and institutions determine the effectiveness of extractive revenue booms in developing countries (Robinson et al., 2006). Mehlum et al. (2006) have shown that the resource curse only affects countries with low institutional quality, and improvement in institutional quality is a condition for the effective contribution of natural resources to economic growth. Policies that promote transparency and accountability increase the cost of corrupt episodes (Kolstad and Wiig, 2009) and the accountability of governments to their citizens in managing extractive industries' revenue (Mejía Acosta, 2013). Busse and Gröning (2013) argue

that greater transparency regarding the use of revenues by national governments and international investors could help mitigate the resource curse. The authors identify the Extractive Industries Transparency Initiative (EITI) as an example of an initiative designed to promote transparency in resource-rich countries.

The EITI was first publicly announced by the United Kingdom Prime Minister Tony Blair at the World Summit on Sustainable Development in Johannesburg in 2002 and formally launched in London in June 2003 ([Lujala, 2018](#)). The EITI is headquartered in Oslo (Norway), with national committees in each member country, and is considered the most broadly implemented and supported transparency initiative in natural resource governance. It has been endorsed and supported by the United Nations, African Union, G8 and G20 countries, as well as many international organizations such as the International Monetary Fund and the World Bank ([Sovacool et al., 2016](#)). The institution promotes transparency and accountability in the governance of the extractive sector, including the collection, management and distribution of resource revenues, thereby contributing to sustainable development and poverty reduction. The 2023 EITI Standard requires implementing countries to disclose information on key aspects of the extractive sector value chain, including exploration activities; the award of licenses and contracts; production and exports; payments made by extractive companies and revenues received by governments; the allocation and distribution of these revenues; and certain social, environmental and quasi-fiscal expenditures, as well as the sector's contribution to the national economy ([EITI, 2023](#)). The objective is to make natural resources an engine of sustainable economic growth in developing member countries.²

Based on the literature, we have identified three main transmission channels through which EITI implementation may affect economic growth in developing countries: the improvement of investment climate, an increase in foreign direct investment attractiveness, and increasing resource revenue mobilization. Firstly, natural resource revenues tend to increase corruption ([Arezki and Brückner, 2011](#)), and this effect depends on the institutional quality ([Mehlum et al., 2006](#); [Bhattacharyya and Hodler, 2010](#)). However, solid democratic institutions make politicians accountable to their citizens, increasing detour and extractive revenue' capture costs ([Bhattacharyya and Hodler, 2010](#)). The EITI, through its incentive and enforcement mechanism, could help to reduce the misappropriation of extractive rents and improve governance and accountability in public management, leading to a healthy investment climate

²Further details on the EITI implementation process are provided in Appendix [B.1](#).

for long-term foreign investment. Secondly, exploiting natural resources requires significant investments and specific advanced technologies ([Lucke and Rehfeldt, 2023](#)). However, developing countries do not have sufficient domestic revenue to make these investments and are incentivized to attract foreign direct investments (FDI). [Aleksynska and Havrylchyk \(2013\)](#) explain that large institutional distance discourages investment from the North, while natural resources constitute a factor in attracting FDI from emerging countries (the South) to developing countries with worse institutions. However, [Busse et al. \(2016\)](#) suggest that this resource-seeking FDI in African countries explains the insufficient FDI environment, which could diminish the positive effects of FDI on economic growth. The authors find that better institutions enable countries to benefit more from FDI, positively affecting economic growth. They recommend that developing countries develop a better environment for the private sector and a more transparent regulatory environment, which could lead to significant spillover effects, particularly from FDI from the South (such as FDI from China). By enhancing the mining investment climate and sending a signal to international investors about member countries' commitment to promoting transparency and combating corruption in the extractive sector ([Öge, 2016a](#); [Lujala, 2018](#)), EITI implementation should enhance the attractiveness of foreign direct investment and boost economic growth. Thirdly, the need for domestic resources to finance Sustainable Development Goals (SDGs) in developing countries were highlighted at the International Conference on Financing for Development in June 2015. In these countries, domestic revenue positively contributes to economic growth ([Chauvet and Ferry, 2021](#)), and this effect depends on the allocation of these revenues to finance infrastructure spending, which in turn depends on levels of corruption and government accountability. Moreover, [Bornhorst et al. \(2009\)](#) and [Crivelli and Gupta \(2014\)](#) find that natural resource revenue decreases domestic (non-resource) revenue, highlighting the lower incentive of countries with resource endowments to mobilize non-resource domestic revenue. In the same line, [McGuirk \(2013\)](#) explains that in these countries, leaders lighten the burden of taxation on the population to reduce the demand for democratic accountability and make them more inclined to accept the current regime's policies. This makes it essential to manage natural resources better and collect more revenue from the sector. Thus, by increasing resource revenue and requiring governments to disclose extractive industries' payments and government revenue collected, the EITI implementation could positively affect economic growth in developing member countries. Furthermore, we also analyze three additional (indirect) potential transmission channels: corporate tax revenue, personal income tax revenue, and income inequality.

Although the literature on the analysis of the EITI's effects on institutional and development indicators has progressed, to the best of our knowledge, no study has evaluated its direct treatment effects on economic growth in developing countries. Moreover, no study has provided evidence of the dynamic effects of EITI and the main transmission channels through which EITI implementation affects economic growth. On the other hand, the EITI effectiveness analysis faces numerous analytical challenges. Indeed, a country's decision to join the EITI is voluntary and not exogenous, but rather influenced by the country's socio-political and economic characteristics. Therefore, countries have started the implementation of EITI at different times. In addition, member countries can be suspended from the organization, leading to breakdowns during the EITI implementation process for some countries. For these reasons, it is legitimate to think that the treatment effects of EITI implementation are heterogeneous across countries and over the years. Previous studies have not considered the heterogeneous effects in EITI implementation due to the heterogeneity in EITI membership dates within member countries and, more importantly, the breakdowns in EITI implementation for some countries. This paper aims to fill these gaps in the literature

First, to identify the treatment effects of EITI implementation on economic growth, we consider EITI implementation as a treatment and the GDP per capita growth rate as the dependent variable. Our analysis exploits a difference-in-differences (DID) setup that compares countries implementing the EITI and those not implementing the EITI. As highlighted by several studies ([De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#); [Sun and Abraham, 2021](#); [Goodman-Bacon, 2021](#); [Callaway and Sant'Anna, 2021](#)), the ordinary difference-in-differences (ordinary DID) estimator could be biased if the treatment effects are heterogeneous across countries and years. To address these analytical challenges, we employ the heterogeneity-robust difference-in-differences (heterogeneity-robust DID) estimator of [De Chaisemartin and d'Haultfoeuille \(2020\)](#).³ Using a sample of 99 developing countries from 1995 to 2019, we find that implementing the EITI has a positive and statistically significant effect on economic growth by increasing the GDP per capita growth rate in member developing countries. This result is robust to several robustness tests, such as excluding potential outliers, using alternative samples, adding additional control variables, exploiting the exogenous variation in the main resource world prices, conducting placebo tests, and employing alternative estimation methods.

³We also provide the ordinary DID estimation results and evaluate the bias attached to this result.

Second, we analyze EITI's dynamic treatment effects using the dynamic heterogeneity-robust DID estimator (allowing dynamic effects) proposed by [De Chaisemartin and d'Haultfoeuille \(2024\)](#). The results reveal that EITI's annual positive and statistically significant effects occur at two distinct points during the implementation process: in the short term (during the second and third years of implementation) and the medium term (after the fifth and sixth years).

Third, to explain these results, we analyze the potential transmission channels through which EITI implementation may affect economic growth in member countries and provide evidence that the main transmission channels could be an increase in foreign direct investment and extractive resource revenue. While we find an improvement in the investment climate during EITI implementation, this result is not robust as past trends influence post trends.

Finally, our results conclude that despite the benefits of EITI, it does not promote long-term economic growth. We postulate and explore that the lack of evidence of a negative relationship between natural resource abundance and long-term economic growth over the study period, a possible increasing reliance on non-resource taxes, the use of EITI membership by some member countries as a signaling mechanism to gain benefits from the international community, and the lack of effect on reducing corruption are the main possible explanations for this lack of long-term effects of EITI implementation on economic growth.

The rest of the paper proceeds as follows. In [Section 2.2](#), we present data and descriptive statistics. [Section 2.3](#) describes the methodology. The main results are presented in [Section 2.4](#), followed by a robustness analysis in [Section 2.5](#). [Section 2.6](#) provides evidence of the EITI's dynamic treatment effects on economic growth and highlights transmission channels, and [Section 2.7](#) discusses the results. Finally, [section 2.8](#) concludes and offers some policy recommendations.

2.2 Data and descriptive statistics

2.2.1 Data

To evaluate the effect of implementing the EITI on economic growth, we use a panel of 99 developing countries from 1995 to 2019. The analysis sample and time horizon are mainly determined by data availability. We construct the treatment variable (EITI implementation) based on the information available on the EITI

website⁴ and from Lujala (2018). The treatment variable *EITI* is defined as equal to 1 for each year t in which country i is a member of the EITI and 0 otherwise. Consequently, we take into account all stages of the EITI implementation process. The study sample includes 47 countries that joined the EITI during the study period and 52 non-members. The complete list of countries in the sample is available in Table B1 (in Appendix B.4). Details on important dates in the EITI implementation process of the treatment group countries are provided in Table B2.

The outcome variable in our study is economic growth. Referring to the literature (Barro, 1991; Sala-i Martin, 1997; Barro, 2000), we measure economic growth by the annual GDP per capita growth rate. Data comes from the World Bank's World Development Indicators (WDI) database.

In line with the literature on economic growth and that on the determinants of EITI membership, we use the following control variables identified as EITI determinants and correlated with economic growth: Initial GDP per capita (in logarithm), net official development assistance, natural resources rents, net foreign direct investment flows, control of corruption index, level of democratic accountability, political stability, commodity price index, inflation, and internal conflicts. Details on the choice of these control variables are available in Appendix B.2.

Following Lujala (2018), we transform the natural resources rents and official development assistance variables using natural logarithms due to their highly asymmetric values. To limit the influence of the extreme values in the foreign direct investment data, we transform this variable using the inverse hyperbolic sine function.⁵ In addition to the initial GDP per capita that we include to capture a convergence effect, we lag all the control variables considered in the analysis to limit the reverse causality problem and in line with the literature on the EITI determinants.

Tables B15 and B16 describe the data and their sources, and Table B6 provides descriptive statistics of the main variables used in the study.

2.2.2 Stylized facts

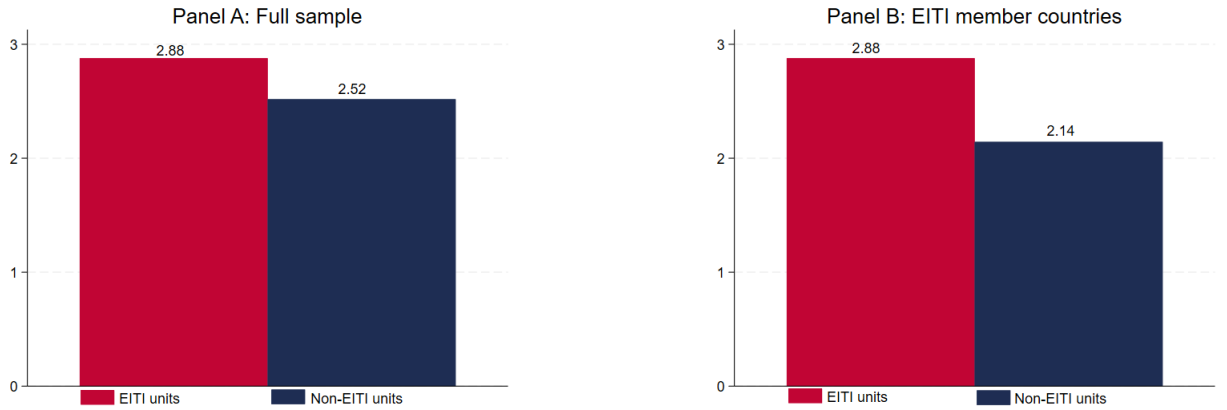
We present descriptive statistics on the correlation between the GDP per capita growth rate and EITI implementation. In Fig. 2.1, we compare the GDP per capita

⁴EITI website: <https://eiti.org/countries>.

⁵The log transformation of the extractive rents and the transformation of the FDI variable using the inverse hyperbolic sine function is the best functional form for these variables (Lujala, 2018).

growth rate in EITI and non-EITI observations. Panel A compares the average GDP per capita growth rate in EITI and non-EITI observations in the whole sample, while panel B restricts the sample to EITI member countries and compares the average GDP per capita growth rate before and after EITI implementation. An analysis of this figure reveals a higher GDP per capita growth rate in EITI units (2.88%) compared to non-EITI units (2.52% for the entire sample and 2.14% for the member countries group). Furthermore, the difference between the two groups is statistically significant. However, these statistics are only correlations and not causal effects. This does not allow us to conclude a causal relationship between EITI implementation and the GDP per capita growth rate. To investigate the treatment effects of EITI implementation on economic growth, we rely on the identification strategy explained in the following section.

Figure 2.1: Average GDP per capita growth rate in EITI units and non-EITI units



Note: This graph presents the average GDP per capita growth rate in EITI units (country-year with EITI implementation) and non-EITI units (country-year without EITI implementation) from 1995 to 2019.

Source: Author's construction.

2.3 Methodology

This study aims to evaluate the treatment effects of EITI implementation on economic growth in developing countries. We exploit variations in EITI membership and implementation timing across countries, resulting in the following equation:

$$GDPpc_{it} = \alpha_i + \beta EITI_{it} + \delta X_{it} + \mu_t + \epsilon_{it} \quad (2.1)$$

Where $GDPpc_{it}$ is the GDP per capita growth rate of country i in year t ; α_i represents country-fixed effects that capture time-invariant country-specific effects; μ_t represents year-fixed effects that capture time-specific factors affecting sample

countries; $EITI_{it}$ is a dummy variable representing the treatment and indicates whether country i implements the EITI in year t (it is equal to 1) or not (it is then equal to 0). X_{it} is a set of control variables; ϵ_{it} is the random error term.

Equation 2.1 represents an ordinary difference-in-differences (ordinary DID) specification with additional controls. Due to the EITI implementation design, our analysis faces various methodological challenges that must be addressed to ensure the validity of the results. Indeed, the EITI is a global organization that any country can join voluntarily. Thus, the decision to implement the EITI standard is not exogenous. Therefore, countries do not adhere to the EITI on the same date. In addition, suspensions can occur when countries do not fully respect the EITI standard.⁶ For these reasons, the effects of EITI treatment could be heterogeneous over time and between countries. Several studies (De Chaisemartin and d'Haultfoeuille (2020; 2024); Sun and Abraham, 2021; Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021) highlighted some limitations of linear regressions with period and group fixed effects (the ordinary DID estimation method)⁷, a widely used method in the literature to estimate treatment effects. Indeed, it can produce biased estimations when treatment effects are heterogeneous since it could give negative weight to some of them. The assignment of these negative weights to treatment effects in estimating the average effect can lead to a bias in the estimated effect and, in extreme cases, to an inversion of the sign of the estimated effect. We first provide the ordinary DID estimation results and check their validity by applying the test proposed by De Chaisemartin and d'Haultfoeuille (2020), which consists of calculating the number of estimated ATTs attached to negative weights. The higher the percentage of ATTs attached to estimated negative weights in the total number of ATTs estimated by the ordinary DID method, the higher the probability of these results being biased.

To address these challenges and identify the effect of EITI implementation on economic growth, we consider EITI implementation as a treatment and the GDP per capita growth rate as the outcome variable, and we implement the heterogeneity-robust difference-in-differences (DID) estimator developed by De Chaisemartin and d'Haultfoeuille (2020), which is a method robust to heterogeneous treatment effects. Indeed, this estimator will be equal to a weighted average of two double

⁶Details on these suspension episodes are provided in Appendix B.1.

⁷The ordinary DID method relies on two major assumptions: the common trends assumption or parallel trends assumption (which states that in the absence of the treatment, the change in the outcome variable would have been identical in the treatment and control groups) and the assumption that the treatment effect is constant between groups and over time.

differences: (a) a first one that compares the evolution of economic growth (outcome) in groups that go from non-treated to treated from $t-1$ to t and in groups untreated at both dates; (b) a second one that compares the evolution of economic growth in groups that move from treated to untreated from $t-1$ to t and in groups treated at both dates. More specifically, this method allows us to compare switchers to non-switchers, ensuring that the control used for a switcher had the same treatment as that switcher in $t-1$. That ensures that this estimator relies only on the identification assumption of parallel trends rather than the assumption of a constant treatment effect. In addition, the heterogeneity-robust DID estimator allows us to test the parallel trends assumption between the group of treated and untreated units by comparing the $t-2$ to $t-1$ outcome evolution of $t-1$ to t switchers and non-switchers. Intuitively, this placebo assesses if switchers and non-switchers were on parallel trends before the switch. Therefore, this estimator identifies the treatment effect of the switchers when they switch.⁸ We complement the heterogeneity-robust DID estimator with alternative estimation methods (in the robustness analysis). The dynamic heterogeneity-robust DID estimator (robust to heterogeneous and dynamic effects) developed by [De Chaisemartin and d'Haultfoeuille \(2024\)](#) is also employed to analyze the EITI's dynamic effects on economic growth in Section 2.6.

2.4 Main results

First, we present the result of the ordinary DID estimation in column (1) of Table B11 (in Appendix B.4). This result indicates that implementing the EITI increases the GDP per capita growth rate by 1.02 percentage points, which is statistically significant at the 5% threshold. As explained previously, the results obtained using the ordinary DID method may not be robust to the heterogeneous effects of EITI implementation. Applying the validity test of ordinary DID estimation proposed by [De Chaisemartin and d'Haultfoeuille \(2020\)](#), the result indicates that, under the assumption of common trends, β estimates a weighted sum of 390 ATTs, 36 of which receive a negative weight, i.e., 9.23% of total estimated ATTs. This result means that the ordinary DID estimates are not entirely robust to the heterogeneous treatment effects of the EITI implementation.

Thus, Column (1) of Table 2.1 presents the results of the treatment effects of EITI implementation on economic growth, applying the heterogeneity-robust DID

⁸See the original paper by [De Chaisemartin and d'Haultfoeuille \(2020\)](#) for more technical details.

Table 2.1: EITI and Economic Growth

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Baseline	Excluding units	Excluding units	Applying filters	Resource-dependent
GDP per capita growth rate	main result	<1% & >99%	<5% & >95%	to control units	countries sample
		percentiles	percentiles		
EITI	0.6947**	0.7456**	0.6869**	0.7069**	0.9394**
	(0.3212)	(0.2988)	(0.3491)	(0.3152)	(0.4679)
$DID_M^{pl,1}$	0.2495	0.4562	0.4550	0.1967	0.1012
	(0.3537)	(0.3392)	(0.3387)	(0.3572)	(0.4926)
$DID_M^{pl,2}$	-0.4088	-0.3986	-0.7761	0.4036	-0.6009
	(0.4654)	(0.4393)	(0.4919)	(0.5016)	(0.6208)
$DID_M^{pl,3}$	0.3676	0.0774	0.3272	0.4403	0.6030
	(0.6158)	(0.4505)	(0.3715)	(0.6308)	(0.8308)
Control variables	Yes	Yes	Yes	Yes	Yes
Country & Year fixed effects	Yes	Yes	Yes	Yes	Yes

Note: The results are obtained using the heterogeneity-robust DID estimator (De Chaisemartin and d'Haultfoeuille, 2020). 100 bootstrap replications were applied, and 7 placebo estimators were estimated. Robust standard errors are in parentheses. EITI is the treatment variable. Control variables: Initial real GDP per capita (log), official development assistance (log), natural resources rents (log), foreign direct investment (asinh), control of corruption, voice and accountability, political stability, commodity price index, inflation, and internal conflict. All control variables are lagged by one year. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Source: Author's construction.

estimator developed in Section 2.3. In the regression, we include placebo estimators, which consider the past evolution of the outcome between treated and untreated units (we consider seven years before EITI membership for placebo effects estimations). The results indicate that implementing the EITI increases the GDP per capita growth rate by 0.69 percentage points, with a statistically significant effect at the 5% threshold. We also present three pre-treatment estimators ($DID_M^{pl,1}$, $DID_M^{pl,2}$, and $DID_M^{pl,3}$), corresponding respectively to the second, third, and fourth years before the implementation of the EITI.⁹ The results show that all estimated placebo effects are not statistically significant.¹⁰ This means that before implementing the EITI, countries did not experience significant changes in their GDP per capita growth rate compared to those that never implemented the EITI. Thus, the result of the placebo

⁹Since De Chaisemartin and d'Haultfoeuille (2020) consider $t = -1$ as the reference period, $DID_M^{pl,1}$ compares the difference in the outcome between EITI and non-EITI countries in $t - 1$ with the difference between the two groups in $t - 2$, $DID_M^{pl,2}$ makes such a comparison between $t - 1$ and $t - 3$, while $DID_M^{pl,3}$ makes such a comparison between $t - 1$ and $t - 4$.

¹⁰We do not present the results for all placebo effect estimations in the table, but any placebo effect is significant.

analysis attests to the validity of the parallel trends assumption in our results (an assumption on which this estimator is based) and validates the non-anticipation assumption. In the next section, we check the robustness of our results by addressing potential additional identification threats that our analysis may face.

2.5 Robustness analysis

Our estimation results show that EITI implementation promotes economic growth in developing member countries compared to non-member countries. In this section, we perform several robustness tests. First, we check the robustness of our results by excluding potential outliers and considering alternative samples. Second, we control for additional control variables likely to influence the EITI membership and economic growth. Next, we test for robustness by focusing on the influence of the exogenous variation in world prices of extractive resources. In addition, we check robustness by conducting a placebo test. Finally, we estimate the effects of EITI implementation using alternative estimation methods such as instrumental variables and entropy balancing methods.

2.5.1 Alternative samples

We use alternative samples to ensure that a group of observations does not drive our results and that the control group is reasonably comparable to the treatment group. Firstly, we use samples that exclude potential outliers. Indeed, columns (2)–(3) of Table 2.1 show the estimation results considering samples that exclude observations below the 1st percentile and above the 99th percentile and observations below the 5th percentile and above the 95th percentile. These results are consistent with our baseline results and indicate a positive and statistically significant effect of EITI implementation on economic growth, with coefficients equal to 0.75 percentage points and 0.69 percentage points, respectively. Second, in column (4), we follow a similar process as in [Lin and Ye \(2009\)](#) by retaining in the control group only EITI non-members that have a real per capita GDP at least as large as those of the poorest EITI members and with a population size at least as large as those of the smallest EITI member. Thirdly, in column (5), we retain only the sample of natural resource-dependent countries. Following the literature (see, for example, [Haglund, 2011](#); [Dobbs et al., 2013](#); [Coutinho et al., 2022](#)), we define resource-dependent countries as those whose ratio of resource exports to total exports is equal to or greater than 20%, or whose ratio of extractive rents to GDP is equal to or greater

than 10%, or whose ratio of resource revenue to total government revenue is equal to or greater than 20%. These two last results are consistent with our baseline results and indicate a positive and statistically significant effect of EITI implementation on economic growth, with coefficients equal to 0.71 percentage points and 0.94 percentage points, respectively. The relative stability of the coefficients in these specifications reflects the robustness of the analysis.¹¹

2.5.2 Additional control variables

We test the robustness of our results using additional control variables likely to influence both the decision to implement the EITI and economic growth. This test will allow us to correct for potential estimation bias due to omitted variables. Referring to the literature on the determinants of EITI membership and the literature on economic growth, we have identified six main groups of additional control variables¹²: A- Membership to other international organizations in natural resource management; B- Additional economic variables; C- Additional institutional and social variables; D- Major international events and reforms; E- Geographic variables; and F- Additional structural factors. We include each of these variables individually in the regression as an additional control variable. To avoid a potential bias due to reverse causality, these variables are lagged by one year (except for dummy variables). Table 2.2 presents these estimation results, and all results are consistent with our baseline results, i.e., adding additional control variables keeps our baseline results unchanged.

Finally, we augment our baseline specification by adding this set of control variables by group. These results, presented in Table 2.3, also confirm our baseline results. The different specifications performed in this subsection confirm the robustness of our results to the addition of control variables. Moreover, these specifications allow us to address concerns about potential estimation bias from omitting pertinent control variables.

2.5.3 Focus on the main resource world prices

The dynamic of world prices of the main resource (mineral or fuel) produced by countries is an essential factor in estimating the effects of EITI implementation

¹¹We note a higher effect for the sample of natural resource-dependent countries.

¹²The reasons for choosing these variables are discussed in Appendix B.3.

Table 2.2: EITI and Economic Growth
Additional control variables, estimations using heterogeneity-robust DID estimator

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Kimberly Process	ICGLR membership	OPEC membership	OPEC+ membership	Public Debt	Trade openness	Financial development	Public investments
GDP per capita growth	membership							
EITI	0.7078** (0.3220)	0.7114** (0.3320)	0.6928** (0.3335)	0.7026** (0.3308)	0.7035** (0.3529)	0.8043* (0.4453)	0.7359** (0.3580)	0.6790** (0.3165)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable:	Private investments	General government expenditures	Exchange rate	Rule of law	Government effectiveness	Religious tensions	Ethnic tensions	Global financial crisis
GDP per capita growth								
EITI	0.6889** (0.3240)	0.7181** (0.3156)	0.7253** (0.3671)	0.6908** (0.3200)	0.7035** (0.3270)	0.6860** (0.3213)	0.6983** (0.3176)	0.6947** (0.3212)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Dependent variable:	Commodity prices super cycle period	Fiscal rule	IMF programs	Sub-Saharan region	Latin-America region	Population growth	Labor force	Income inequality
GDP per capita growth								
EITI	0.6947** (0.3212)	0.6862** (0.3215)	0.6947** (0.3214)	0.6947** (0.3212)	0.6947** (0.3212)	0.6889** (0.3196)	0.6731** (0.3178)	0.8587** (0.4371)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The results are obtained using the heterogeneity-robust DID estimator (De Chaisemartin and d'Haultfoeulle, 2020). Robust standard errors are in parentheses. EITI is the treatment variable. Control variables are included and are lagged by one year. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

Table 2.3: EITI and Economic Growth
Additional control variables included by group

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Other organizations in natural resource management group	Economic variables group	Institutional and social variables group	Major international events and reforms group	Geographic variables group	Structural factors group
GDP per capita growth						
EITI	0.7252** (0.3422)	1.0291** (0.4385)	0.6956** (0.3216)	0.6865** (0.3213)	0.6947** (0.3212)	0.8317** (0.4199)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country & Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: The results are obtained using the heterogeneity-robust DID estimator (De Chaisemartin and d'Haultfoeulle, 2020). Robust standard errors are in parentheses. EITI is the treatment variable. Control variables are included. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

on economic growth. Indeed, the evolution of world prices of the main resource produced is a factor that can affect both a country's decision to join the EITI and its economic growth. Like [Berman et al. \(2017\)](#), we exploit exogenous changes in the world price of the main resource produced by the countries in the sample. We identify ten resources for which price data are available¹³, and the main resource produced is defined as the resource with the highest production value over the entire study period.¹⁴ We thus replace the commodity price index variable (used in the main analysis as a control variable) with the logarithm of the main produced resource world prices.¹⁵ The results are presented in column (1) of Table [B7](#). However, diamond prices can be problematic because they vary considerably depending on the quality and type of diamonds produced and the unstable evolution of the price series of the different qualities ([Berman et al., 2017](#)). Thus, we exclude diamonds when identifying the main resource and present the results in column (2) of Table [B7](#). The results are consistent with our primary results: implementing the EITI increases the GDP per capita growth rate in developing member countries compared to non-member countries.

2.5.4 Additional placebo test

Other reforms and policies can accompany the implementation of EITI. In addition to the robustness tests already achieved, we conducted an additional placebo test by performing a random falsification test considering placebo treatment dates in the treatment group. Specifically, we randomly shift the treatment dates of the treated units and re-estimate the effect of the EITI implementation on economic growth (columns (1) and (2) of Table [B9](#), respectively, for the static and dynamic effects). The intuition is that if our baseline results are due to EITI implementation, using placebo dates should produce non-statistically significant estimated effects of EITI implementation. The results indicate non-statistically significant effects of EITI implementation on economic growth and support the robustness of our baseline results. This additional placebo test confirms that our results are not driven by confounding factors such as implementing other reforms or policies.

¹³These resources are bauxite (aluminum), coal, copper, diamond, gold, iron, oil, platinum, silver, and zinc.

¹⁴The list of the main resources identified for each country is available in Appendix [B.4](#), Table [B8](#).

¹⁵Details on data and their sources are provided in Appendix [B.4](#), Table [B16](#).

2.5.5 Alternative estimation methods

To verify that our results are not influenced by the analysis method, we use two alternative estimation methods: instrumental variables (IV) and entropy balancing estimation methods.

Instrumental variables method. To deal with the potential self-selection bias of EITI implementation (Lujala, 2018), some studies in the literature conducted an instrumental variables estimation. We have already controlled for factors influencing countries' decision to join and implement the EITI standard. Moreover, in our baseline analysis, we tested and validated the parallel trends assumption. Furthermore, following the literature (Villar, 2020; Okada and Shinkuma, 2022), we adopt an instrumental variables estimation approach by using the percentage of neighboring countries (with common borders) that are EITI members among the total number of neighboring countries as an instrumental variable. The use of this neighborhood variable as an instrumental variable comes from studies on the geographic diffusion of public policies. The intuition is that a country's participation in the EITI is influenced by its neighbors' (exogenous) participation because a country is more likely to participate if its neighboring countries join the EITI (Okada and Shinkuma, 2022). This choice can be explained by factors like competitive, coercive, and imitative motives (Villar, 2020). We construct our instrument as follows:

$$NeighboursEITI_{it} = \frac{1}{N_{it}} \sum_{j \neq i}^N \times EITI_{jt} \quad (2.2)$$

Where j indicates the country that borders country i in year t (its neighboring country). N_{it} is the total number of countries that border country i in year t . $EITI_{jt}$ is a dummy variable equal to 1 when the country j is an EITI member in year t . The variable " $NeighboursEITI_{it}$ " is our first instrument and indicates, for each country in the sample and each year, the percentage of its neighboring countries that are EITI members. In addition to this instrument, we use the lagged EITI as a second instrument. Indeed, in addition to the test of the relevance of the instruments, the use of two instruments allows us to test the exogeneity (exclusion condition) and instrument strength.

Column (2) in panel A of Table B11 presents the results of the first-stage equation, where we regress the treatment variable on instruments and all control variables of the baseline model and indicate that our two instruments are positively and significantly correlated to the treatment variable. Column (3) of panel B presents the second-stage result and indicates a positive and statistically significant effect of

EITI implementation on GDP per capita growth.¹⁶

Entropy balancing method. As an alternative impact evaluation method, we use the entropy balancing method, which is a non-parametric impact evaluation method based on a matching procedure (for more details on this method and its two-step estimation procedure, see, e.g., [Hainmueller, 2012](#); [Neuenkirch and Neumeier, 2016](#)). This method limits the selection bias problem in the adoption of EITI. Specifically, entropy balancing allows us to identify the effect of EITI implementation on economic growth by comparing EITI member and non-member countries that are similar on observable variables while controlling for country and year-fixed effects. The entropy balancing method is implemented in two main stages. First, weights are calculated and assigned to observation units that are not exposed to the treatment but have observable characteristics as similar as possible to the treated units. The computation of these weights satisfies defined balance constraints concerning the specified characteristics, ensuring that the synthetic control group consists, on average, of observation units not exposed to the treatment as similar as possible to the treated units. This method creates a counterfactual group whose difference from the treatment group will be the implementation of the EITI based on the defined observable characteristics. Following [Neuenkirch and Neumeier \(2016\)](#), we choose equilibrium constraints that impose equal covariate means between the treatment and control groups. In other words, we want to ensure that the control group, on average, has untreated units similar to treated ones. In the second step, to estimate the treatment effect on the treated (ATT) of EITI implementation on economic growth, we use the weights from the first stage in a regression analysis where the GDP per capita growth rate is our dependent variable, and the EITI implementation dummy is the main interest variable. We also control for year and country-specific effects and include the entropy balancing covariates (used in the first stage) to improve the estimation efficiency because it is equivalent to including control variables in a randomized experiment.

Firstly, we verify the effectiveness of entropy balancing in constructing the counterfactual group. Descriptive statistics on the control variables considered in the analysis are presented in panel A of Table [B10](#). This panel provides information on the sample means before weights for all control variables between country-year observations with EITI implemented, which represent the treatment group (col-

¹⁶In addition, the Kleibergen-Paap F-statistic is significantly higher than the value of the Stock-Yogo test at the 10% critical threshold, and the Hansen p-value is greater than 0.10 (attesting the relevance and strength of instruments used and confirming the exclusion condition).

umn (1)), and country-year observations without EITI implemented, the potential synthetic control group (column (2)). Column (3) shows the differences in means between these two groups. The t-test values and corresponding p-values (columns (4) and (5)) indicate that the differences between the treatment and control groups are significant at the 1% level for most of the considered variables. From the first stage of the entropy balancing method, we construct a synthetic control group that is as comparable as possible to the treatment group concerning all control variables considered. This is achieved by reweighting the untreated observations using these control variables. Panel B of Table B10 shows the results. Columns (1) and (2) summarize the results for the sample means of the control variables for the treated and untreated groups, respectively. Columns (4) and (5) indicate that entropy balancing eliminated differences between the means of variables for the treatment and control groups because no differences between the variables are significant.

Secondly, the estimation result performed in the second step is reported in column (4) of Table B11. Once again, the result remains consistent with our main findings and indicates a robust positive and statistically significant effect of EITI implementation on economic growth.

Based on the results of these different specifications, we can conclude that our baseline results are robust since the change in methods confirms our conclusions concerning the estimated effect of EITI implementation on economic growth. However, it is important to point out that our baseline results are more robust than those obtained using alternative estimation methods since the heterogeneity-robust DID estimator is a much more relevant method regarding key potential challenges posed by the EITI implementation design.

2.6 Dynamic effects of EITI implementation on economic growth and transmission channels

2.6.1 Dynamic effects of EITI implementation on economic growth

In this section, we analyze the dynamic effects of EITI implementation on economic growth. Beyond whether EITI membership and implementation affect economic growth, an even more interesting question is whether this effect persists over time. Moreover, countries can be suspended from the organization for various

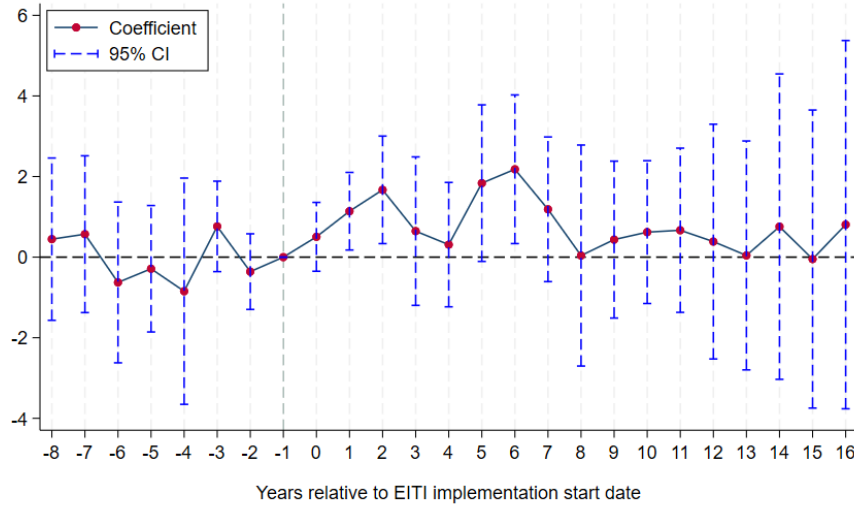
reasons (as explained in Appendix B.1), leading to breakdowns in these countries' EITI implementation. As a result, past treatments may thus influence the treatment outcome at time t . To ensure the validity of our analysis, we must use an estimator that allows us to estimate a difference-in-differences specification while considering heterogeneous and dynamic treatment effects. To analyze the dynamic effects of EITI implementation on economic growth while addressing these potential threats to identification, we implement the dynamic heterogeneity-robust difference-in-differences (dynamic heterogeneity-robust DID) estimator developed by [De Chaisemartin and d'Haultfoeuille \(2024\)](#). The intuition behind this estimator is that it compares the first-time switchers to the not-yet switchers. Specifically, it compares groups whose treatment changes for the first time at t to groups whose treatment has not yet changed at t (indeed, only these units can be considered valid controls according to [De Chaisemartin and d'Haultfoeuille \(2023\)](#)). Moreover, this estimator allows us to test the parallel trends assumption through placebo analysis and calculate treatment effects during some periods after the EITI membership. Specifically, we estimate the following equation:

$$GDPpc_{it} = \alpha_i + \mu_t + \sum_{t=-8}^{-2} \beta_e^{Lag} \times EITI_{it}^e + \sum_{t=0}^{16} \beta_e^{TE} \times EITI_{it}^e + \delta X_{it} + \epsilon_{it} \quad (2.3)$$

Where $GDPpc_{it}$ is the GDP per capita growth rate of country i in year t ; e is the event study time; α_i represents country-fixed effects that capture time-invariant country-specific effects; μ_t represents year-fixed effects that capture time-specific factors affecting sample countries; $EITI_{it}$ is an "event-study" dummy variable that takes value one if a unit i is e periods away from initial treatment at time t and zero otherwise. X_{it} is a set of control variables; ϵ_{it} is the random error term. The period $t = -1$ is considered the baseline year for the treatment effects computation. We, therefore, consider seven placebo estimators to be estimated and calculate the dynamic effects over 16 years after the introduction of the treatment.

Fig. 2.2 presents the estimation results of the dynamic effects of EITI implementation on GDP per capita growth. Firstly, we observe that pre-trends leading up to the EITI membership are not statistically different from zero, confirming the parallel trends assumption and the absence of anticipation effects. Next, this figure shows two distinct stages of positive and statistically significant effects of EITI implementation on economic growth. The first stage shows positive and statistically significant

Figure 2.2: EITI dynamic effects on GDP per capita growth



Note: EITI dynamic effects on GDP per capita growth applying the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2024\)](#). Bars represent 95% confidence intervals around the effects of long differences and placebo tests. 100 bootstrap replications were applied. All control variables are included.

Source: Author's construction.

effects of EITI implementation on economic growth in the short term, one and two years after the EITI membership. However, these initial effects become insignificant after the third year of implementation. A second stage of positive and statistically significant effects occurs in the medium term, after the fifth and sixth years of implementation, and is even larger in magnitude than the first stage.

More interestingly, we exploit the correlation between the different phases of EITI implementation (and, more precisely, their average duration in the sample) to indirectly assess a variation in the treatment effects of member countries according to these different phases. This analysis reveals that the first part of the positive and significant effects of the EITI corresponds to the period of countries' commitment, while the second part of the positive and significant effects corresponds to the period after the countries' candidacy has been validated and before the countries achieve compliance status.¹⁷ This suggests that the positive and significant annual effects of the EITI on economic growth are observed, on average, during the commitment

¹⁷The average commitment duration of countries (from commitment to join the EITI to candidate validation) in the sample is about one year and eleven months. The sample's average duration of the candidate validation period (from candidate validation to compliance status) is about four years and six months. The average duration of the compliance period (from compliance status to the end of the study period) in the sample is seven years and one month, while the average suspension time is two years and one month.

periods and after country validation.

In the following subsection, we analyze the transmission channels before discussing the non-significance of the effects of EITI implementation in the long term to provide more explanations on the source of these effects.

2.6.2 Transmission channels

As identified and explained in Section 2.1, we assume that the improvement of investment climate and the increase in foreign direct investment and resource revenue are the main channels through which EITI implementation may affect economic growth. We test these main transmission channels by adopting a two-step approach.¹⁸

In the first step, we test the relationship between the potential channel and economic growth by performing panel fixed effects estimations, controlling for country and year fixed effects. In the second step, we analyze the treatment effects of EITI implementation on channels by applying the same methodologies as in our main analysis (the estimators of [De Chaisemartin and d'Haultfoeuille \(2020\)](#) and [De Chaisemartin and d'Haultfoeuille \(2024\)](#)). [Gutmann et al. \(2023\)](#) pointed out that evaluating the transmission channels based on a uniform empirical framework compared to those employed in the main analysis ensures a reasonable identification of causal effects, which are comparable and cannot result from carefully selected model specifications. Specifically, we estimate Equation 2.3 using investment climate, foreign direct investment, and resource revenue as dependent variables.¹⁹ Our intuition is that if the potential channel positively (respectively negatively) and significantly affects economic growth, and EITI implementation has a positive (respectively negative) and significant effect on this channel, this channel can be considered as a valid channel through which transit EITI implementation effects on economic growth. However, it is important to note that the fact that EITI implementation affects a potential channel and that this channel affects economic growth is a necessary but not sufficient condition for establishing the channel's validity.

First, panel A of Table 2.4 shows the results of the analysis of the relationship between potential channels and economic growth. These results indicate that investment climate, foreign direct investment, and resource revenue are positively correlated

¹⁸[Gutmann et al. \(2023\)](#) and [Bambe et al. \(2024\)](#), for instance, have also implemented a similar approach.

¹⁹More details on these variables are available in Tables [B15](#) and [B16](#).

Table 2.4: EITI and Economic Growth
Validity of transmission channels

Panel A: Relationship between the channel and economic growth			
	(1)	(2)	(3)
Investment climate	1.5067*** (0.5221)		
Foreign direct investment (asinh)		0.3122** (0.1557)	
Resource revenue (in % of GDP)			0.0739*** (0.0276)
Panel B: Effect of the EITI implementation on the channel			
	(1)	(2)	(3)
Panel B1: Static analysis results	Investment climate	Foreign direct investment	Resource revenue
EITI	0.0379** (0.0166)	0.1966** (0.0952)	0.5588** (0.2770)
Panel B2: Dynamic analysis results			
EITI	0.1399*** (0.0485)	0.3747** (0.1711)	1.3507*** (0.5471)

Note: Panel A presents the relationship between the different potential channels and economic growth based on Fixed Effects regressions. Panels B1 and B2 report the effects of EITI implementation on the potential channels based on the heterogeneity-robust DID estimators of [De Chaisemartin and d'Haultfoeuille \(2020\)](#) and [De Chaisemartin and d'Haultfoeuille \(2024\)](#), respectively, applying 100 bootstrap replications. The equation specified is the same as in the main model, replacing the dependent variable with the potential channel. Country and year fixed effects are included. Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

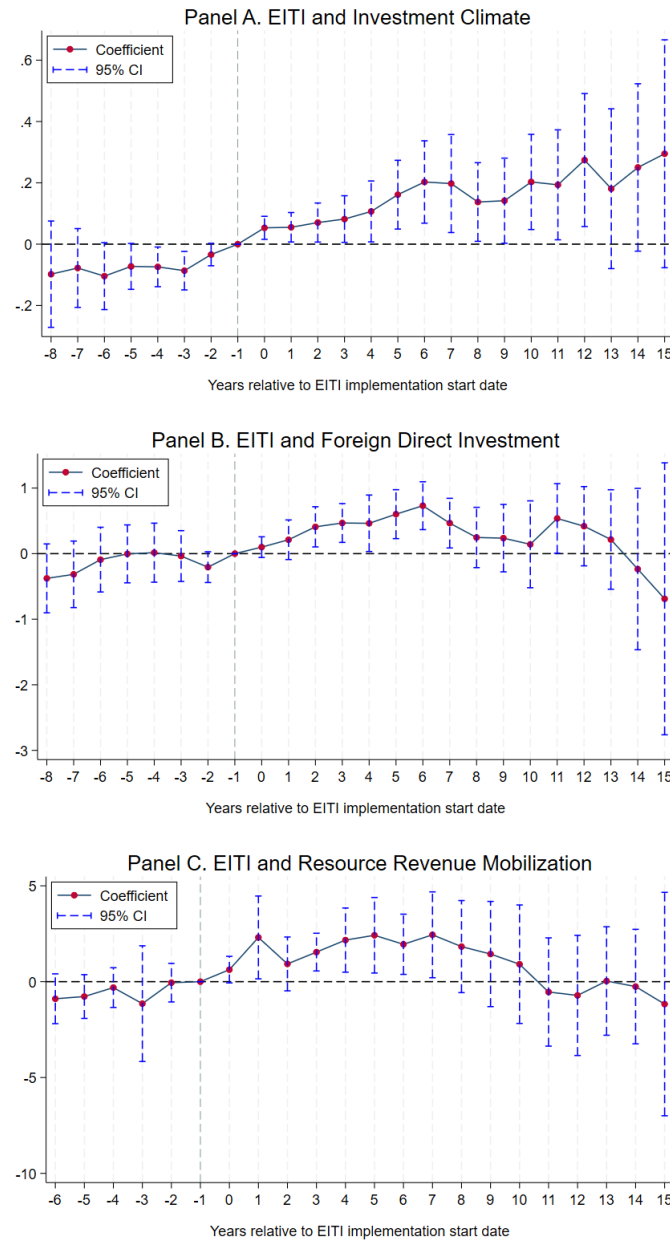
Source: Author's construction.

with the GDP per capita growth rate.

Second, the analysis results of EITI implementation effects on potential channels are presented in Fig. 2.3, and the average effects are reported in Panel B of Table 2.4 (Panel B1 for the static effects and Panel B2 for the dynamic effects). These results indicate that, on average, EITI implementation improves the investment climate index and increases foreign direct investment and resource revenue. In addition, the analysis of foreign direct investment and resource revenue shows that all placebo effects are not statistically significant, meaning that before implementing the EITI, countries did not experience significant changes in their foreign direct investment and resource revenue mobilization compared to those that never implemented the EITI. This attests to the validity of the parallel trends assumption. However, the analysis of climate investment is not as robust as those of other transmission channels. Indeed, the parallel trend assumption is not valid for this variable since there appears to be

a positive trend throughout the study horizon, suggesting that the identification is wrong. Therefore, the increase in foreign direct investment and resource revenue represent the valid transmission channels through which EITI implementation affects economic growth.

Figure 2.3: Results of EITI dynamic effects on potential transmission channels



Note: Results are obtained using the dynamic heterogeneity-robust DID estimator (De Chaisemartin and d'Haultfoeuille, 2024), applying 100 bootstrap replications. 5 placebo estimators were estimated. Bars represent the 95% confidence intervals around long differences effects and placebo tests.
Source: Author's construction.

Third, we also investigate three additional potential transmission channels: corporate tax revenue, personal income tax revenue, and income inequality. Implementing

the EITI could have a diffusion effect on other sectors. Indeed, some countries may complement the reforms implemented within the framework of the EITI with other reforms intended to increase tax revenue from other sectors of activity, which could influence economic growth. In addition, a possible effect of EITI implementation on income inequality could influence its effect on economic growth. Following the same two-step approach used previously, Table B12 presents the results of this additional transmission channel analysis. On the one hand, Panel A indicates a positive and statistically significant effect of corporate tax revenue on economic growth²⁰, a positive but non-statistically significant effect of personal income tax revenue on economic growth, and a negative and statistically significant effect of income inequality on economic growth.²¹ On the other hand, Panels B1 and B2 show that EITI implementation has no statistically significant effects on corporate tax revenue, personal income tax revenue, and income inequality, concluding that these variables are not valid transmission channels of the effects of EITI implementation on economic growth.

2.7 Discussion on the non-significance of EITI implementation effects in the long-term

The analysis carried out in Sections 2.4 and 2.5 indicates positive and statistically significant average effects of EITI implementation on economic growth in member countries. Our more in-depth analysis of the EITI's dynamic effects in Section 2.6 highlights even more interesting results: the EITI's effects occur only in the short-term and medium-term but are no longer significant in the long-term. These last results are relevant and question the effectiveness of the EITI in fostering sustainable development in member countries. To explain the EITI's mitigated

²⁰Our result on corporate tax revenue is opposite of those of [Lee and Gordon \(2005\)](#), who found a negative and statistically significant relationship between corporate tax rate and GDP per capita growth. To deal with possible endogeneity issues, we follow their methodology using, as instrumental variables, the weighted average personal and corporate tax revenue in other countries, weighting by the inverse of the distance between the two countries. Data on distance measures between two countries come from Centre D'Etudes Prospectives Et D'Informations Internationales (CEPII). The results using the instrumental variables method are similar to our baseline results and are available on request. Analyzing the relationship between tax structure and economic growth focusing only on developing countries remains an interesting question for future research.

²¹Our results concerning the effect of income inequality on economic growth are in line with those of a significant part of the literature, such as [Persson and Tabellini \(1994\)](#), [Alesina and Rodrik \(1994\)](#), and [Alesina and Perotti \(1996\)](#). In addition, [Barro \(2000\)](#) found that the effect of income inequality on economic growth is negative in less developed countries.

results in promoting long-term economic growth, we postulate and explore four possible reasons: (1) The lack of evidence of a negative relationship between natural resource abundance and long-term economic growth over the study period; (2) The possible influence of an increasing reliance on taxes; (3) The signal effect some countries are looking for during the EITI implementation process; and (4) The lack of effectiveness of the EITI in reducing levels of corruption in member countries.

2.7.1 Exploring the relationship between natural resource abundance and economic growth in the long-term

The relationship between natural resource abundance and economic growth, in the long run, could partly explain our results on the long-term effects of the EITI on economic growth. Indeed, implementing the EITI may not contribute to long-term growth if natural resources do not negatively affect economic growth in the long run over the study period. We thus investigate the effects of natural resources on economic growth in our dataset in the long run without controlling for EITI and compare results to previous studies that also focused on the long run.

First, we follow the same methodology as in [Brunnschweiler \(2008\)](#) using cross-section data and estimate the following equation:

$$G^i = \alpha_0 + \alpha_1 Y_{95}^i + \alpha_2 R^i + \alpha_3 INST^i + \alpha_4 Z_i + \epsilon^i \quad (2.4)$$

Where G^i is the logarithm of average economic growth between 1995 and 2019 in country i ; Y is the logarithm of GDP in 1995, R and $INST$ are the natural resource abundance and institutional quality variables, respectively; Z is a vector of other covariates, and ϵ is the random error term.

We use the same variables as in [Brunnschweiler \(2008\)](#). Specifically, we use three indicators for natural resource abundance: the share of primary exports in GDP, the logarithm of per capita total natural capital, and the logarithm of per capita subsoil wealth. For each variable, we use the average value from 1995 to 2019. The two variables used to measure institutional quality are the rule of law index and the government effectiveness index (the average values over the study period are also used). We also include regional effects. Details on these variables and their sources are provided in Table [B16](#). Table [2.5](#) presents the results using standard cross-country Ordinary Least Squares (OLS) regressions. Columns (1)–(5) show the results using the rule of law index as the main institutional indicator, while columns (6)–(10) indicate the results using the government effectiveness index as

the main institutional indicator. Firstly, while [Brunnschweiler \(2008\)](#) found a significant negative effect of the share of primary exports in GDP on economic growth, columns (1) and (6) of Table 2.5 show a positive and statistically significant relationship of natural resource abundance on economic growth when using this indicator. Secondly, columns (2)–(3) and (7)–(8) show a positive and statistically significant effect between natural resource abundance and economic growth when using the logarithm of per capita total natural capital as the main natural resource abundance indicator. Moreover, our results remain significant when we control for regional effects. Thirdly, the results obtained using the logarithm of per capita subsoil wealth as the main natural resource abundance indicator are not as robust as in [Brunnschweiler \(2008\)](#). Indeed, columns (4)–(5) show positive but not statistically significant coefficients (when we use the rule of law index), while columns (9)–(10) show positive and statistically significant effects at the 10% threshold. In all estimates, the institutional quality indicators are positive and highly significant, confirming the importance of institutional quality in the growth process. In line with the results of [Brunnschweiler \(2008\)](#), our results suggest that natural resource abundance enhances long-term growth and show no evidence of a negative and significant effect of natural resource abundance on economic growth.

Table 2.5: Natural resources and economic growth. OLS regressions
Dependent variable: Log of GDP per capita growth, average 1995-2019

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Primary exports (in GDP)	0.0115* (0.0067)					0.0156** (0.0071)				
Total natural capital (logarithm)		0.3554*** (0.1241)	0.2450** (0.0946)				0.3742*** (0.1255)	0.2673*** (0.0959)		
Subsoil wealth (logarithm)				0.0604 (0.0367)	0.0474 (0.0291)				0.0683* (0.0382)	0.0503* (0.0279)
Rule of law	0.5975** (0.2538)	0.4161** (0.2020)	0.5916*** (0.1853)	0.3733* (0.2049)	0.5793*** (0.2026)					
Government effectiveness						1.0991*** (0.3036)	0.8059*** (0.2086)	0.8092*** (0.2104)	0.7473*** (0.2567)	0.7504*** (0.2369)
Initial GDP per capita (logarithm)	-0.2213** (0.0930)	-0.3861*** (0.1035)	-0.4392*** (0.0941)	-0.2837** (0.1140)	-0.4117*** (0.0942)	-0.4524*** (0.1007)	-0.5568*** (0.1021)	-0.5937*** (0.1075)	-0.4522*** (0.0921)	-0.5309*** (0.1120)
Africa & Middle East			-1.2540*** (0.1666)		-1.2326*** (0.1736)			-1.1475*** (0.1695)		-1.1297*** (0.1757)
Asia & Ocean			-0.4086** (0.1885)		-0.4313** (0.1875)			-0.4675** (0.1883)		-0.4776** (0.1930)
North America			-0.6831 (0.4630)		-0.5585 (0.5164)			-0.4855 (0.5207)		-0.5642 (0.6384)
Central & South America			-0.8306*** (0.1585)		-0.7417*** (0.1678)			-0.7186*** (0.1675)		-0.6665*** (0.1716)
Observations	87	79	79	74	74	87	79	79	74	74
R ²	0.0853	0.1281	0.4368	0.0926	0.4466	0.1976	0.2258	0.4756	0.1789	0.4696

Note: The dependent variable is log of economic growth, average 1995-2019. Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Source: Author's construction.

Furthermore, panel A of Table B13 (in Appendix B.4) shows the results when we use alternative natural resource abundance indicators, namely natural resource rents, fuel rents, and mineral rents. This follows the same analysis as Arin and Braunfels (2018), who use oil rents as the main natural resource abundance indicator. The results indicate positive and statistically significant effects of natural resource total rents and oil rents on economic growth, while the effect of mineral rents is not statistically significant (in line with the findings of Arin and Braunfels (2018)). These additional results show no evidence of a negative growth effect of natural resource abundance in the long run.

Second, we follow the same methodology as Alexeev and Conrad (2009)²². These authors measure long-term growth by GDP per capita levels (especially in the last year of the study period) rather than using growth rates over the study period. In addition, they suggested that one of the main reasons for the positive evidence of a resource curse in the literature is the inclusion of initial GDP per capita in the regression.²³ Using cross-section data, we estimate the following equation:

$$Y_{i,2019} = \beta_0 + \sum \beta_i X_i + \gamma N_i + \epsilon_i \quad (2.5)$$

Where $Y_{i,2019}$ is the logarithm of per capita GDP in year $T=2019$ in country i ; N represents a measure of oil endowment; X_i is a vector of other covariates, and ϵ_i is the random error term.

We also use the same variables as Alexeev and Conrad (2009). Specifically, we use five indicators for natural resource abundance: the share of primary exports in GDP, the value of per capita oil production (in logarithm), the share of oil production in GDP, the value of per capita mineral production (in logarithm), and the share of mineral production in GDP. For each variable, we use the value in the last year of the study period (year=2019). The rule of law index (the value in 2019) is the variable used to measure institutional quality. We also include regional effects as in the authors' original paper. Details on these variables and their sources are provided in Table B16. Table 2.6 presents the estimation results using standard cross-country Ordinary Least Squares (OLS) regressions. Columns (1)–(5) show the results without controlling the institutional indicator, while columns (6)–(10) indicate the results when controlling the rule of law index. Firstly, columns (1) and (6) show a positive and statistically significant effect of the share of primary

²²Their methodology differs from the methodology used in Brunnschweiler (2008).

²³See Alexeev and Conrad (2009) for more details.

exports in GDP on economic growth. Secondly, columns (2)–(3) and (7)–(8) show a positive and statistically significant effect between the measures of oil endowment and economic growth. Considering the effect of mineral endowment on economic growth, columns (4) and (9) show a positive and statistically significant relationship, while columns (5) and (10) show positive but not significant coefficients. Thus, in line with the work of [Alexeev and Conrad \(2009\)](#), our results suggest no evidence of a negative and significant effect of natural resource abundance on economic growth.

Table 2.6: Natural resources and economic growth. OLS regressions
Dependent variable: Log of per capita GDP in 2019

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Primary exports (logarithm)	0.1511** (0.0732)					0.1884*** (0.0647)				
Oil production, per capita (logarithm)		0.1462*** (0.0264)					0.1610*** (0.0194)			
Oil production (in GDP)			0.2707*** (0.0655)					0.3406*** (0.0513)		
Mining production, per capita (logarithm)				0.0467** (0.0231)					0.0359* (0.0196)	
Mining production (in GDP)					0.0059 (0.0377)					0.0090 (0.0326)
Rule of law						0.7543*** (0.1269)	0.7943*** (0.1032)	0.8506*** (0.1142)	0.6909*** (0.1372)	0.7138*** (0.1411)
Latitude	2.7034*** (0.5143)	2.3936*** (0.4461)	2.6078*** (0.4623)	2.4868*** (0.5529)	2.7043*** (0.5356)	2.6167*** (0.4466)	2.2738*** (0.3106)	2.4858*** (0.3442)	2.4654*** (0.5061)	2.6178*** (0.4970)
Latin America	1.2955*** (0.1687)	1.0649*** (0.1639)	1.2171*** (0.1608)	1.1250*** (0.1877)	1.2248*** (0.1904)	1.2213*** (0.1306)	0.9535*** (0.1179)	1.1120*** (0.1131)	1.0676*** (0.1399)	1.1359*** (0.1462)
East Asia	0.5806 (0.6271)	0.3001 (0.4610)	0.5687 (0.5220)	0.4262 (0.4706)	0.5861 (0.4557)	0.3180 (0.7544)	-0.0021 (0.5476)	0.2698 (0.6326)	0.2289 (0.5347)	0.3356 (0.5293)
Observations	96	96	96	96	96	96	96	96	96	96
R ²	0.4064	0.5344	0.4758	0.4028	0.3796	0.5569	0.7015	0.6628	0.5291	0.5158

Note: The dependent variable is per capita GDP in 2019. Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Source: Author's construction.

Furthermore, panel B of Table [B13](#) shows the results using natural resources, fuel, and mineral rents as resource abundance indicators. The results also indicate positive and statistically significant effects of natural resource total rents and oil rents on economic growth, while the effect of mineral rents is not statistically significant. These additional results also show no evidence of a negative and significant effect of natural resource abundance on economic growth.

In conclusion, we investigated whether natural resource abundance negatively affects economic growth in our dataset in the long run. Indeed, EITI implementation may not contribute to long-term growth if there is no negative relationship between natural resource abundance and economic growth in the long run. We follow different methodologies, such as [Brunnschweiler \(2008\)](#), [Alexeev and Conrad \(2009\)](#), and [Arin and Braunfels \(2018\)](#). Comparing our results to those of these previous studies,

we conclude that there is no evidence of a negative relationship between natural resource abundance and economic growth in the long run in our dataset.

2.7.2 A possible influence from an increasing reliance on taxes?

A second explanation for the mitigated effects of EITI implementation on long-term growth could be a possible increase in the reliance of EITI members on non-resource taxes. Indeed, if developing member countries increasingly shift towards generating revenue through non-resource taxation rather than relying on extractive industries revenue, this could mitigate the positive effects of EITI implementation on economic growth. To investigate whether increasing reliance on taxes matters, we considered two additional control variables: personal and corporate tax revenue (both in percentage of GDP).²⁴ Panels A and B of Figure B1 plot the dynamic effects of EITI implementation on economic growth, controlling corporate tax revenue and personal income tax revenue, respectively. Including these additional control variables does not change our main results since these results indicate an average positive and statistically significant effect of EITI implementation on economic growth. In addition, controlling for these additional variables does not change the conclusion on the effects of EITI implementation on long-run economic growth: the positive effects are observed in the short-term and medium-term.

2.7.3 A possible signal effect targeting

Some countries may also see EITI membership as a mechanism to signal to the international community their potential intention to fight corruption and improve transparency and accountability in the extractive sector to gain certain benefits. In this case, these countries will not consider the EITI implementation as a real opportunity to achieve the effective contribution of the extractive sector to development financing. They will not provide sufficient effort to enable structural change in managing natural resources. There is some evidence in the literature suggesting this signal effect. Indeed, countries see EITI membership as a way to improve their reputation in the international community (Pitlik et al., 2010; David-Barrett and Okamura, 2016). This signal effect could serve to attract more foreign investments through the commitment expressed by countries on their willingness to improve transparency and accountability in the management of natural resources (Öge, 2016a).

²⁴Details on the source of these variables are provided in Table B16.

Our results of the analysis of the effects of EITI implementation on foreign direct investment confirm that EITI member countries attract more foreign investment during the implementation process. Considering these factors, if countries join the EITI to benefit from a signal effect, they will have no long-term incentives to make the necessary efforts in the implementation process, mainly once they achieve compliance status.

2.7.4 Exploring the trend in corruption levels

The lack of EITI's effects on long-run growth could be explained by the lack of effects on reducing corruption levels in member countries. This hypothesis is supported by the results of [Kolstad and Wiig \(2009\)](#), who conclude that transparency alone is insufficient to improve leaders' behavior and is, therefore, not the ideal solution for tackling corruption and enhancing government accountability. Previous studies have also provided evidence suggesting that the EITI has not been effective in reducing corruption ([Sovacool et al., 2016](#); [Kasekende et al., 2016](#)).

To test this hypothesis, we explore the effect of EITI implementation on corruption levels using three different indicators of corruption: the World Governance Indicators (WGI) control of corruption index used in the main analysis, the International Country Risk Guide (ICRG) corruption index, and the Bayesian corruption index. Panels A and B of Table [B14](#) (in Appendix [B.4](#)) show the results of EITI implementation effects on these corruption indicators (respectively for the static and dynamic effects) and indicate that the EITI has not been effective in reducing corruption at the national level in member countries. Our results are similar to those previously found in the literature. However, it is essential to note that one limitation of this analysis is that the indicators used to measure corruption are not exclusive to the extractive sector.

2.8 Concluding remarks and policy implications

This study analyzes the treatment effects of EITI implementation on economic growth, using a sample of 99 developing countries from 1995 to 2019. Relying on heterogeneity-robust DID estimators, we show that, on average, EITI implementation increases the GDP per capita growth rate in member developing countries. This result is robust to several robustness checks. Most interestingly, we analyze the dynamic treatment effects of EITI implementation and highlight that the positive and significant effects of EITI implementation on economic growth occur in the

short term and medium term. We explore and provide some possible explanations for the lack of EITI's effects on long-term growth: the lack of evidence of a negative relationship between natural resource abundance and long-term economic growth over the study period, a possible influence of an increasing reliance on taxes, the signal effect some countries are looking for during the EITI implementation process, and the lack of effectiveness of the EITI in reducing levels of corruption in member countries. Moreover, an analysis of the transmission channels shows that valid transmission channels include an increase in foreign direct investment and resource revenue. Our conclusions can be summarized as follows: Contrary to growing skepticism about the possible benefits of the EITI, implementing the EITI stimulates economic growth in member countries compared to non-member countries, at least in the short and medium term. However, regarding the EITI's effectiveness in fostering long-term growth, it must be recognized that the EITI appears ineffective in achieving this objective. The positive effects of EITI implementation on short- and medium-term growth seem to mitigate potentially adverse effects of the arrival of substantial extractive rents on institutions and, therefore, enable member countries to benefit more quickly from the favorable long-term effects of natural resources (attraction of foreign direct investment and higher resource revenue).

The present study contributes primarily to two strands of literature. The first is the literature on the EITI's impact evaluation and the methodological challenges in the EITI literature. First, we analyze the relationship between EITI implementation and economic growth, addressing a gap in the literature. Second, we apply robust econometric methods to address the challenges arising from the heterogeneous treatment effects over the EITI implementation process and between countries faced by previous empirical analyses. Third, we document the dynamic effects of EITI implementation on economic growth while highlighting the main potential transmission channels. The second strand of the literature to which this paper contributes is the resource curse literature. Indeed, we contribute to this literature by revisiting the effects of natural resource abundance on long-term economic growth, using various natural resource abundance indicators.

This paper has important economic policy implications for developing countries and the EITI board. First, the EITI norm is an instrument that can be used by developing countries to drive reforms in public management in general and in extractive sector management in particular. Our results suggest that improving transparency and governance in natural resource management increases resource revenue mobilization. Moreover, the effects of EITI implementation are not limited

to the extractive sector alone. By joining the EITI, the positive signal sent to the international community is reflected in the attractiveness of foreign direct investment that can spread throughout the economy. Second, regarding the EITI Board, the non-significance of the EITI's effects on long-term growth calls for better control over the implementation of the requirements. In addition to the incentives provided to convince countries to join, the EITI should be able to provide more incentives to members after they have achieved compliance status. The EITI board should also increase requirements for disclosure of resource revenue allocated to the national budget and promote better disclosure of quasi-fiscal expenditures resulting from these revenues since these expenditures could benefit economic growth in developing countries. Furthermore, the EITI should step up its efforts to promote transparency and governance in the management of extractive resources in general and critical minerals in particular, the latter being essential in the clean energy transition. Indeed, promoting and improving governance in managing critical minerals is vital to avoid a "new curse of critical minerals", as international demand for these resources is expected to grow strongly.

B EITI implementation process and justification of the selection of variables

B.1 EITI implementation process

The process for countries seeking to join the EITI and implement the EITI standard is as follows (EITI, 2019). Firstly, the government of a country seeking to implement the EITI standard must publicly announce its commitment to joining the organization. It must appoint a government official to lead the membership process, establish a national EITI secretariat, and form an independent and active multi-stakeholder group (MSG). The MSG must be composed of representatives from government, civil society, and extractive companies, with the mission to monitor the implementation of the standard and develop a work plan detailing the country's objectives linked to national reforms and development priorities. Then comes the candidate stage, during which the country submits a formal application to the EITI Board. If the EITI Board determines that the standard's implementation requirements have been satisfied, the country's application is validated. Finally, the country will have to publish its first annual report and meet all other requirements, after which it will be declared Compliant. To become a fully compliant country, the EITI multi-stakeholder group and national secretariat must prepare the required documents and data on the extractive sector. After this, an independent consultant prepares a validation report, which is submitted to the EITI board within two and a half years. The EITI board, after reviewing the documents, decides whether the country is compliant or not. When the country is declared compliant, it will have to publish regular reports according to the deadlines fixed by the EITI Board. In practice, however, the deadline for achieving compliance status is not always met. Most countries achieve compliance later in the engagement process but publish their EITI reports annually and comply with the standard's requirements.²⁵ Sanctions can be taken against countries that can be suspended from the organization for four main reasons. First, when the country does not meet the deadline for the publication of EITI reports (This was the case for Gabon in 2013). Second, when

²⁵While the wealth of information published in EITI reports is essential to analyze the extractive sector in developing countries (concerning, for example, value-added, production, and employment), one limit is the lack of comparability between countries. Indeed, member countries do not adopt the same calculation methodology, do not have the same definition of the extractive sector (mining, oil, gas, agriculture, fish farming, forestry), and do not consider both industrial and artisanal sectors. Therefore, this lack of harmonization in the available information limits the exploitation of data published in EITI reports (Bouterige and Pafadnam, 2024).

the country does not demonstrate significant progress, as Niger left the organization in October 2017 following its suspension. Third, when the country does not comply with the EITI principles (like Afghanistan, suspended since January 2019). Fourth, when the country faces political instability that prevents it from implementing the EITI standard (this was the case for the Central African Republic after the "Coup d'état" in March 2013). However, the suspension can be lifted when the conditions for lifting the suspension are met, depending on the suspension type.

B.2 Control variables in the main analysis (in subsection 2.2.1)

The initial GDP per capita is included to capture the country's development level. Indeed, countries with a low level of development are more likely to join the EITI because they are most exposed to external pressures due to their high dependence on aid from the international community, and they are also considered to benefit most from the EITI (Pitlik et al., 2010; David-Barrett and Okamura, 2016; Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). Consistent with the convergence hypothesis in a neo-classical growth model, constant initial GDP per capita is negatively correlated with economic growth (Barro, 1991; Barro, 1997; Sala-i Martin, 1997). Theoretically, the initial GDP per capita should negatively and significantly impact economic growth (developing countries tend to grow faster than developed countries).

Official Development Assistance (ODA) measures a country's dependence on international aid and technical assistance. Countries that are more dependent on ODA are more likely to implement the EITI (David-Barrett and Okamura, 2016; Kasekende et al., 2016; Lujala, 2018). Indeed, ODA operates as an external pressure instrument for these countries, and international organizations see EITI membership as a signal of a country's commitment to improving governance in the extractive sector. No consensus has emerged in the literature concerning the analysis of the effects of aid on economic growth. Some authors have found that official development assistance has positive effects on economic growth (Galiani et al., 2017), while others found a mixed effect of aid (Easterly et al., 2004).

Natural resource dependence is an internal motivation for countries to join the EITI (Lujala, 2018) and thus favors the implementation of the EITI (Pitlik et al., 2010; Öge, 2016a; David-Barrett and Okamura, 2016; Kasekende et al., 2016; Lujala, 2018). Countries heavily dependent on natural resources are considered to be those that should benefit the most from the public benefits of membership due to the

importance of extractive revenue in their national income (Pitlik et al., 2010; Öge, 2016a; Lujala, 2018). No consensus exists on a resource curse (Havranek et al., 2016). The resource curse theory has highlighted the adverse effects of natural resource dependence on economic growth (Sachs and Warner, 1995), while Mehlum et al. (2006) argue that these adverse effects are conditioned by institutional quality. However, other authors found a positive and significant effect of natural resources on economic growth (Brunnschweiler, 2008; Alexeev and Conrad, 2009).

Foreign investors prefer to invest in a healthy environment with minimal risk, where they have access to all information (Öge, 2016a). Foreign direct investment (FDI) inflows positively influence the likelihood of implementation of the EITI standard (Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). Countries for which FDI flows are an important source of revenue are most likely to implement the EITI to demonstrate their commitment to promoting transparency in the management of the extractive sector to maintain and increase their FDI inflows (Öge, 2016a; Lujala, 2018). Moreover, despite the debate in the literature about the effects of foreign direct investment (Li and Liu, 2005), studies suggest that FDI promotes economic growth (Balasubramanyam et al., 1996; Borensztein et al., 1998).

The political environment and institutional quality are important determinants of EITI implementation. Membership in the international organization is an opportunity for countries perceived to be the most corrupt to send a signal about their commitment to promoting transparency and good governance in resource management and combating corruption, and thus improve their reputation within the international community (David-Barrett and Okamura, 2016; Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). Implementing the EITI lends important credibility to reforms to fight corruption and promote good governance (Pitlik et al., 2010). Therefore, the most corrupt countries are the most likely to implement the EITI. The level of democratic accountability is positively correlated with the likelihood of joining the EITI (Pitlik et al., 2010; Öge, 2016a; Lujala, 2018), and governments with popular support are more likely to initiate reforms toward greater transparency (Lujala, 2018). Furthermore, the adverse effects of corruption on economic growth have been widely documented in the literature. Mauro (1995) and Mo (2001) find that corruption reduces economic growth.

A country's experience of conflicts is a crucial determinant of EITI implementation (Lujala, 2018), mainly when these conflicts are centered around natural resources. Political instability is negatively correlated with economic growth (Barro, 1991), and

there is also a significant negative relationship between conflicts and economic growth (Sala-i Martin, 1997). Conflict-affected countries can be encouraged to undertake reforms in the extractive sector through the presence and influence of international organizations that provide development assistance (Lujala, 2018). Some studies also suggest that implementing the EITI helps to mitigate the negative effect of rising mineral prices on the occurrence of conflict (Berman et al., 2017).

We include two other control variables: the commodity price index (particularly the export price index) and the inflation level. The commodity price index accounts for global changes in commodity world prices. Since the sample is composed of developing countries, the export price index is more relevant in this study because these countries are commodity exporters due to their low industrialization. Deaton (1999) shows that downturns in international commodity prices generate lower economic growth in sub-Saharan African exporting countries. World commodity prices are important for economic growth in natural resource-dependent countries. Indeed, studies have highlighted commodity prices' positive and significant effects on economic growth (Collier and Goderis, 2012). The inflation level is also included to capture macroeconomic stability, which is a precondition for the successful implementation of reforms. Macroeconomic stability is also an important factor for economic growth. High inflation negatively affects economic growth (Barro, 1995), while growth is reinforced by lower inflation (Barro, 1997).

B.3 Additional control variables in the robustness analysis

Membership in another global organization promoting better governance could influence the decision to join the EITI and, thus, the effects of its implementation. We control four other organizations promoting transparency in the extractive sector at the state level. These are the Kimberly Process (KP), the International Conference on the Great Lakes Region (ICGLR), and the Organization of Petroleum Exporting Countries (OPEC and OPEC+). The KP, created in 2003, is a major initiative for better global governance in the diamond sector. The ICGLR comprises 12 African countries and aims to promote peace, security, democracy, and development in the Great Lakes Region. OPEC brings together the world's major oil producers, while OPEC+ is an alliance between OPEC member countries and ten other oil-producing countries, formed in 2016. These countries are traditionally associated with the resource curse (Sovacool et al., 2016). The lists of Kimberley Process, ICGLR, OPEC, and OPEC+ member countries are in the Appendix (Tables B3, B4, and B5).

External public debt can influence a country's decision to join the EITI. Countries with high levels of external debt are likely to face external pressure from their creditors to implement reforms in order to improve governance ([Lujala, 2018](#)).

The economic literature has provided evidence of the influence of trade openness as a mechanism of the natural resource curse. A positive association exists between trade openness and economic growth ([Harrison, 1996](#)). Countries with low trade openness experience greater negative consequences of natural resources on economic growth and this negative impact can be reduced by implementing policies that promote greater trade openness ([Arezki and van der Ploeg, 2007](#)).

If there is a positive and significant link between financial development and economic growth ([Christopoulos and Tsionas, 2004](#)), financial development also influences different components of economic development. Strong financial institutions could facilitate achieving a transparent economic system by promoting better governance and information availability. Moreover, [Van der Ploeg and Poelhekke \(2009\)](#) showed that the resource curse is less pronounced in a well-developed financial sector.

The relationship between the size of the government and economic growth appears ambiguous in the economic literature. Indeed, analyses using the level of government spending as a variable of interest find a negative relationship between this variable and economic growth, while studies using the growth rate of government spending as a variable of interest find a positive correlation between this variable and economic growth ([Lindauer and Velenchik, 1992](#)).

The relationship between monetary policy and economic growth has received considerable attention in the literature. [Rodrik \(2008\)](#) showed that exchange rate appreciation affects economic growth. Since our sample consists of commodity-exporting developing countries, we control the exchange rate.

The rule of law and government effectiveness indicators are determinants of economic growth ([Barro, 1997](#)) that also affect the decision to join the EITI. Ethnic tensions have also been documented as a determinant of EITI membership ([Pitlik et al., 2010](#)).

Transparency and accountability in the extractive sector have received increasing international attention and have been identified as a mechanism to mitigate the negative effects of the global financial crises ([Mejía Acosta, 2013](#)). Some countries made significant progress in implementing the EITI during the economic crisis between 2008 and 2009. The period 2003–2008 was also marked by a generalized

rise in world commodity prices, qualified as a "commodity super-cycle". Natural resource-dependent developing countries have shown strong growth rates in this period mainly due to rising world commodity prices ([Amra et al., 2019](#)). Most of the countries in the sample have joined the EITI during this period. Thus, controlling for a dummy variable characteristic of this period is important. Other country-level policies can also influence economic growth, such as fiscal rules and IMF programs in place in countries. [Castro \(2011\)](#) provides evidence that fiscal rules promote economic growth in countries that implement them. Also, the policies implemented under IMF arrangements are aimed at promoting economic growth ([Oberdabernig, 2013](#)). For all these reasons, we control these different policies in our analysis.

A geographic diffusion mechanism for the EITI appears to exist in sub-Saharan Africa. Indeed, the fact that a country is located in sub-Saharan Africa positively influences the decision to join the EITI ([Öge, 2016a](#)), which could be explained by the high dependence of these countries on foreign direct investment and international aid. Being part of sub-Saharan Africa and Latin America has also been documented as a major determinant that negatively affects economic growth ([Barro, 1991](#); [Sala-i Martin, 1997](#)). To avoid a threat that the estimated effect is mainly attributable to some characteristics of the countries in these regions (although we include country and year fixed effects in the analysis), we control with two binary variables, one equal to 1 for each sub-Saharan African country, and the other equal to 1 for each Latin American country.

We also control by total population growth, labor force, and income inequality, which can affect economic growth ([Barro, 1997](#); [Alesina and Perotti, 1996](#); [Sala-i Martin, 1997](#); [Barro, 2000](#)). The size of the population and the share of the labor force can influence a country's decision to join the EITI in the sense that a larger and youngest population is more likely to hold leaders accountable and, therefore, to call for implementing anti-corruption and governance improvement policies. In addition, a high level of income inequality may raise questions about the efficient management of natural resources and call for policies to promote better governance in the sector.

B.4 Study samples, robustness, and data sources

Table B1: List of countries in the study sample

Afghanistan	Cameroon	Guyana	Myanmar	El Salvador
Angola	Congo, Dem. Rep.	Honduras	Mongolia	Sao Tome and Principe
Albania	Congo, Rep.	Haiti	Mozambique	Suriname
Argentina	Colombia	Indonesia	Mauritania	Eswatini
Armenia	Cabo Verde	India	Malawi	Chad
Azerbaijan	Costa Rica	Iran, Islamic Rep.	Malaysia	Togo
Burundi	Djibouti	Jamaica	Namibia	Thailand
Benin	Dominican Republic	Jordan	Niger	Tajikistan
Burkina Faso	Algeria	Kazakhstan	Nigeria	Turkmenistan
Bangladesh	Ecuador	Kenya	Nepal	Timor-Leste
Bulgaria	Egypt, Arab Rep.	Kyrgyz Republic	Pakistan	Tunisia
Bosnia and Herzegovina	Eritrea	Cambodia	Peru	Tanzania
Belarus	Ethiopia	Lao PDR	Philippines	Uganda
Belize	Gabon	Lebanon	Papua New Guinea	Uzbekistan
Bolivia	Georgia	Liberia	Paraguay	Venezuela, RB
Brazil	Ghana	Lesotho	Russian Federation	Vietnam
Botswana	Guinea	Morocco	Rwanda	South Africa
Central African Republic	Gambia, The	Madagascar	Sudan	Zambia
China	Guinea-Bissau	Mexico	Senegal	Zimbabwe
Cote d'Ivoire	Guatemala	Mali	Sierra Leone	

Source: Author's construction.

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Table B2: EITI members with important dates and their status at the end of the study period

EITI Country	Commitment	Creation of the multi-stakeholder group	Candidate validation	Compliance	Suspension/withdrawal period	Status at 31/12/2019
Afghanistan	March 2009	November 2009	February 10, 2010	-	January 2019-	Suspended
Albania	January 2009	December 2008	May 15, 2009	May 2013	-	Compliant
Argentina	December 2017	December 2018	February 2019	-	-	Candidate validated
Armenia	January 2017	November 2016	September 03, 2017	-	-	Candidate validated
Azerbaijan	June 2003	November 2005	September 2007	February 2009	March 2017-	Suspended
Burkina Faso	July 2007	December 2008	May 15, 2009	February 2013	-	Compliant
Central African Republic	August 2007	July 2008	November 21, 2008	March 2011	2013-2021	Suspended
Cote d'Ivoire	May 2007	February 2008	May 12, 2008	May 2013	-	Compliant
Cameroon	March 2005	June 2005	September 27, 2007	October 2013	-	Compliant
Congo, Dem. Rep.	January 2005	November 2005	September 2007	July 2014	April 18, 2013-July 2, 2014	Compliant
Congo, Rep.	June 2004	October 2006	September 27, 2007	February 2013	-	Compliant
Colombia	May 2013	February 2014	October 15, 2014	-	-	Candidate validated
Dominican Republic	July 2015	December 2015	February 23, 2016	-	-	Candidate validated
Ethiopia	August 2009	July 2009	March 19, 2014	-	-	Candidate validated
Gabon	May 2004	July 2005	September 2007	-	February 2013-October 2021	Suspended
Ghana	June 2003	February 2005	September 27, 2007	October 2010	-	Compliant
Guinea	April 2005	April 2005	September 27, 2007	July 2014	December 2009-March 2011	Compliant
Guatemala	June 2010	May 2012	March 2011	March 2014	-	Compliant
Guyana	May 2010	February 2017	October 25, 2017	-	-	Candidate validated
Honduras	January 2013	February 2013	May 22, 2013	-	February-June 2018 & April 2019-	Suspended
Indonesia	December 2008	June 2010	November 24, 2010	October 2014	February-December 2015	Compliant
Kazakhstan	June 2005	October 2005	September 27, 2007	October 2013	-	Compliant
Kyrgyz Republic	May 2004	July 2008	September 27, 2007	March 2011	-	Compliant
Liberia	May 2007	April 2007	September 27, 2008	October 2009	2018-March 2020	Compliant
Madagascar	January 2006	January 2008	February 22, 2008	-	October 25, 2011-June 6, 2014	Candidate validated
Mexico	April 2015	November 2016	October 25, 2017	-	-	Candidate validated
Mali	August 2006	June 2007	September 22, 2007	August 2011	-	Compliant
Myanmar	December 2012	February 2014	July 02, 2014	-	-	Candidate validated
Mongolia	April 2006	January 2006	September 2007	October 2010	-	Compliant
Mozambique	May 2008	April 2009	May 15, 2009	October 2012	-	Compliant
Mauritania	September 2005	December 2006	September 27, 2007	February 2012	-	Compliant
Malawi	June 2014	March 2015	October 22, 2015	-	-	Candidate validated
Niger	March 2005	July 2005	September 2007	March 2011	October 2017-January 2019	Re-commitment
Nigeria	November 2003	February 2004	September 27, 2007	March 2011	-	Compliant
Peru	May 2005	May 2006	September 27, 2007	February 2012	-	Compliant
Philippines	July 2012	January 2013	May 22, 2013	-	-	Candidate validated
Papua New Guinea	April 2013	November 2013	March 19, 2014	-	-	Candidate validated
Senegal	February 2012	January 2013	October 17, 2013	-	-	Candidate validated
Sierra Leone	October 2007	June 2007	February 2008	April 2014	-	Compliant
Sao Tome and Principe	December 2004	December 2007	February 22, 2008	-	2010-2011	Candidate validated
Suriname	February 2016	December 2016	May 24, 2017	-	February-June 2019	Candidate validated
Chad	September 2007	February 2010	April 16, 2010	October 2014	-	Compliant
Togo	December 2009	March 2010	October 10, 2010	May 2013	-	Compliant
Tajikistan	August 2012	August 2012	February 26, 2013	-	-	Candidate validated
Timor-Leste	May 2007	May 2007	February 22, 2008	July 2010	March-June 2017	Compliant
Tanzania	November 2008	November 2009	February 16, 2009	December 2012	September-December 2015	Compliant
Zambia	July 2008	September 2008	May 15, 2009	September 2012	-	Compliant

Source: Author's construction from <https://eiti.org/countries>.

Table B3: List of Kimberley Process (KP) members

Country	Membership date	Country	Membership date
Angola	2003	Kazakhstan	2012
Armenia	2003	Lao PDR	2003
Belarus	2003	Lebanon	2003
Brazil	2003	Liberia	2007
Botswana	2003	Lesotho	2003
Central African Republic**	2003	Mexico	2008
China	2003	Mali	2013
Cote d'Ivoire	2003	Malaysia	2003
Cameroon	2012	Namibia	2003
Congo, Dem. Rep.	2003	Russian Federation	2003
Congo, Rep.*	2003	Sierra Leone	2003
Gabon	2018	Eswatini	2011
Ghana	2003	Togo	2003
Guinea	2003	Tanzania	2003
Guyana	2003	South Africa	2003
Indonesia	2005	Zimbabwe	2003
India	2003		

Note: * Suspended in 2003 and rejoined in 2007. ** Suspended for the period 2013-2015.

Source: Author's construction from Kimberley Process information: <https://www.kimberleyprocess.com/en/kp-participants-and-observers>.

Table B4: List of International Conference on the Great Lakes Region (ICGLR) members

Angola	Congo, Rep.	Tanzania
Burundi	Kenya	Uganda
Central African Republic	Rwanda	Zambia
Congo, Dem. Rep.	Sudan	

Note: The ICGLR was created in 2008, which is considered the beginning of membership for the 11 member countries in our sample.

Source: Author's construction from ICGLR information: <https://www.icglr.org/index.php/fr/>.

Table B5: List of countries in the sample that are members of OPEC and OPEC⁺

Country	Membership date	Withdrawal date	Status in 2019
Angola	2007	-	Member
Congo, Rep	2018	-	Member
Algeria	1969	-	Member
Ecuador	1973 and 2007	1992 and 2020	Member
Gabon	1975 and 2016	1995	Member
Indonesia	1962 and 2016	2008 and 2016	Retired
Iran, Islamic Rep.	1960	-	Member
Kazakhstan ⁺	2016	-	Member
Malaysia ⁺	2016	-	Member
Mexico ⁺	2016	-	Member
Nigeria	1971	-	Member
Russian Federation ⁺	2016	-	Member
Sudan ⁺	2016	-	Member

Note: ⁺ Country only member of OPEC⁺

Source: Author's construction from information available on: <https://geoconfluences.ens-lyon.fr/glossaire/opec> and <https://bpsuperfioul.fr/quest-ce-que-l-opec-petrole/>.

Table B6: Descriptive statistics for the entire sample

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
GDP per capita growth rate	2416	2.594	4.855	-36.557	92.202
Constant GDP per capita (log)	2401	7.526	0.975	5.390	9.561
Official development assistance (log)	2333	0.771	1.838	-7.663	4.404
Extractive rents (log)	2428	1.438	1.550	-6.852	4.472
Foreign direct investment (asinh)	2428	1.591	1.072	-4.309	5.331
Control of corruption	2076	-0.629	0.525	-1.673	1.245
Voice and accountability	2079	-0.525	0.732	-2.259	1.152
Political stability	2077	-0.562	0.780	-2.848	1.224
Commodity price index	2429	95.990	7.570	41.466	106.769
Inflation	2437	12.194	43.010	-72.729	992.389
Internal conflicts	1835	8.615	1.1.627	1.25	12

Source: Author's construction.

Table B7: EITI and Economic Growth
Focus on the main resource world prices

Dependent variable:	Main Mineral world price	
	Included diamond	Excluded diamond
GDP per capita growth	(1)	(2)
EITI	0.6825* (0.3710)	0.6883* (0.3689)
Control variables	Yes	Yes
Country & Year fixed effects	Yes	Yes

Note: The results are obtained using the heterogeneity-robust DID estimator (De Chaisemartin and d'Haultfoeuille, 2020). EITI is the treatment variable. Control variables are included. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.
Source: Author's construction.

Table B8: Main resource of sample countries

Country	Main resource 1*	Main resource 2**	Country	Main resource 1*	Main resource 2**	Country	Main resource 1*	Main resource 2**
Afghanistan	coal	coal	Angola	oil	oil	Albania	oil	oil
Argentina	silver	silver	Armenia	silver	silver	Azerbaijan	oil	oil
Burundi	gold	gold	Benin	oil	oil	Burkina Faso	gold	gold
Bangladesh	oil	oil	Bulgaria	silver	silver	Bosnia and Herzegovina	bauxite	bauxite
Belarus	oil	oil	Belize	oil	oil	Bolivia	silver	silver
Brazil	bauxite	bauxite	Botswana	diamond	copper	Central African Republic	diamond	gold
China	silver	silver	Cote d'Ivoire	oil	oil	Cameroon	oil	oil
Congo, Dem. Rep.	copper	copper	Congo, Rep.	oil	oil	Colombia	oil	oil
Cabo Verde	-	-	Costa Rica	-	-	Djibouti	-	-
Dominican Republic	silver	silver	Algeria	oil	oil	Ecuador	oil	oil
Egypt, Arab Rep.	oil	oil	Eritrea	silver	silver	Ethiopia	gold	gold
Gabon	oil	oil	Georgia	gold	gold	Ghana	gold	gold
Guinea	bauxite	bauxite	Gambia, The	-	-	Guinea-Bissau	-	-
Guatemala	silver	silver	Guyana	bauxite	bauxite	Honduras	silver	silver
Haiti	-	-	Indonesia	silver	silver	India	silver	silver
Iran, Islamic Rep.	oil	oil	Jamaica	bauxite	bauxite	Jordan	oil	oil
Kazakhstan	oil	oil	Kenya	gold	gold	Kyrgyz Republic	silver	silver
Cambodia	-	-	Lao PDR	silver	silver	Lebanon	-	-
Liberia	gold	gold	Lesotho	diamond	-	Morocco	silver	silver
Madagascar	gold	gold	Mexico	silver	silver	Mali	gold	gold
Myanmar	oil	oil	Mongolia	silver	silver	Mozambique	coal	coal
Mauritania	iron	iron	Malawi	coal	coal	Malaysia	oil	oil
Namibia	diamond	silver	Niger	oil	oil	Nigeria	oil	oil
Nepal	coal	coal	Pakistan	oil	oil	Peru	silver	silver
Philippines	silver	silver	Papua New Guinea	silver	silver	Paraguay	-	-
Russian Federation	oil	oil	Rwanda	gold	gold	Sudan	oil	oil
Senegal	gold	gold	Sierra Leone	bauxite	bauxite	El Salvador	-	-
Sao Tome and Principe	-	-	Suriname	bauxite	bauxite	Eswatini	coal	coal
Chad	oil	oil	Togo	gold	gold	Thailand	oil	oil
Tajikistan	silver	silver	Turkmenistan	oil	oil	Timor-Leste	-	-
Tunisia	oil	oil	Tanzania	gold	gold	Uganda	gold	gold
Uzbekistan	silver	silver	Venezuela, RB	oil	oil	Vietnam	oil	oil
South Africa	coal	coal	Zambia	copper	copper	Zimbabwe	gold	gold

Note: * Including diamonds among resources. **Excluding diamonds among resources.
Source: Author's construction based on data from "The Global Economy": <https://www.theglobaleconomy.com/download-data.php>, and World Bank Commodity Price Data: <https://www.worldbank.org/en/research/commodity-markets>.

Table B9: EITI and Economic Growth
Additional placebo tests

Dependent variable:	Static framework	Dynamic framework
GDP per capita growth	(1)	(2)
EITI (false)	0.1047 (0.3882)	0.8972 (0.6062)
Placebo joint-test p-value	-	0.0516
Control variables	Yes	Yes
Country & Year fixed effects	Yes	Yes

Note: Results are obtained using the estimators of [De Chaisemartin and d'Haultfoeuille \(2020\)](#) and [De Chaisemartin and d'Haultfoeuille \(2024\)](#). Robust standard errors are in parentheses. EITI (false) is the placebo treatment variable (random falsification treatment). Control variables are included. Unreported constant included. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level
Source: Author's construction.

Table B10: Entropy balancing method: descriptive statistics before and after weighting

	[1]	[2]	[3] = [2] - [1]	[4]	[5]
	EITI	Non-EITI	Difference	T-test	p-value
Panel A: Descriptive statistics	mean	mean			
Initial real GDP per capita (log)	7.42	7.75	0.33	5.77	0.00
Lag official development assistance (log)	0.83	0.21	-0.62	-5.94	0.00
Lag extractive rents (log)	2.20	1.19	-1.01	-13.60	0.00
Lag foreign direct investment (asinh)	2.05	1.47	-0.58	-9.14	0.00
Lag control of corruption	-0.71	-0.58	0.13	5.64	0.00
Lag voice and accountability	-0.40	-0.44	-0.04	-1.10	0.27
Lag political stability	-0.53	-0.54	-0.01	-0.27	0.78
Lag commodity price index	97.38	96.29	-1.09	-2.88	0.00
Lag inflation	6.78	8.61	1.83	2.94	0.00
Lag internal conflicts	8.59	8.57	-0.02	-0.26	0.80
Observations	390	968			
	[1]	[2]	[3] = [2] - [1]	[4]	[5]
	EITI	Non-EITI	Difference	T-test	p-value
Panel B: Covariate balancing	mean	mean			
Initial real GDP per capita (log)	7.42	7.42	0.00	-0.02	0.98
Lag official development assistance (log)	0.83	0.83	0.00	-0.00	1.00
Lag extractive rents (log)	2.20	2.20	0.00	-0.01	0.99
Lag foreign direct investment (asinh)	2.05	2.05	0.00	-0.00	1.00
Lag control of corruption	-0.71	-0.71	0.00	0.01	0.99
Lag voice and accountability	-0.40	-0.40	0.00	0.00	1.00
Lag political stability	-0.53	-0.53	0.00	0.00	1.00
Lag commodity price index	97.34	97.38	0.04	-0.05	0.96
Lag inflation	6.77	6.77	0.00	-0.01	1.00
Lag internal conflicts	8.58	8.59	0.01	-0.02	0.98
Observations	390	968			
Total of weights	390	390			

Source: Author's construction.

Table B11: EITI and Economic Growth
Alternative estimation methods

	Ordinary DID estimation results	Panel Instrumental variables results	Entropy balancing method results
Panel A: first-stage (Instruments)	(1)	(2)	(3)
NeighbourEITI		0.0783*** (0.0270)	
Lagged EITI		0.7692*** (0.0316)	
Panel B: Second-stage regression results			
Dependent variable: GDP per capita growth	(1)	(2)	(3)
EITI (Treatment)	1.0164** (0.4775)	1.4244*** (0.4005)	1.0252*** (0.3836)
Initial GDP per capita (log)	-5.9130*** (1.5915)	-4.9048*** (0.9247)	-10.5077*** (2.7420)
Official development assistance (log)	0.4619* (0.2391)	0.5091** (0.2052)	0.2130 (0.2906)
Extractive rents (log)	-0.3009 (0.3031)	-0.1906 (0.2086)	0.4590 (0.3239)
Foreign direct investment (asinh)	0.1328 (0.1984)	0.2216 (0.1617)	0.5235*** (0.1894)
Control of corruption	1.1460 (0.7038)	0.6057 (0.5586)	1.4265 (0.9595)
Voice and accountability	1.4405* (0.7931)	1.1245* (0.5986)	3.4327*** (0.8216)
Political stability	0.1443 (0.4212)	-0.0770 (0.3390)	-1.6057*** (0.5143)
Commodity price index	0.0700** (0.0303)	0.0967*** (0.0294)	0.1757*** (0.0439)
Inflation	0.0110 (0.0159)	0.0000 (0.0144)	-0.0252 (0.0339)
Internal conflicts	-0.0479 (0.2093)	0.1541 (0.1352)	0.3913 (0.2507)
Control variables	Yes	Yes	Yes
Country and Year fixed effects	Yes	Yes	Yes
Observations	1358	1358	1358
ATTs with negative weights	9.2308%	-	-
Kleibergen-Paap F-stat	-	420.122	-
Stock-Yogo critical values (10%)	-	19.93	-
Hansen test (p-value)	-	0.1580	-
R ²	0.3642	0.0883	0.5398

Note: Robust standard errors are in parentheses. Column (2) of Panel A presents the first-stage results (with NeighbourEITI and lagged EITI used as instruments). Column (1) of Panel B presents the estimation results using ordinary TWFE-DID, and Column (3) of Panel B presents the second-stage results of the instrumental variables method (with EITI as the treatment variable). Column (4) shows the results of the entropy balancing method. All control variables are lagged by one year. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

Table B12: EITI and Economic Growth
Additional transmission channel analysis

Panel A: Relationship between the channel and economic growth			
	(1)	(2)	(3)
Corporate tax	0.4611*** (0.1297)		
Personal income tax		0.0165 (0.0653)	
Income inequality			-0.1459* (0.0779)
Panel B: Effect of the EITI implementation on the channel			
	(1)	(2)	(3)
Panel B1: Static analysis results	Corporate tax	Personal income tax	Income inequality
EITI	0.1191 (0.0752)	0.2909 (0.1781)	0.0357 (0.0350)
Panel B2: Dynamic analysis results			
EITI	0.1743 (0.1207)	0.3988 (0.2955)	0.3610 (0.2503)
Placebo joint-test p-value	0.3249	0.5648	0.1229

Note: Results of the additional potential transmission channels analysis. Panel A presents the relationship between the different potential channels and economic growth based on panel Fixed Effects estimations. Panels B1 and B2 report the effects of EITI implementation on the potential channels, respectively, based on the heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020\)](#) and the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2024\)](#). The equation specified is the same as in the main model, replacing the dependent variable with the potential channel. Country and year effects are included. Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

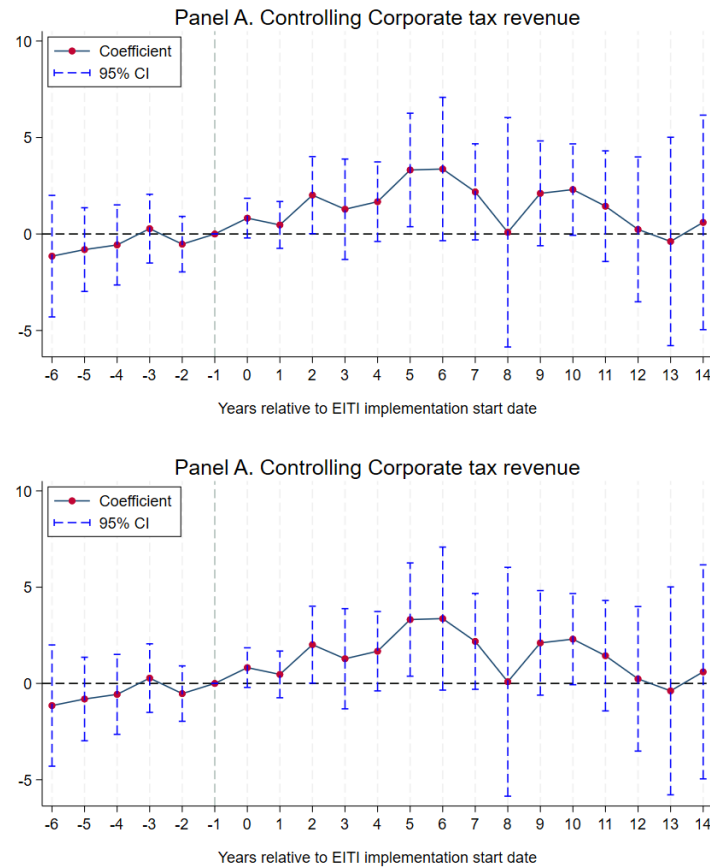
Table B13: Natural resources and economic growth. OLS regressions
Additional robustness analysis

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Extractive rents	0.0245** (0.0111)			0.0262** (0.0117)		
Fuel rents		0.0523*** (0.0157)			0.0487*** (0.0144)	
Mineral rents			-0.0062 (0.0342)			0.0100 (0.0336)
Initial GDP per capita	-0.3436*** (0.0995)	-0.4838*** (0.1219)	-0.2952*** (0.1065)	-0.5377*** (0.1244)	-0.6647*** (0.1483)	-0.4621*** (0.1299)
Rule of law	0.8802*** (0.2601)	1.0136*** (0.2913)	0.7078*** (0.2484)			
Government effectiveness				1.1467*** (0.3291)	1.2248*** (0.3360)	0.9515*** (0.3048)
Africa & Middle-East	-1.5361*** (0.2225)	-1.5001*** (0.2126)	-1.4804*** (0.2301)	-1.3627*** (0.2036)	-1.2978*** (0.2004)	-1.3447*** (0.2192)
Asia & Ocean	-0.4228** (0.2047)	-0.4046** (0.1942)	-0.4652** (0.1918)	-0.4856** (0.2179)	-0.4668** (0.2122)	-0.5401** (0.2151)
North America	-0.7889* (0.4348)	-0.6598 (0.4459)	-1.0385** (0.4377)	-0.5413 (0.5271)	-0.4480 (0.5336)	-0.8286* (0.4786)
Central & South America	-0.8144*** (0.1643)	-0.6603*** (0.1818)	-0.9324*** (0.1782)	-0.6472*** (0.1802)	-0.5094** (0.2036)	-0.8096*** (0.1901)
Observations	87	87	87	87	87	87
R ²	0.3912	0.4297	0.3617	0.4277	0.4566	0.3938
Panel B						
Extractive rents	0.0276*** (0.0086)			0.0316*** (0.0076)		
Fuel rents		0.0452*** (0.0109)			0.0428*** (0.0099)	
Mineral rents			-0.0479 (0.0464)			-0.0234 (0.0387)
Rule of law	0.8397*** (0.1408)	0.8378*** (0.1304)	0.6949*** (0.1422)			
Government effectiveness				1.1268*** (0.0974)	1.0677*** (0.0972)	0.9766*** (0.1123)
Latitude	2.7968*** (0.4359)	2.6498*** (0.4116)	2.7031*** (0.4828)	2.2418*** (0.4011)	2.1042*** (0.3915)	2.1674*** (0.4616)
Latin America	1.2713*** (0.1339)	1.2139*** (0.1247)	1.1371*** (0.1831)	1.0379*** (0.1188)	0.9740*** (0.1122)	0.9198*** (0.1277)
East Asia	0.2435 (0.6794)	0.3934 (0.5528)	0.4646 (0.5160)	0.1296 (0.3851)	0.3046 (0.2535)	0.3090 (0.2291)
Observations	96	96	96	96	96	96
R ²	0.5542	0.6057	0.5211	0.6813	0.7124	0.6310

Note: Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

Figure B1: EITI dynamic effects on economic growth with additional control variables



Note: Results are obtained using the dynamic heterogeneity-robust DID estimator (De Chaisemartin and d'Haultfoeuille, 2024). Bars represent the 95% confidence intervals around long differences effects and placebo tests.

Source: Author's compilation.

Table B14: EITI and Economic Growth
Exploring the EITI effects on corruption

Dependent variable:	WGI control of corruption	ICRG control of corruption	Bayesian corruption index
	(1)	(2)	(3)
Panel A: Static effects EITI	0.0209 (0.0137)	0.0344 (0.0221)	-0.0834 (0.0759)
Panel B: Dynamic effects EITI	0.0070 (0.0482)	-0.0352 (0.1046)	-0.0718 (0.4644)
Placebo joint-test p-value	0.4955	0.5205	0.2319
Control variables	Yes	Yes	Yes
Country & Year fixed effects	Yes	Yes	Yes

Note: Results are obtained using the estimators of De Chaisemartin and d'Haultfoeuille (2020) and (De Chaisemartin and d'Haultfoeuille, 2024). Robust standard errors are in parentheses. EITI is the treatment variable. Control variables are included. Unreported constant included. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level

Source: Author's construction..

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Table B15: Sources and definition of data

Variables	Description	Sources
Dependent variable		
Economic growth (%)	Annual percentage growth rate of GDP per capita.	World Development Indicators (WDI).
Treatment variable		
<i>EITI</i>	Dummy variable equals 1 if the country <i>i</i> implements the EITI in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://eiti.org/countries and Lujala (2018).
Control variables		
Initial GDP per capita	Real GDP per capita at the beginning of the period.	Author's construction (from WDI).
ODA	All Official development assistance (ODA), expressed as a percentage of GDP.	World Development Indicators (WDI).
Natural resources rents	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. It is expressed as a percentage of GDP.	World Development Indicators (WDI).
FDI	Foreign direct investment (net inflows), expressed as a percentage of GDP.	World Development Indicators (WDI).
Control of Corruption	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	World Governance Indicators (WGI).
Voice and Accountability	Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	World Governance Indicators (WGI).
Political stability	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	World Governance Indicators (WGI).
Commodity Price Index	The commodity export price index is an index for a commodity export bundle of 45 commodities (12 are energy and metal commodities). Individual commodities are weighted by the ratio of exports to GDP. Time-invariant weights based on average trade flows and output over 1980-2015 are used. For every country, every commodity, and for each year, the weights are expressed as the export value of the commodity by the country in the year, divided by the country's nominal GDP in this year.	Gruss and Kebhaj (2019) .
Inflation	Inflation, average consumer prices (Percent change).	World Economic Outlook (WEO) - IMF.
Internal conflicts index	This is an assessment of political violence in the country and its actual or potential impact on governance. A score of 4 points equates to Very Low Risk, and a score of 0 points to Very High Risk.	International Country Risk Guide (ICRG).
Additional control variables robustness, transmission channels analysis		
Kimberley Process	Dummy variable equals 1 if the country <i>i</i> is member of Kimberley Process in year <i>t</i> .	Author's construction based on information available at https://www.kimberleyprocess.com/en .
ICGLR	Dummy variable equals 1 if the country <i>i</i> is member of the International Conference on the Great Lakes Region in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.icglr.org/index.php/fr/ .
OPEC	Dummy variable equals 1 if the country <i>i</i> is member of the Organization of the Petroleum Exporting Countries in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.opec.org/opec_web/en/about_us/25.htm .
OPEC+	Dummy variable equals 1 if the country <i>i</i> is member of the Organization of the Petroleum Exporting Countries and its allies in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.opec.org/opec_web/en/about_us/25.htm .
Public debt (% GDP)	General government gross debt as a percentage of GDP.	International Monetary Fund (IMF).
Trade openness (% of GDP)	Trade is measured as a share of GDP.	World Development Indicators (WDI).
Financial development	Degree of development of financial institutions and financial markets in terms of depth, access, and efficiency.	International Monetary Fund (IMF). https://data.world/imf/financial-development-fd .
Resource revenue	Total resource revenue in percentage of GDP.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Public investments	General government domestic, expressed as a percentage of GDP.	IMF Investment and Capital Stock dataset.
Private investments	Private domestic investment, expressed as a percentage of GDP.	IMF Investment and Capital Stock dataset.
General government expenditures	General government total expenditure as a percentage of GDP. Total expenditure consists of total expense and the net acquisition of nonfinancial assets.	World Economic Outlook (WEO) - IMF.

Source: Author's construction.

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Table B16: Sources and definition of data

Variables	Description	Sources
Exchange rate	Exchange rate, national currency/USD (market + estimated).	Penn World Table, version 10.0.
Rule of law	Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution i.e., ranging from approximately -2.5 to 2.5 .	World Governance Indicators (WGI).
Government effectiveness	Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5 .	World Governance Indicators (WGI).
Regulatory quality	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5 .	World Governance Indicators (WGI).
ICRG corruption index	Assessment of corruption within the political system. Index ranges from 0 to 6 (lower scores represent higher levels of corruption).	International Country Risk Guide (ICRG).
Bayesian corruption index	The Bayesian Corruption Indicator (BCI) is a composite index of the perceived level of public corruption in a given country. Index Range: 0 – 100 (with higher scores given to countries with higher levels of corruption).	https://users.ugent.be/~saastanda/BCI/BCI.html .
Religious tensions	Religious tensions may stem from the domination of society and/or governance by a single religious group that seeks to replace civil law by religious law and to exclude other religions from the political and/or social process.	International Country Risk Guide (ICRG).
Ethnic tensions	This component is an assessment of the degree of tension within a country attributable to racial, nationality, or language divisions.	International Country Risk Guide (ICRG).
Global financial crisis	Dummy variable equals 1 during the period of the financial crisis (years 2007, 2008, and 2009).	Author's construction.
Commodities super-cycle period	Dummy variable equals 1 for commodity super-cycle years (2003 to 2008).	Author's construction.
Fiscal rule	Dummy variable equals 1 if the country i applies a fiscal rule in year t . A fiscal rule is a long-lasting constraint on fiscal policy through numerical limits on budgetary aggregates. Fiscal rules typically aim to correct distorted incentives and contain pressures to overspend, particularly in good times, so as to ensure fiscal responsibility and debt sustainability.	International Monetary Fund (IMF).
IMF programs	Dummy variable equals 1 if the country i benefits from an IMF program in year t .	International Monetary Fund (IMF).
Sub-Saharan region	Dummy variable equals 1 for each sub-Saharan African country.	Author's construction.
Latin-America region	Dummy variable equals 1 for each Latin American country.	Author's construction.
Population growth	Annual population growth rate for year t is the exponential rate of growth of midyear population from year $t-1$ to t , expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	World Development Indicators (WDI).
Labor force	Total population between the ages 15 to 64 as a percentage of total population. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	World Development Indicators (WDI).
Extractive resource production	This is the production value of the main extractive resources produced by the country.	"The Global Economy": https://www.theglobaleconomy.com/download-data.php .
Main Mineral world price	This is the world price (in logarithm) of the country's main commodity (energy or metal). The main commodity is defined as the one for which the value of production is the highest over the entire study period (1995-2019). The world price of oil is "Brent oil prices".	"The Global Economy" and World Bank Commodity Price Data https://www.theglobaleconomy.com/download-data.php https://www.worldbank.org/en/research/commodity-markets
Income inequality	Income inequality is approximated by GINI index.	Standardized World Income Inequality Database (SWIID)
Resources abundance indicators used in Subsection 2.7.1		
Primary exports	Primary exports over GDP in 1995.	Author's construction based on data from UNCTADstat: https://unctadstat.unctad.org/datacentre/
Total natural capital	Log of the average total natural capital over the period 1995-2019, estimated in USD per capita. The measure includes subsoil assets, timber resources, non-timber forest resources, cropland, and pastureland.	Changing Wealth of Nations (World Bank)
Subsoil wealth	Log of the average subsoil assets over the period 1995-2019, estimated in USD per capita. The measure includes wealth stemming from oil, natural gas, coal, and minerals.	Changing Wealth of Nations (World Bank)
Oil production, per capita	Logarithm of one plus oil total production in 2019.	"The Global Economy" and World Bank Commodity Price Data https://www.theglobaleconomy.com/download-data.php https://www.worldbank.org/en/research/commodity-markets
Oil production (in GDP)	Logarithm of one plus the share of total oil production in the country's GDP in 2019.	"The Global Economy" and World Bank Commodity Price Data https://www.theglobaleconomy.com/download-data.php https://www.worldbank.org/en/research/commodity-markets
Mining production, per capita	Logarithm of one plus mining total production in 2019.	"The Global Economy" and World Bank Commodity Price Data https://www.theglobaleconomy.com/download-data.php https://www.worldbank.org/en/research/commodity-markets
Mining production (in GDP)	Logarithm of one plus the share of total mining production in the country's GDP in 2019.	"The Global Economy" and World Bank Commodity Price Data https://www.theglobaleconomy.com/download-data.php https://www.worldbank.org/en/research/commodity-markets

Source: Author's construction.

CHAPTER 3

Governance in Natural Resources Management and Debt-to-GDP Ratios in Resource-Dependent Developing Countries

This chapter is a joint work with Samuel Guerineau (CERDI, UCA).¹

Abstract

Over the last decade, debt-to-GDP ratios rose in developing countries, particularly in natural resource-dependent countries. To reduce the debt overhang, the economic literature has highlighted the necessity of implementing efficient policies that allow better revenue mobilization and promote private investment inflows. By improving transparency and accountability in natural resources management, we hypothesize that the implementation of the Extractive Industries Transparency Initiative (EITI) should foster access to diversified sources of financing, thus limiting the development financing through government public debt. We analyze the dynamic treatment effects of implementing the EITI on the government debt-to-GDP ratio in a panel of 69 natural resource-dependent developing countries from 1995 to 2021. Our empirical strategy relies on an event study approach, using the dynamic heterogeneity-robust difference-in-differences estimator. Our main finding is that implementing the EITI reduces the government debt-to-GDP ratio. These effects remain robust to several robustness checks. Finally, we show that the improvement in the investment climate, the rise in government resources and total revenues, and increases in foreign direct

¹The initial version of this work was presented at the CSAE Conference 2025 (Economic Development in Africa) at Oxford, United Kingdom, at the 73rd Congress of the French Economic Association (AFSE) hosted by ENS Paris-Saclay and at the 2025 European Economics and Finance Society (EEFS) hosted by EDC Paris Business School. I appreciate all comments and suggestions.

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investment and domestic private investment (by providing diversified sources of financing and fostering robust economic growth) may represent the main transmission channels through which EITI implementation reduces debt-to-GDP ratios. Although the EITI is not a panacea for breaking the debt overhang, this study provides evidence that EITI is an effective policy for reducing indebtedness vulnerabilities in natural resource-dependent developing countries.

Keywords: • Resource curse • Government debt • EITI • Heterogeneous and dynamic treatment effects • Natural resource-dependent developing countries

JEL Classifications: C22, H6, O11, O19, Q38.

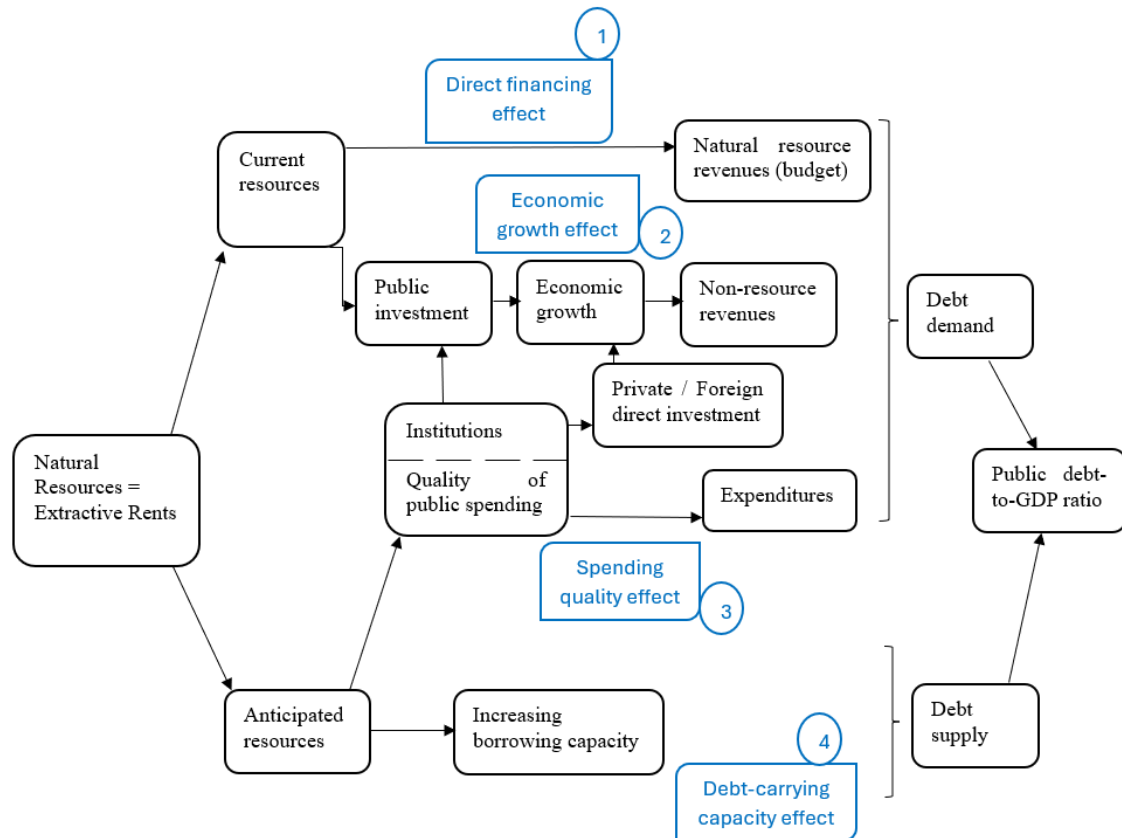
3.1 Introduction

Natural resource management has always been a crucial issue for natural resource-dependent developing countries. [Sachs and Warner \(1995\)](#) have highlighted a negative and significant relationship between natural resource abundance and economic growth, which has been qualified as the "resource curse". The literature has identified four main determinants of the resource curse: the Dutch disease ([Corden and Neary, 1982](#) [Sachs and Warner, 1995](#)), conflicts ([Collier and Hoeffler, 1998](#); [Berman et al., 2017](#)), institutional quality and governance ([Mehlum et al., 2006](#); [Robinson et al., 2006](#); [Bhattacharyya and Hodler, 2010](#); [Sala-i Martin and Subramanian, 2013](#)), and public debt ([Krugman, 1988](#); [Sachs, 1990](#); [Manzano and Rigobon, 2001](#)).

The early 2000s were marked by a generalized rise in world mineral prices, still known as the "commodity super-cycle" ([Chávez and Rodríguez-Puello, 2022](#)), which has fostered a new financing model referred to as "resource-backed loans." According to this model, countries can use the future income streams from their natural resource wealth as collateral or in exchange for financing ([Manzano and Rigobon, 2001](#); [Mihalyi and Scurfield, 2021](#); [Mihalyi et al., 2022](#)). This new financing model is encouraged by financial restrictions and credit constraints, and can lead to a debt trap. Indeed, based on anticipated future resource revenues, governments assess their borrowing capacity. First, the efficiency of global financial markets is crucial because inefficient markets can lead natural resource-dependent developing countries' governments to overestimate their borrowing capacity, resulting in high indebtedness. Second, poor institutional quality tends to reduce the efficiency of public spending, which in turn will favor indebtedness due to higher inefficient expenditures. Third, world natural resource prices are volatile ([Hansen and Gross, 2018](#)). One direct consequence is that the fall in natural resource world prices, by decreasing the expected revenues on which these countries were relying to pay off their debts, reduces the capacity of these countries to settle their debts and contributes to the debt trap phenomenon. As a consequence, these countries move into a state of "debt overhang", where high debt levels lead to an inability for governments to generate sufficient revenues not only to pay off debts but also to finance future spending ([Manzano and Rigobon, 2001](#)). In addition, countries that do not implement adequate policies to counter the effects of the volatility of world natural resource prices face high levels of debt, which compromises their efforts to achieve sustainable development ([Ampofo et al., 2021](#); [Wang et al., 2023](#)). The accumulation of debt is detrimental to economic growth, as high levels of debt act as a tax on future investment projects, limiting the financing of such projects in the

future (Arezki and Brückner, 2012).

Figure 3.1: Transmission mechanism of natural resource effects on public debt-to-GDP ratio



Source: Authors' construction

Fig. 3.1 describes how natural resources can affect the public debt-to-GDP ratio. First, there is a "direct financing effect" of current resource exploitation on the public debt-to-GDP ratio. Indeed, the exploitation of natural resources generates revenues that, by increasing the government's total income, can reduce the need (demand) for debt. This effect can, therefore, be considered as the immediate accounting effect of natural resource exploitation. However, this effect is conditioned by the quality of the institutions, which affect how the additional revenues are used (Arezki and Brückner, 2012).

Second, an important (indirect) effect of current resource exploitation is the "economic growth effect". Concretely, income from natural resource exploitation can finance public investments, which, in the medium and long term, will stimulate economic growth and therefore reduce the debt-to-GDP ratio. Moreover, as economic activity is taxed, the generated growth should favor an increase in non-extractive revenues. Although this second channel is not supported by some of the literature

on resource curse (as discussed above), other authors, such as [Brunnschweiler \(2008\)](#), [Alexeev and Conrad \(2009\)](#), [Smith \(2015\)](#), and [Arin and Braunfels \(2018\)](#) have provided evidence that extractive resources have enhanced rather than inhibited long-term growth. However, all these authors have also emphasized the important role of institutional quality in the growth process.

Third, an important channel through which natural resources can affect the public debt-to-GDP ratio is the quality of institutions and public spending. This channel can be derived from both anticipated and current resource exploitation, since institutional quality has been identified as an initial condition ([Mehlum et al., 2006](#) and [Robinson et al., 2006](#)) and a determinant ([Bhattacharyya and Hodler, 2010](#) and [Sala-i Martin and Subramanian, 2013](#)) of the resource curse. On the one hand, several papers have provided evidence that better institutional quality has a positive and economically significant effect on foreign direct investment ([Daude and Stein, 2007](#); [Daude and Stein, 2007](#)) and private investment ([Gwartney et al., 2006](#)). In addition, a part of the literature has highlighted the positive contribution of private investment and foreign direct investment on economic growth (see, for example, [Khan and Reinhart, 1990](#) and [Borensztein et al., 1998](#)). Therefore, the low institutional quality in developing countries penalizes private domestic investment and foreign direct investment, which negatively affects economic growth. Consequently, this slowdown in economic growth will be reflected in lower non-resource revenue collection. On the other hand, lower institutional quality negatively affects the efficiency of public spending, leading to an inefficient use of these additional resources. This leads to higher expenditures (as inefficient public spending means that public investment costs more), which increases the debt-to-GDP ratio. This effect can be represented as the "spending quality effect". An illustration is the study of [Arezki and Brückner \(2012\)](#) which has highlighted that an increase in the international prices of exported commodity goods leads to a significant reduction in external debt in democratic countries but not in autocratic countries because commodity windfalls lead to a significant and large increase in government consumption expenditures in autocracies, while government consumption expenditures did not increase significantly in democracies.

Finally, another potential effect of natural resources on the public debt-to-GDP ratio is the "debt-carrying capacity effect", derived from anticipated resources. Indeed, in a world of imperfect financial markets, financial restrictions, and credit constraints, the mechanism of financing public investment through natural resources is a potential lever. As explained above, countries endowed with natural resources can use the expected future income flows from their natural resources as collateral or in exchange

for financing (Mihalyi and Scurfield, 2021; Mihalyi et al., 2022). This new model of resource-based financing offers new financing opportunities to resource-endowed countries, thus increasing the debt supply (the more the country guarantees future resources, the higher the debt supply). However, as explained above, it could lead to a debt trap.

In summary, Fig. 3.1 presents four channels through which the exploitation of natural resources (both current and anticipated) can affect the public debt-to-GDP ratio: three effects of natural resources that affect debt demand (through the budget balance, which determines debt demand, i.e., the marginal benefit of debt) and one effect that affects debt supply.

Fortunately, the literature suggests that, despite high debt levels and vulnerabilities, debt stabilization can be achieved in many cases. Laws et al. (2025) have found that many sub-Saharan African countries have often been able to consolidate their debt ratios without debt restructuring, even after the end of the commodity super cycle. For these authors, "Successful debt stabilization requires measures to strengthen public finances and a sound macroeconomic environment, strong institutions, and pro-growth structural reforms". Ampofo et al. (2021) and Wang et al. (2023), which have found a positive and robust relationship between resource rents and public debt, have highlighted that the quality of institutions and the accountability of the government in the management of extractive resources are important factors for sustainable and effective management of public debt. To avoid debt overhang incidence, these authors stressed the need for natural resource-dependent developing countries to engage in responsible borrowing, invest in sectors that will stimulate development, and implement anti-corruption and better transparency-promoting policies to plug revenue leakages and attract private and foreign investment.

The Extractive Industries Transparency Initiative (EITI) was first publicly announced by the United Kingdom Prime Minister Tony Blair at the World Summit on Sustainable Development in Johannesburg in 2002 and formally launched in London in June 2003 (Lujala, 2018). The EITI is headquartered in Oslo (Norway), with national committees in each member country, and is considered the most broadly implemented and supported transparency initiative in natural resource governance. The EITI is a global initiative to which resource-rich countries can adhere to enhance transparency in resource management, reduce corruption, and improve institutional quality. It promotes transparency and accountability in the governance of the extractive sector, including the disclosure of resource revenues, their allocation and

distribution, and certain social, environmental, and quasi-fiscal expenditures. By strengthening public oversight and informing policy debate, these disclosures can contribute to improved natural resource governance, sustainable economic growth, poverty reduction, and greater public well-being.

The EITI Standard provides a global Standard that aims to improve national governance in developing countries by enhancing transparency and accountability in resource revenue collection. As explained in Fig. C1, it requires member countries to publish annual reports with information on all the key stages of the extractive sector value chain, including disclosure of information about exploration activities, awarding of licenses and contracts, data on production and exports, disclosure of information on revenue flows between extractive industry companies and national governments, their allocation to public administrations as well as the resulting spending. In other words, the EITI Standard emphasizes the necessity for payments and revenues from extractive resources (oil, gas, and mining) from extractive sector companies to be published regularly, for a wide audience, in an accessible, comprehensive, and understandable manner, after reconciliation and a "credible independent audit" in line with international auditing standards, carried out by an independent and trusted external auditor.²

This study provides a quantitative analysis of the dynamic treatment effects of the EITI implementation on the government's public debt-to-GDP ratio in natural resource-dependent developing countries while identifying the main transmission channels. Concretely, this paper aims to answer the following questions: Does implementing the EITI reduce the government's public debt-to-GDP ratio in natural resource-dependent developing member countries? If so, what are the dynamic effects? What are the transmission channels? The conceptual framework developed in Section 3.2 suggests that implementing the EITI should reduce the government's public debt-to-GDP ratio through four possible channels: (1) government resource and total revenues, (2) investment climate, (3) foreign direct investment, and (4) private domestic investment.

In this paper, we consider a sample of 69 natural resource-dependent developing countries over the period 1995-2021 and evaluate the effects of implementing the EITI on the government's public debt-to-GDP ratio. We use government gross debt as a percentage of GDP, which comes from the World Economic Outlook (WEO), as the dependent variable. Our analysis exploits a difference-in-differences

²More details on the EITI implementation process are provided in Appendix C.1.

(DID) setup that compares countries implementing the EITI and those that do not implement the EITI. However, this analysis faces some analytical challenges. Firstly, the EITI is a global organization that any country can join voluntarily. Secondly, countries adhere to the EITI at different times. Thirdly, and most importantly, some treatment units are going in and out of treatment status due to suspension, creating breakdowns in the implementation process. Consequently, the EITI implementation effects may vary across countries and periods. To ensure the validity of the results and estimate the dynamic treatment effects of the EITI implementation, we apply the dynamic heterogeneity-robust difference-in-differences estimator (the DID_M estimator) proposed by [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#). As explained by [Gutmann et al. \(2023\)](#), the advantage of this kind of research design is that empirical estimates can be represented in intuitive graphs based on a simple econometric approach, which allows us to provide evidence that the treatment effects of the EITI implementation on the public debt-to-GDP ratio are causal and not mere correlations.³ Our main results indicate that implementing the EITI contributes to reducing the government debt-to-GDP ratio in natural resource-dependent developing member countries compared to non-member countries. This result is robust to several robustness checks, such as excluding potential outliers, using alternative estimation samples, controlling for additional control variables, exploring alternative dependent variables, and employing alternative estimation methods. Finally, we provide evidence that the improvement of the investment climate, the rise in government resources and total revenue, the increase in foreign direct investment and private domestic investment, and economic growth may represent the main transmission channels through which the EITI implementation reduces the government debt-to-GDP ratio.

This study contributes primarily to four strands of literature. The first is the literature on the link between political institutions, debt, and development. Indeed, [Arezki and Brückner \(2012\)](#) highlighted that the plausibly exogenous changes in international commodity prices affect the accumulation of government debt and that better institutional quality is essential for using the additional revenues from international commodity price booms to reduce the level of debt. Our empirical results show that EITI member countries are more successful in reducing their debt. The second strand of the literature to which this paper contributes is the literature on the EITI's impact evaluation and the methodological challenges present in the EITI literature ([Kasekende et al., 2016](#); [Sovacool et al., 2016](#); [Lujala, 2018](#)). We

³We also provide the ordinary DID estimation results in robustness analysis.

apply a new analysis method that addresses the heterogeneous treatment effects over the EITI implementation process and between countries, and, more interestingly, provides the evaluation of dynamic treatment effects. Third, our result is also related to the debt overhang literature. This literature shows that natural resource abundance can lead to higher debt levels (Manzano and Rigobon, 2001; Ampofo et al., 2021), and argues that high debt levels negatively affect real per capita GDP growth (Krugman, 1988; Sachs, 1990). Our results suggest that the EITI implementation could allow to attenuate the adverse effects of high debt levels on economic development. The fourth and final strand of the literature to which this paper contributes is that on the political economy literature on the resource curse, especially the rent-seeking and resource misappropriation (Bhattacharyya and Hodler, 2010; Mehlum et al., 2006; Robinson et al. (2006) Arezki and Brückner, 2011). Indeed, this study highlights the EITI's ability to reduce the capacity for misappropriation of resource revenue by corrupt agents.

The rest of this paper proceeds as follows. Section 3.2 provides a conceptual framework for the EITI implementation and highlights several channels through which the EITI can reduce government debt. Section 3.3 presents data and descriptive statistics. In Section 3.4, we develop the empirical strategy. The main results are presented in Section 3.5, followed by a robustness analysis in Section 3.6. Section 3.7 provides the transmission channels analysis. Finally, Section 3.8 concludes.

3.2 Conceptual framework

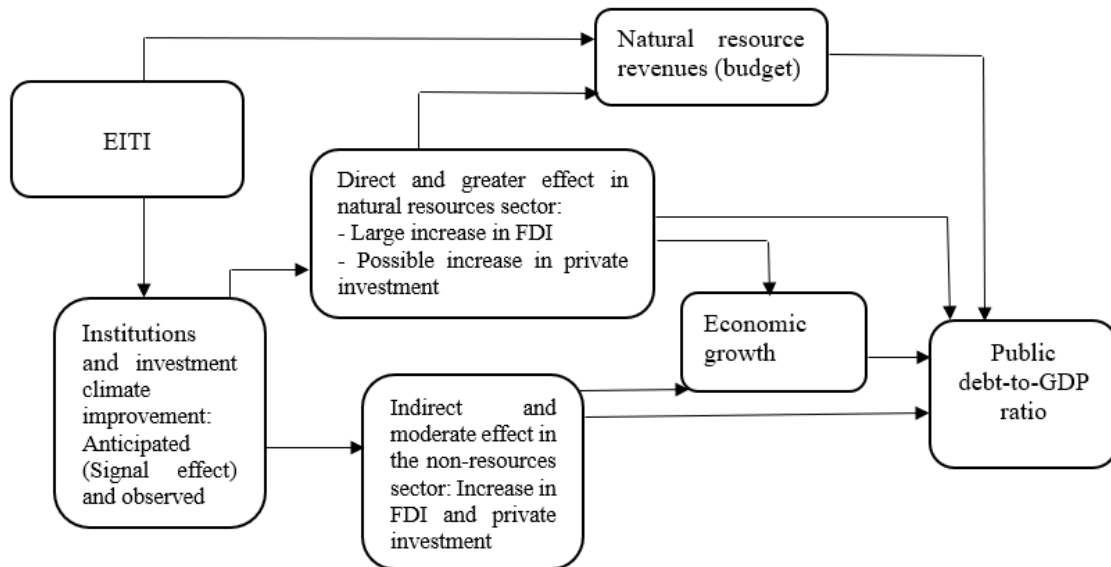
As noted above, measures to strengthen public finances and a sound macroeconomic environment, strong institutions, and pro-growth structural reforms are essential conditions for reducing public debt (Laws et al., 2025). Drawing on the literature, we develop a conceptual framework explaining how EITI implementation may reduce the government's public debt-to-GDP ratio. In this subsection, Fig. 3.2 describes the potential transmission channels.

First, the direct mechanism through which EITI implementation can reduce the government's public debt-to-GDP ratio is the increase in natural resource revenues in the national budget. Indeed, a decrease in government revenue can lead to an increase in public debt. Cooray et al. (2017) have found that corruption increases public debt through its negative effect on government revenues. The fall in domestic revenue reduces the government's ability to finance public expenditure and investment, and to provide public goods. In this situation, a government may have to resort to

borrowing to finance public projects. The implementation of EITI should increase resource revenue by limiting the gap between the revenue that extractive companies should pay and the amount of extractive revenue that is finally collected in the national budget. [Mehlum et al. \(2006\)](#) have found that rent-seeking is an important factor leading to the resource curse. The major consequence of these resource-rent appropriation activities by mining companies, political elites, and corrupt agents is limited resource revenue collection by public administration. The main objective of the EITI is precisely to ensure that there is no loss between the amount of extractive revenues that should be collected and revenues that appear in the national budget. In other words, for the same amount of revenue generated, more will end up in the national budget. Therefore, implementing the EITI can increase resource revenue collection through its mechanism which makes public the award of contracts, licenses, and data on the exploitation activities, makes corruption more costly, increases the cost of detour and the capture of extractive revenue, limits rent-seeking, and improves the accountability of political elites ([Kolstad and Wiig, 2009](#); [Bhattacharyya and Hodler, 2010](#); [Mejía Acosta, 2013](#)). This channel is supported by the study of [Okada and Shinkuma \(2022\)](#) which suggests, through a theoretical model, that implementing the EITI can increase tax revenue from the extractive sector through limited under-reporting because the under-reporting of production by extractive companies reduces the payment of taxes and royalties owed by these extractive companies. Moreover, [Öge \(2016b\)](#) has provided evidence that EITI implementation is associated with better transparency by improving the overall disclosure of aggregate data in member countries.

Second, the implementation of the EITI can reduce the public debt-to-GDP ratio through a signal effect (anticipated effect) and an improvement in institutions, specifically in the investment climate that could stimulate foreign direct investment (FDI) and private investment. Resource-rent appropriation activities by political elites and corruption negatively affect the investment climate and private investment in an extractive sector that requires significant investments and specific advanced technologies. In fact, corruption discourages private domestic investment through a poor business environment ([Brunetti et al., 1998](#); [Campos et al., 1999](#)) and negatively affects foreign direct investment ([Wei, 2000](#)). However, private investments (both domestic and foreign) are important for developing countries as they contribute to financing public goods, and their decrease thus leads these countries to find alternative sources of financing, including borrowing. The implementation of EITI can affect the quality of institutions and, more specifically, the business climate in two

Figure 3.2: The EITI implementation and government debt-to-GDP ratio



Source: Authors' construction

distinct ways. Firstly, EITI membership could be well perceived by private investors, who could anticipate an improvement in the investment climate in member countries. In this case, the EITI's implementation could induce a signal effect that would benefit member countries. Secondly, implementing the EITI, through its incentive and enforcement mechanisms, could help reduce the misappropriation of extractive revenue and improve governance and accountability in public management, leading to a healthy investment climate. Thanks to this second mechanism, the implementation of the EITI could lead to a real improvement in the investment climate. By improving trust in politicians and their accountability in the governance of extractive resources (Villar, 2020), improving the mining investment climate (Malden, 2017) and sending a signal to international investors about the commitment of member countries to promote transparency and combat corruption in the extractive sector (Öge, 2016a; Lujala, 2018), the implementation of EITI should enhance the attractiveness of foreign direct investment (Sovacool et al., 2016; Öge, 2016a; Sovacool, 2020) and private domestic investment. As explained by Ampofo et al. (2021), implementing anti-corruption policies to plug revenue leakages and attract private and foreign investment can avoid debt-overhang incidence. On the one hand, higher FDI and private investment in the natural resources sector will contribute to higher natural resource revenue, which will provide additional revenues to governments to finance public goods, thus limiting the need to resort to higher borrowing. On the other

hand, an increase in FDI and private domestic investment in both resource and non-resource sectors will stimulate economic growth and could lead to lower debt levels. Nevertheless, it should be noted that while the anticipated or real improvement in the investment climate through the implementation of the EITI may influence private investment in both the resource and non-resource sectors, we anticipate greater effects in the resource sector. More specifically, we anticipate a greater increase in foreign direct investment and a possible increase in private domestic investment in the resources sector (FDI being more important in this sector than private domestic investment and also because the implementation of the EITI can send a clearer and more useful signal to foreign investors than observing a possible improvement in the quality of institutions), while the effect on each of these two types of investment should be of approximately the same magnitude in the non-resources sector.⁴

In summary, the conceptual framework suggests that the EITI implementation may affect government debt through five potential channels: (1) increasing government resources and total revenues, (2) improving the investment climate, (3) increasing private domestic investment, (4) attracting more foreign direct investment, and (5) stimulating economic growth. In Section 3.7, we provide evidence of the validity of these channels.

3.3 Data and descriptive statistics

3.3.1 Data

We aim to evaluate the treatment effects of the implementation of the EITI on government debt. In doing so, we use a panel of 69 natural resource-dependent developing countries during the period 1995-2021. We first explain how we classify countries as natural resource-dependent, while in the following subsection, we explain the reasons behind our focus on natural resource-dependent developing countries. Based on the literature (see, for example, Haglund, 2011; Baunsgaard et al., 2012; Lundgren et al., 2013; Dobbs et al., 2013; Coutinho et al., 2022), we use different criteria to construct our sample of natural resource-dependent countries. Specifically, we define resource-dependent countries as those whose ratio of resource exports⁵ to

⁴However, due to the lack of disaggregated FDI and private domestic investment data between the resource and non-resource sectors, a disaggregated analysis of this transmission channel is not possible.

⁵The value of extractive sector exports was calculated from UNCTADstat data, using Standard International Trade Classification categories 27, 28, 3, 667, 68, and 971, following the same

total exports (respectively to GDP) is equal to or greater than 20% (respectively 8%), or whose ratio of extractive rents to GDP is equal to or greater than 10%, or whose ratio of resource revenues to total government revenues is equal to or greater than 20%. This gives us a sample of 69 developing countries.⁶ The complete list of countries in the sample is available in Table C1 (in the Appendix).

The treatment variable (*EITI*) is from the information available on the EITI website and from Lujala (2018). *EITI* is defined as equal to 1 for each year t in which country i is a member of the EITI and 0 otherwise. The study sample includes 38 countries that joined the EITI during the study period and 31 non-member countries. Details on important dates in the EITI implementation process of the sample EITI countries are provided in Table C2.

Our dependent variable (outcome) is government gross debt (as a percentage of GDP). This variable is from the International Monetary Fund (IMF) World Economic Outlook (WEO). In line with the literature on the determinants of EITI membership and government debt, we use the following control variables: the control of corruption index, the commodity price index, GDP per capita growth, trade openness, the primary balance, and inflation.

First, the level of corruption is positively correlated with the likelihood of joining the EITI (Pitlik et al., 2010; Öge, 2016a; Lujala, 2018). Indeed, membership in the EITI is an opportunity for countries perceived to have low institutional quality to send a signal about their commitment to promoting transparency and good governance in resource management and combating corruption to improve their reputation within the international community (David-Barrett and Okamura, 2016; Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). In addition, implementing the EITI lends credibility to reforms aimed at improving institutional quality (Pitlik et al., 2010). Moreover, the literature has shown that poor institutional quality significantly affects the level of public debt (Lavigne, 2011). Cooray et al. (2017) have provided evidence that an increase in corruption level leads to an increase in public debt. Second, since the level of natural resource dependence is an internal motivation for countries to join the EITI (Lujala, 2018) and favors the implementation of the Standard (Pitlik

methodology as Haglund (2011).

⁶The sample of natural resource-dependent developing countries initially obtained by applying these criteria consisted of 80 countries. However, some countries (11 in total) did not have data available for either the dependent variable or certain control variables for the entire period studied. Because these missing data excluded these countries from the analysis, they were excluded from the final sample of natural resource-dependent developing countries retained.

et al., 2010; Öge, 2016a; David-Barrett and Okamura, 2016; Kasekende et al., 2016; Lujala, 2018), we control for the international commodity export price index to account for global changes in commodity world prices following the literature (Collier and Goderis, 2008; Arezki and Brückner, 2012; Ehrhart and Guerinéau, 2013). It captures the effects of changes in world commodity prices (since the sample comprises developing countries, the export price index is more relevant to this study, as these countries are commodity exporters due to their low levels of industrialization). Moreover, the dynamics of commodity prices affect government debt. Arezki and Brückner (2012) have highlighted a significant relationship between the international prices of exported commodity goods and government external debt. Third, we control for economic growth to account for economic development. Indeed, countries with a low level of development are more likely to join the EITI because they are considered to benefit most from the EITI, and they are also exposed to external pressures due to their high dependence on aid from the international community (Pitlik et al., 2010; David-Barrett and Okamura, 2016; Öge, 2016a; Kasekende et al., 2016; Lujala, 2018). Moreover, numerous empirical studies confirm that economic growth is a key determinant of government debt, although the direction of the relationship varies among studies. Ampofo et al. (2021) have found that the effect of economic development differs between the short term and the long term. Fourth, we control for trade openness. There is a positive association between trade openness and economic growth (Harrison, 1996). The aim of improving trade openness can be an incentive to implement the EITI. Concerning the link between trade openness and government debt, the literature does not reach a consensus. While Awan et al. (2015) and Omrane Belguith and Omrane (2017) have found a positive and significant relationship between trade openness and government debt, Ampofo et al. (2021) have provided evidence that trade openness reduces government debt in the long term. Fifth, we control for the primary balance. The need for borrowing could depend on the level of primary balance (the difference between government revenue and government expenditures, without interest payments on debt). The higher the tax revenue, the lower the ratio of public debt to GDP, while increased government expenditure increases borrowing (Cooray et al., 2017). Finally, the level of inflation is included to capture macroeconomic stability, which is a precondition for the successful implementation of reforms. In addition, several studies find that inflation reduces government debt (Aizenman and Marion, 2011; Bittencourt, 2015; Omrane Belguith and Omrane, 2017; Ampofo et al., 2021). However, Forslund et al. (2011) and Sadik-Zada and Gatto (2019) found no statistically significant relationship between inflation and government debt, while Reinhart and Rogoff

(2010a) noted that inflation can increase the stock of debt by increasing the interest payments on debt. Cooray et al. (2017) finds a positive and statistically significant effect of inflation level on debt.

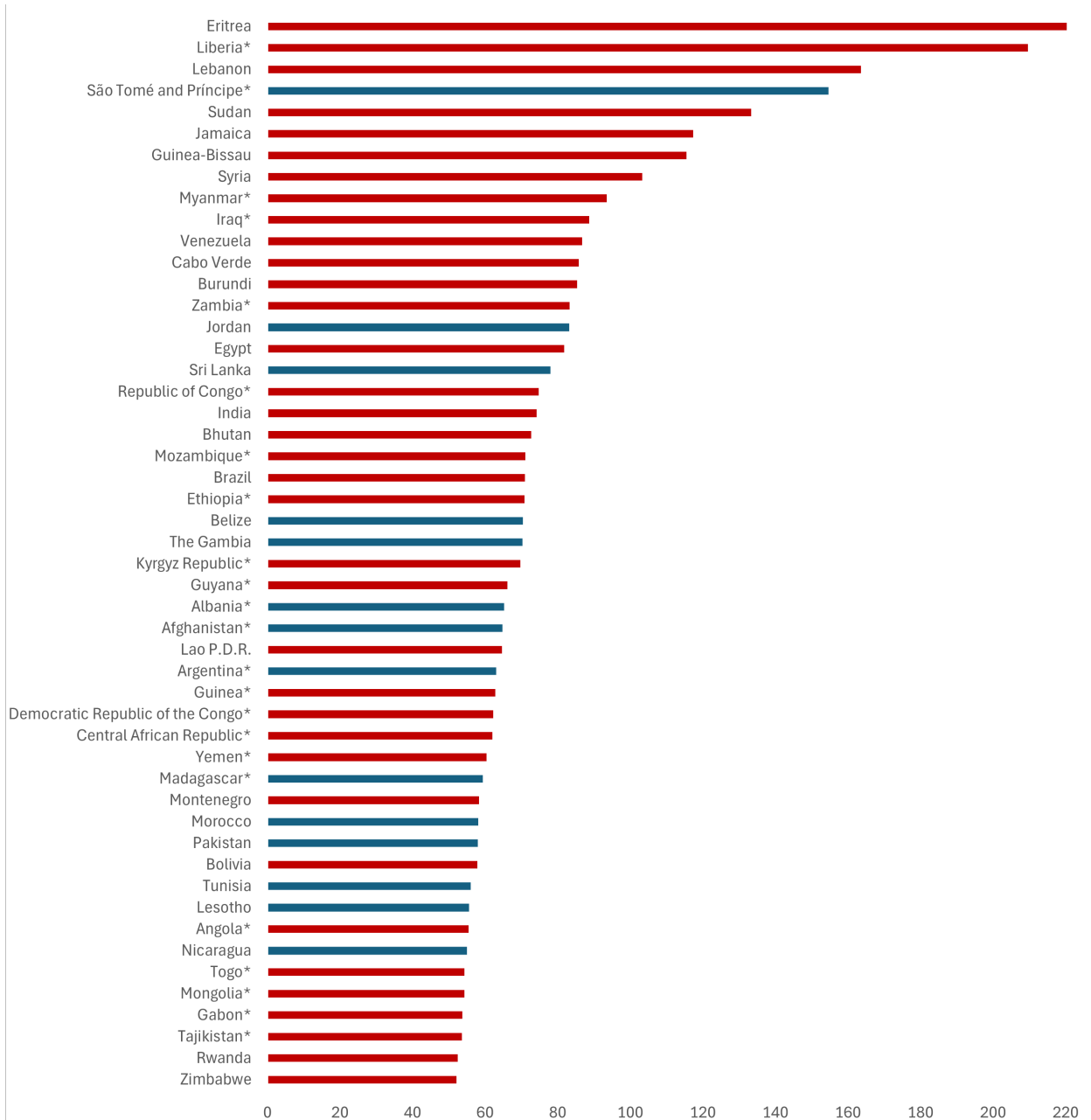
In line with the literature on the EITI determinants (Lujala, 2018) and also to limit the reverse causality problem, all control variables are lagged by one year. Following the literature (Arezki and Brückner, 2012, Ampofo et al., 2021, Lujala, 2018), we use the logarithm of the government debt-to-GDP ratio to limit the influence of the extreme values. Indeed, as shown in the descriptive statistics in the next subsection, the debt-to-GDP ratio variable has a high degree of asymmetry and dispersion. Using the logarithm of this variable, therefore, reduces dispersion, makes the distribution more symmetrical, and stabilizes variance, which will make the coefficients more reliable and comparable between countries. Moreover, as explained by Lujala (2018), analysis using Martingale residuals suggests that the log-transformation provides the best functional form for this variate. For the same reasons, we also use the logarithm of trade openness and the commodity price index. Data on the control of corruption index is from the World Governance Indicators (WGI) database, and the commodity price index is drawn from the International Monetary Fund (IMF) Commodity Terms of Trade database. The primary balance data is from the International Monetary Fund (IMF) World Economic Outlook (WEO). Data on GDP per capita growth, inflation, and trade openness come from the World Development Indicators (WDI) database. Descriptive statistics for these variables are provided in Table C3. Tables C8 and C9 describe the complete list of data and their sources.

3.3.2 Descriptive statistics

In this subsection, we present some descriptive statistics on the implementation of EITI and the average government's public debt-to-GDP ratio in our sample countries over the study period (1995-2021).

On the one hand, Fig. 3.3 ranks developing countries that are most indebted (debt-to-GDP ratio, on average over the entire study period). Among these top 50 countries, Zimbabwe has the lowest public debt as a percentage of GDP (52.06%), while Eritrea has the highest (227.67%). The red bars show the public debt-to-GDP ratio for resource-dependent developing countries, while the blue bars show the ratio for non-resource-dependent developing countries. This distinction yields interesting results, showing that almost three-quarters of the 50 most indebted developing countries (36 out of 50) are resource-dependent. These stylized facts,

Figure 3.3: Public debt (estimated debt stock as a share of GDP)



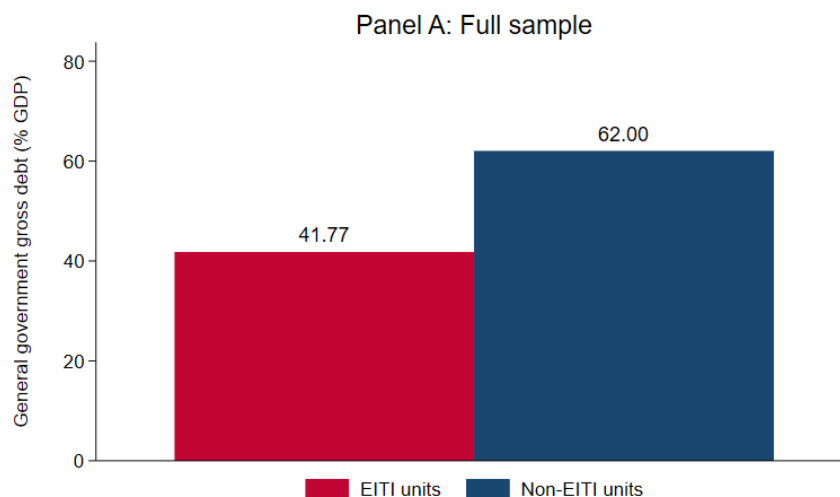
Note: Data is shown for the 50 developing countries with the highest average debt-to-GDP ratio over the period 1995-2021. * refers to EITI member countries. The bars in red represent resource-dependent countries, and the bars in blue refer to non-resource-dependent countries.

Source: Author's construction based on data from World Economic Outlook (WEO), World Development Indicators (WDI), and United Nations Conference on Trade and Development (UNCTAD).

complementing the evidence developed in the literature and presented in Section 3.1, therefore motivate the choice of natural resource-dependent developing countries as the sample in our analysis. Moreover, this graph shows that among the top 50 most indebted developing countries, 23 countries joined the EITI during the analysis period, including 18 resource-dependent and 5 non-resource-dependent countries.

On the other hand, Fig. 3.4 presents the average government debt-to-GDP ratio in EITI and non-EITI observation units. It compares the average government debt-to-GDP ratio in EITI and non-EITI observations in the whole sample. This graph reveals a lower government debt-to-GDP ratio in treated units (41.77%) compared to non-EITI units (62.00%). Moreover, the difference between the two groups is statistically significant ($t\text{-test} = 10.2289$, and $p\text{-value} = 0.000$). Even if these stylized facts indicate a negative and significant relationship between EITI implementation and the government debt-to-GDP ratio, these statistics are only correlations and not causal effects. This does not allow us to conclude a causal relationship between the EITI implementation and the government debt-to-GDP ratio. To do so, we conduct an impact evaluation analysis, following the methodology described in the next section.

Figure 3.4: Average government debt-to-GDP ratio in EITI and non-EITI units



Note: This graph presents the average government debt-to-GDP ratio in EITI units (country-year with EITI implementation) and non-EITI units (country-year without EITI implementation) over the period 1995-2021.

Source: Author's construction based on data from International Monetary Fund (IMF) World Economic Outlook (WEO).

3.4 Empirical strategy

This study aims to evaluate the dynamic treatment effects of the implementation of EITI on the government debt-to-GDP ratio in natural resource-dependent developing countries. To do so, we exploit the variations in the membership of EITI and the implementation timing between countries, resulting in the following equation:

$$\ln Debt_{it} = \beta EITI_{it} + \alpha_i + \mu_t + \delta X_{it} + \epsilon_{it} \quad (3.1)$$

Where $\ln Debt_{it}$ is the logarithm of the government gross debt-to-GDP ratio of country i in year t . $EITI_{it}$ is a dummy variable representing the treatment and indicates whether country i implements the EITI in year t (it is equal to 1) or not (it is equal to 0); α_i represents country-fixed effects that capture time-invariant country-specific effects; μ_t represents year-fixed effects that capture time-specific factors affecting sample countries. X_{it} is a set of control variables, and ϵ_{it} is the random error term.

Equation 3.1 represents an ordinary difference-in-differences (ordinary DID) specification with additional controls, a method generally used in the literature to analyze treatment effects. However, our analysis faces some analytical challenges that we need to address in order to ensure the validity of the results. First, the EITI is a global organization that any country can join voluntarily. Second, countries implement the EITI at different times. Then, a country's decision to implement the EITI Standard may be influenced by its economic and institutional characteristics. Third, and most importantly, some treatment units go in and out of treatment status. Indeed, Table 3.1 describes the timeline in the EITI implementation process for all EITI countries in our sample and shows that some countries were suspended at different times before rejoining the EITI. Indeed, countries can be suspended from the EITI for four reasons: Firstly, when the country does not meet the deadline for the publication of EITI reports (For example, Gabon, which left the organization in February 2013 before the government announced its commitment to rejoin in June 2020). Secondly, when the country does not demonstrate significant progress, such as Niger, which left the organization in October 2017 following its suspension before rejoining in January 2019. Thirdly, when the country does not comply with the EITI principles. Fourthly, when the country faces political instability that prevents it from implementing the EITI Standard. These suspension episodes have not been considered in many previous studies evaluating the effects of the EITI, but represent a major threat to identification that can significantly bias the results.

Table 3.1: Timeline in the EITI implementation

Country/Year →	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
↓																			
Angola																		•	•
Armenia																•	•	•	•
Azerbaijan		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Burkina Faso					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Central African Republic					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Cote d'Ivoire					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Cameroon			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Congo, Dem. Rep.			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Congo, Rep.		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Colombia											•	•	•	•	•	•	•	•	•
Ecuador																•	•	•	•
Ethiopia							•	•	•	•	•	•	•	•	•	•	•	•	•
Gabon		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Ghana	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Guinea			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Guyana								•	•	•	•	•	•	•	•	•	•	•	•
Indonesia						•	•	•	•	•	•	•	•	•	•	•	•	•	•
Iraq							•	•	•	•	•	•	•	•	•	•	•	•	•
Kazakhstan			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Kyrgyz Republic		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mali				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mongolia				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mozambique					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mauritania			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Niger			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Peru			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Papua New Guinea											•	•	•	•	•	•	•	•	•
Senegal										•	•	•	•	•	•	•	•	•	•
Sierra Leone					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Suriname														•	•	•	•	•	•
Chad					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Togo							•	•	•	•	•	•	•	•	•	•	•	•	•
Tajikistan										•	•	•	•	•	•	•	•	•	•
Timor-Leste					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Tanzania						•	•	•	•	•	•	•	•	•	•	•	•	•	•
Uganda																	•	•	•
Yemen, Rep.					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Zambia							•	•	•	•	•	•	•	•	•	•	•	•	•

Note: • EITI implementation period • Breaking points in EITI implementation.
Source: Author's construction based on information from the EITI website.

Several studies (De Chaisemartin and d'Haultfoeuille (2020; 2024); Sun and Abraham, 2021; Goodman-Bacon, 2021; Callaway and Sant'Anna, 2021; Borusyak et al., 2021) have provided evidence that the existence of heterogeneous treatment effects (meaning that the same treatment has different effects on different samples or at different times) may induce bias in traditional DID estimation if treatments are phased in at different times over a long panel and, in some extreme scenarios, even reversing the sign of the effect because it may give negative weights to some of the underlying treatment effects. One of the consequences of the interruptions in EITI implementation in some countries is that past treatments may influence the

treatment outcome at time t . More concretely, a unit not treated in $t-1$ and t may have been treated in $t-2$ or $t-3$, and these treatments can influence the estimate of the treatment effect in t . Thus, it is legitimate to consider that the EITI treatment effects could be heterogeneous over time and between countries. The ordinary DID method considers the earlier treated observations as a comparison group for the later treated observations, assuming that the treatment effect is stable (Lu et al., 2023).⁷ We first provide the ordinary DID estimation results and test their validity by applying the test proposed by De Chaisemartin and d'Haultfoeuille (2020), which consists of calculating the number of estimated average treatment effect on the treated (ATT) attached to negative weights. The higher the share of negative weights in the total weighting in the estimation of the ordinary DID method, the higher the probability of these results being biased.

Following Pafadnam (2024), to take into account these identification threats and address such bias, we implement the dynamic heterogeneity-robust difference-in-differences estimator (denoted by " DID_M estimator" in the rest of the analysis), developed by De Chaisemartin and d'Haultfoeuille (2020; 2024). The intuition behind this estimator is that it compares the first-time switchers to the not-yet-switchers. Specifically, it compares groups whose treatment changes for the first time at t to groups whose treatment has not changed yet at t (indeed, only these units can be considered valid controls according to De Chaisemartin and d'Haultfoeuille (2023)). This estimator allows the representation of the results in intuitive graphs that show dynamic post-treatment effects (by calculating the treatment effects over some periods after the membership of EITI) and allows testing the identification assumptions of parallel trends in the treatment and control group through placebo analysis (Schmidheiny and Siegloch, 2023). We then estimate the following equation:

$$\ln Debt_{it} = \sum_{j \geq -K, j \neq -1}^L \beta_j EITI_{it}^j + \alpha_i + \mu_t + \delta X_{it} + \epsilon_{it} \quad (3.2)$$

As precise earlier, $\ln Debt_{it}$ is the logarithm of the government gross debt-to-GDP ratio of country i in year t (in logarithm); α_i represents country-fixed effects; μ_t represents year-fixed effects; X_{it} is a set of control variables; and ϵ_{it} is the random error term. Let us consider u_i as the year when country i adheres to the EITI, K the largest number of years tested before u_i , and L the largest number of years

⁷Indeed, the ordinary DID method relies on two major assumptions: the parallel trends assumption and the assumption that the treatment effect is constant between groups and over time.

tested after u_i . Thus, as mentioned earlier, $EITI_{it}$ is equal to 1 if $t-u_i=j$, and zero otherwise for $-K \leq -j \leq L; j \neq -1$.

In other words, the year immediately before the membership to the EITI ($t-u_i=-1$) is taken as the reference, and we calculate the coefficients for all other years relative to this base. So, the DID_M estimator provides not only a test of the validity of the parallel trends assumption (β_j for $j < -1$), but also an evaluation of the EITI's treatment effect over time (β_j for $j \geq 0$).

Therefore, the average effects of the EITI can be determined by averaging the yearly treatment effects. Finally, we set $K = 5$ and $L = 7$.

3.5 Baseline results

Employing the DID_M estimator developed in Section 3.4, we estimate the treatment effects of implementing the EITI on the government debt-to-GDP ratio in natural resource-dependent developing countries over the period 1995-2021.

First, Table 3.2 presents our main results on the treatment effects of the implementation of the EITI on the government debt-to-GDP ratio, based on the dynamic heterogeneity-robust DID estimator (DID_M). Panel A shows the results for the post-average treatment effect of the EITI implementation on debt-to-GDP ratio. DID_M is the estimated post-average effect over the first seven years ($t+7$) following membership in the EITI. Column (1) shows the results for the baseline regression. This result indicates that EITI implementation is associated with an average decrease in the logarithm of the public debt-to-GDP ratio of 0.26, statistically significant at the 1% threshold.⁸ Then, implementing the EITI reduces, on average, the government's debt-to-GDP ratio by 23% in resource-dependent developing member countries compared to non-members, which represents an economically significant effect.⁹ Moreover, the placebo joint-test performed by this estimator (which are

⁸The coefficients of the binary variable $EITI$ are interpreted in terms of relative effects, applying the following formula: $100 \times [\exp(\beta) - 1]$.

⁹The result of the ordinary DID estimation of the EITI implementation treatment effects on the debt-to-GDP ratio is presented in column (1) of Table C7 in the Appendix. This result indicates that the EITI implementation is associated with an average decrease in the logarithm of the public debt-to-GDP ratio of 0.19, which is statistically significant at the 5% threshold. In other words, implementing the EITI leads to an average reduction of around 17% in the debt-to-GDP ratio. However, the result of the validity test of ordinary DID estimation proposed by [De Chaisemartin and d'Haultfoeuille \(2020\)](#) indicates that the share of negative weights in the total weighting is approximately equal to 2.4%. It is therefore essential to ensure that the results are robust to the heterogeneous effects of the EITI implementation.

Table 3.2: EITI and Government Debt-to-GDP ratio

	Baseline main results	Excluding units <1% & >99% percentiles	Excluding units <5% & >95% percentiles	Excluding unit <10% & >90% percentiles
Dependent variable: Debt-to-GDP ratio	(1)	(2)	(3)	(4)
Panel A				
Post average treatment effects				
DID_M	-0.2590*** (0.0798)	-0.2528*** (0.0805)	-0.2286*** (0.0752)	-0.2307*** (0.0799)
Control variables	No	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Placebo joint-test p-value	0.5936	0.5647	0.8156	0.1132
Panel B				
Pre-treatment (placebo) estimators				
$DID_M^{pl,1}$	0.0364 (0.0491)	0.0370 (0.0489)	0.0076 (0.0379)	0.0217 (0.0444)
$DID_M^{pl,2}$	0.0403 (0.0555)	0.0394 (0.0563)	0.0304 (0.0678)	0.0591 (0.0761)
$DID_M^{pl,3}$	0.0563 (0.0922)	0.0553 (0.0943)	0.0238 (0.0867)	-0.0187 (0.0795)

Note: Results are obtained using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), using 100 bootstrap replications and 5 placebo years. Robust standard errors are in parentheses. EITI membership is the treatment variable, and unreported constant is included. Control variables: corruption index, commodity price index, GDP per capita growth rate, primary balance, Inflation, and trade openness (log). All of these variables are lagged by one year. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

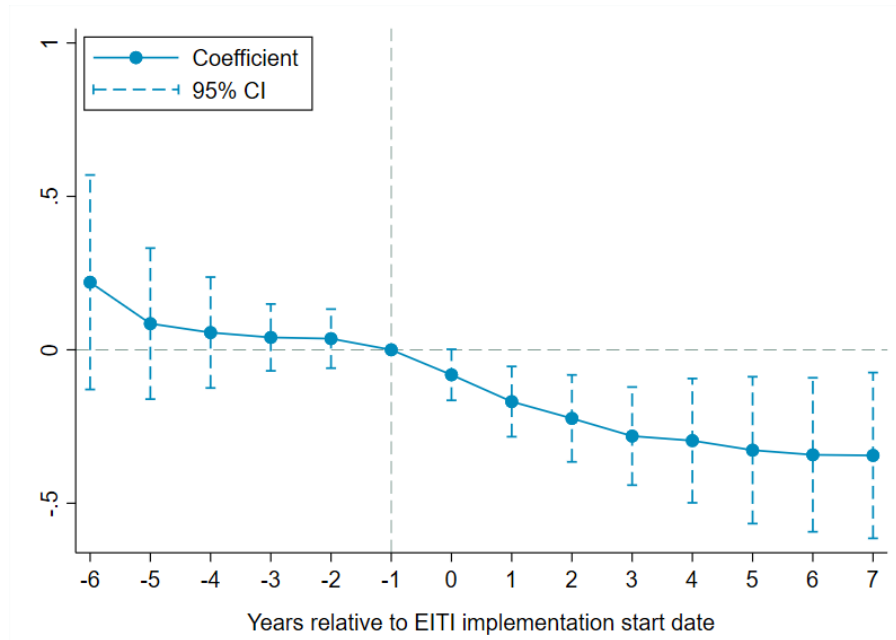
the p-values of a joint test that all placebos are equal to zero) is not statistically significant, attesting to the credibility of the parallel trend and the non-anticipation assumptions. Furthermore, panel B reports the estimation results for the three pre-treatment estimators ($DID_M^{pl,1}$, $DID_M^{pl,2}$, $DID_M^{pl,3}$), corresponding, respectively, to the second, third and fourth years before the implementation of the EITI. The non-significance of these individual pre-treatment estimations results corroborates the placebo joint-test results.¹⁰ This validates the parallel trends and no anticipation

¹⁰Since [De Chaisemartin and d'Haultfoeuille \(2020\)](#) consider $t = -1$ as the reference period, $DID_M^{pl,1}$ compares the difference in the outcome between EITI and non-EITI countries in $t - 1$ with the difference between the two groups in $t - 2$, $DID_M^{pl,2}$ makes such a comparison between

assumptions in the EITI membership.

Second, Fig. 3.5 plots both pre-treatment and post-treatment trends for the main regression (column (1) of Table 3.2.). The post-treatment effects represent the estimated dynamic (annual) effects of the EITI implementation. Since De Chaisemartin and d'Haultfoeuille (2020; 2024) consider $t = 1$ as the reference year, this graph shows pre-treatment estimators corresponding to one up to six years before the EITI implementation and seven years of post-treatment estimates. Firstly, the results reveal that all pre-treatment estimators are small and not significantly different from zero. Secondly, the results show that the annual post-treatment effects of the EITI implementation on the debt-to-GDP ratio are negative and statistically significant.

Figure 3.5: EITI dynamic (annual) effects on the debt-to-GDP ratio



Note: Representation of the EITI dynamic (annual) effects on the debt-to-GDP ratio with the dynamic heterogeneity-robust DID estimator of De Chaisemartin and d'Haultfoeuille (2020; 2024), applying 100 bootstrap replications. Bars represent the 95% confidence intervals around the long differences effects and placebo tests. The placebo joint-test is not significant.

Source: Author's construction.

$t - 1$ and $t - 3$, while $DID_M^{pl,3}$ makes such a comparison between $t - 1$ and $t - 4$, and so on.

3.6 Robustness analysis

The main estimation results in Section 3.5 indicate that the EITI implementation significantly reduces the debt-to-GDP ratio in resource-dependent developing member countries compared to non-member countries, with effects remaining significant over time. We conduct several additional robustness checks in this section to verify our baseline results.

3.6.1 Alternative specifications

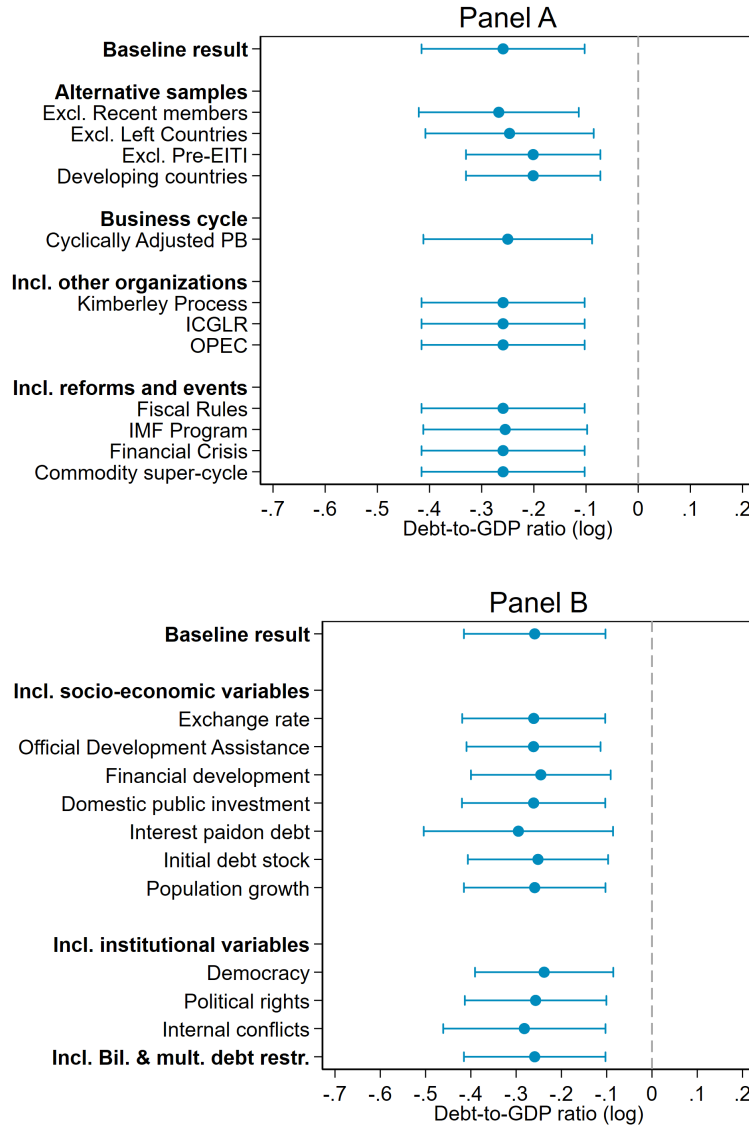
We begin this robustness analysis by testing the robustness of our results to potential outliers. To ensure that our results are not driven by a group of observations, we use samples that exclude potential outliers. Columns (2)-(3) of Table 3.2 show the results of alternative specifications considering samples that exclude, respectively, observations below the 1st percentile and above the 99th percentile, below the 5th percentile and above the 95th percentile, and below the 10th percentile and above the 90th percentile (Fig. C2 in Appendix B plots the pre-treatment and post-treatment effects of these three estimations). The results are consistent with our baseline findings and indicate a statistically significant negative effect of EITI implementation on the debt-to-GDP ratio. The relative stability of the coefficients in these specifications reflects the robustness of the analysis to potential outliers in our dependent variable.

Second, we consider alternative samples obtained by excluding some countries or periods. Firstly, we remove countries that are not long-time members of the EITI.¹¹ Secondly, we remove countries that withdrew from the EITI without rejoining again.¹² This exclusion helps to prevent any potential bias caused by these long periods of non-implementation of the EITI, even if the main estimation method used in the paper already allows us to take this into account. Third, we exclude the period before the creation of the EITI (the period before 2003) to account for institutional, political, and economic changes occurring in this period that could affect the debt-to-GDP ratio, but also to account for potential bias due to missing observations in the data over this period. Finally, although we focus on resource-dependent developing countries for our analysis, we test our results while retaining

¹¹We exclude from the sample countries that joined the EITI during the four years before the end of the study period. These include Ecuador, Uganda, and Angola, which joined in March 2018, February 2019, and August 2020, respectively (See Table C2).

¹²These include Azerbaijan and Yemen (See Table C2).

Figure 3.6: Robustness analysis on the EITI dynamic effects on debt-to-GDP ratio



Note: Representation of the EITI dynamic effects on debt-to-GDP ratio using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications. Control variables are also included. The placebo joint test is not significant.
Source: Author's construction.

all developing countries. Panel A of Fig. 3.6 plots the post-average treatment effects of these estimations (Fig. C3 plots the pre-treatment and post-treatment effects of these four estimations). These results are consistent with our main findings and show negative and statistically significant effects of the EITI implementation on the

debt-to-GDP ratio.

Third, we use the cyclically adjusted primary balance (CAPB) instead of the primary balance as a control variable in the baseline regression. Indeed, the primary balance is the difference between revenue and expenditures, excluding interest spending. However, this indicator has some drawbacks because many factors affect its interpretation (such as discretionary policy measures, cyclical factors like automatic stabilizers, and factors beyond the cycle). Due to these drawbacks, in this robustness analysis, we adjust this variable to take into account the effects of the business cycle and then compute the cyclically adjusted primary balance, which is the primary balance net of cyclical factors. To obtain a proxy of structural government action (CAPB), we decompose the primary balance following [Fedelino et al. \(2009\)](#).

$$CAPB_t = \frac{1}{Y_t^p} \left[R_t \left(\frac{Y_t^p}{Y_t} \right) - G_t \right] \quad (3.3)$$

where R and G are the general government revenue and primary expenditure, respectively, and Y^p is the potential GDP, obtained as the trend component of the nominal GDP Y using the Hodrick-Prescott filter¹³.

The result is plotted in Panel A of Fig. 3.6 and remains consistent with our baseline result (Panel A of Fig. C4 plots the pre-treatment and post-treatment effects of this estimation).

Fourth, we test the robustness of our results using additional control variables that are likely to influence both the decision to implement the EITI and government debt. Referring to the literature, we identified four main groups of additional control variables¹⁴: **A- Membership to other international organizations in the field of natural resources management**: dummy variables indicating membership in the Kimberly Process (KP), membership in the International Conference on the Great Lakes Region (ICGLR), and membership in the Organization of Petroleum Exporting Countries (OPEC). **B- Major reforms and international events**: fiscal rules implementation, IMF programs received, global financial crisis period, and commodity super-cycle period. **C- Additional socio-economic variables**: exchange rate, official development assistance (% of GDP), financial development index, domestic public investment (% of GDP), interest paid on public debt (% of GDP), initial government debt level (government public debt in $t - 1$), and

¹³The Hodrick-Prescott filter is used on the logarithm of the nominal GDP, with a smoothing parameter $\delta = 100$.

¹⁴The reasons for the choice of these variables are discussed in Appendix C.2.

population growth. **D- Institutional variables:** democracy, political rights, and conflicts. Furthermore, bilateral and multilateral debt restructuring and moratoria have reduced public debt ratios in low-income countries (Chuku et al., 2023; Shenai and Bolhuis, 2023). To take into account these debt restructuring episodes, we include a dummy variable equal to 1 in years during which bilateral and multilateral debt restructuring negotiations and moratoria occurred for each country. We identify these periods using several datasets: data on debt restructuring with China come from Horn et al. (2022a), data on restructuring with the Paris Club and multilateral debt treatment (HIPC and MDRI) come from Horn et al. (2022a) and from Djimeu (2018), and data on restructuring negotiations with private creditors are from Asonuma and Trebesch (2016) and Asonuma et al. (2023). To avoid potential bias due to reverse causality, these variables are lagged by one year, as are the control variables used in the main analysis (except for dummy variables). The results are summarized in Panels A and B of Fig. 3.6 (Panels B-D of Fig. C4, Fig. C5, Fig. C6, Fig. C7, and Fig. C8 plots the pre-treatment and post-treatment effects of these estimations). Furthermore, we complete our basic specification by adding this set of control variables by group, and the results are summarized in Table 4.2 (Fig. C9 plots the pre-treatment and post-treatment effects). These results confirm the robustness of our findings to the addition of control variables, as the results of these different specifications support our conclusion that implementing the EITI reduces the government debt-to-GDP ratio in resource-dependent developing member countries compared to non-member countries. Moreover, these specifications allow us to address concerns about potential estimation bias from omitting pertinent EITI membership determinants.

Finally, we made some changes to our dependent variable. Specifically, we use an alternative database (Kose et al., 2022), and three alternative measures for government debt: general government gross debt (% of GDP), general government gross debt (% of average tax revenues), and general government gross debt (% of 10-year moving average GDP). We use these alternative measures and estimate the treatment effects of EITI implementation using the dynamic heterogeneity-robust difference-in-differences estimator. Fig. 3.7 plots both pre-treatment and post-treatment trends over the study period. These results show that the EITI implementation reduces government debt regardless of the measure used.

Table 3.3: EITI and Government Debt-to-GDP ratio

	Other organizations	Major reforms	Economic variables	Institutional variables
Dependent variable:	group	group	group	group
Debt-to-GDP ratio	(1)	(2)	(3)	(4)
Panel A				
Post average treatment effects				
DID_M	-0.2590*** (0.0798)	-0.2549*** (0.0801)	-0.3155*** (0.1048)	-0.2678*** (0.0959)
Control variables	No	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Placebo joint-test p-value	0.5936	0.5364	0.7594	0.7288
Panel B				
Pre-treatment (placebo) estimators				
$DID_M^{plb,1}$	0.0364 (0.0491)	0.0549 (0.0390)	-0.0034 (0.0460)	-0.0115 (0.0365)
$DID_M^{plb,2}$	0.0403 (0.0555)	0.0611 (0.0627)	0.0571 (0.1281)	0.0266 (0.0705)
$DID_M^{plb,3}$	0.0563 (0.0922)	0.0788 (0.1004)	0.2258 (0.2473)	0.0175 (0.1161)

Note: Results are obtained using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), using 100 bootstrap replications and 5 placebo years. Robust standard errors are in parentheses. EITI membership is the treatment variable, and unreported constant is included. Initial Control variables: corruption index, commodity price index, GDP per capita growth rate, primary balance, Inflation, and trade openness (log). All of these variables are lagged by one year. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level

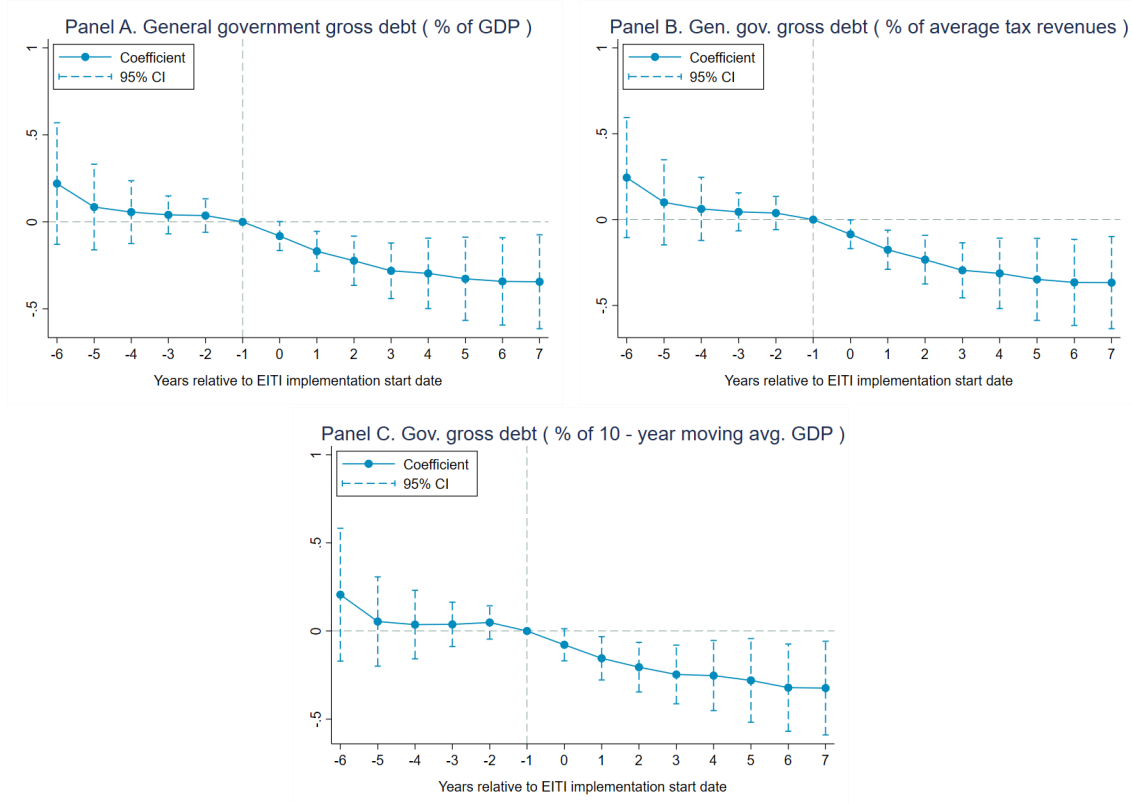
Source: Author's construction.

3.6.2 Alternative estimation methods

To verify that our results are not influenced by the analysis method, we test the robustness using three alternative estimation methods. Specifically, we use ordinary DID estimation, the instrumental variable method, and the entropy balancing method.

Ordinary difference-in-differences (ordinary DID) estimation method. As explained in Section 3.5, we start by applying the ordinary difference-in-differences method and evaluate the effects of the EITI implementation on the debt-to-GDP ratio by estimating Equation 3.1. This method accounts for individual-specific heterogeneity and omitted time-invariant country-specific factors that influence the

Figure 3.7: Robustness analysis on the EITI dynamic effects on alternative dependent variables



Note: Representation of the EITI dynamic effects on alternative dependent variables using the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications. Bars represent the 95% confidence intervals around the long differences effects and placebo tests. The placebo joint-test is not significant.

Source: Author's construction.

debt-to-GDP ratio. The results are resumed in column (1) of Table [C7](#) and indicate a negative and statistically significant relation between the EITI implementation and the debt-to-GDP ratio.

Instrumental variables estimation. To deal with the potential self-selection bias in the EITI membership ([Lujala, 2018](#)), some studies in the literature used a panel instrumental variable (IV) approach. In our analysis, we have already controlled for the determinants of the EITI membership. In addition, in all our estimates using the DID_M estimator, we tested the parallel trend and non-anticipation assumptions. Following the literature ([Villar, 2020; Okada and Shinkuma, 2022](#)), we complete this robustness analysis using an instrumental variable (IV) estimation approach.

As an instrumental variable, we use the percentage of neighboring countries (with common borders) that are EITI members among the total number of neighboring countries. The intuition is that a country's participation in the EITI is influenced by the (exogenous) participation of its neighbors because a country is more likely to participate if its neighboring countries join the EITI. The use of this neighborhood variable as an instrumental variable comes from studies on the geographic diffusion of public policies (see, for example, [Kotera and Okada, 2017](#); [Gilardi and Wasserfallen, 2019](#); [Caselli and Reynaud, 2020](#)), and more specifically from [Acemoglu et al. \(2019\)](#). Indeed, by analyzing the effects of democratization on economic growth, [Acemoglu et al. \(2019\)](#) have instrumented democracy with waves of democratization in neighboring countries. More concretely, their exclusion restriction is that regional waves of democratization have no impact on a country's GDP except through their influence on that country's democracy.¹⁵ We therefore construct our instrument as follows:

$$NeighboursEITI_{it} = \frac{1}{N_{it}} \sum_{j \neq i}^N \times EITI_{jt} \quad (3.4)$$

Where j indicates the country that borders country i in year t (its neighboring country). N_{it} is the total number of countries that border country i in year t . $EITI_{jt}$ is a dummy variable equal to 1 when the country j is an EITI member in year t . Finally, the variable $NeighboursEITI_{it}$ is our first instrument and indicates, for each country in the sample and each year, the percentage of its neighboring countries that are EITI members.

In addition to this instrument, we use the lagged EITI as a second instrument. Indeed, in addition to the test of the relevance of the instruments, the use of two instruments allows us to perform the tests of exogeneity (exclusion condition) and instrument strength.

The results are presented in Column (2) of Table [C7](#). Panel A presents the results of the first-stage equation, where we regress the treatment variable on our instruments and all control variables from the baseline model, and indicate that both instruments

¹⁵Similarly, our exclusion restriction is that the implementation of the EITI by a neighboring country does not directly affect a country's debt level, except through their influence on that country's membership to the EITI. Even if this exclusion restriction is plausible, as explained by [Acemoglu et al. \(2019\)](#), there could be reasons why it might be violated in our case, such as trade linkages. Nevertheless, we already control for trade openness in our regressions, and the results attest to the robustness of the effects to a possible violation of the exclusion condition, in addition to the results of the statistical tests presented in Table [C7](#).

are positively and significantly correlated with the treatment variable. Panel B presents the second-stage estimation results. The results confirm the negative and statistically significant effect of implementing the EITI on the debt-to-GDP ratio in natural resource-dependent developing countries. The coefficients associated with the treatment variable are negative, statistically significant at the 1% threshold, and similar in magnitude to the baseline estimates. In addition, the Kleibergen-Paap F-statistic is significantly higher than the value of the Stock-Yogo test at the critical threshold of 10%, and the Hansen p-value is greater than 0.10 (attesting to the relevance and strength of the instruments used and confirming the exclusion condition).

Entropy balancing method. As an additional alternative impact evaluation method, we use entropy balancing, which is a non-parametric impact evaluation method based on a matching procedure (for more details on this method and its two-step estimation procedure, see e.g., [Hainmueller, 2012](#); [Neuenkirch and Neumeier, 2016](#); [Afesorgbor, 2019](#); and [Gutmann et al., 2023](#)). Specifically, entropy balancing allows us to identify the effect of the EITI implementation on the debt-to-GDP ratio by comparing EITI member and non-member countries that are similar on observable variables while controlling for country and year-fixed effects. The entropy balancing method is implemented in two main stages. First, weights are calculated and assigned to observation units that are not exposed to the treatment but have observable characteristics as similar as possible to the treated units. The computation of these weights satisfies the defined balance constraints concerning the defined characteristics, ensuring that the synthetic control group consists, on average, of observation units not exposed to the treatment that are as similar as possible to the treated units. This method creates a counterfactual group whose difference from the treatment group will be the implementation of the EITI based on the defined observable characteristics. Following [Neuenkirch and Neumeier \(2016\)](#), we choose equilibrium constraints that impose equal covariate means between the treatment and control groups. In other words, we want to ensure that the control group, on average, has untreated units as similar as possible to the treated units. In the second step, in order to estimate the average treatment effect on the treated (ATT) of the EITI implementation on the debt-to-GDP ratio, we use the weights from the first stage in a regression analysis where the debt-to-GDP ratio is our dependent variable, and the EITI implementation dummy is the main interest variable. We also control for year and country-specific effects, and include the entropy balancing covariates (used in the first stage), to improve the efficiency of the estimation because it is

equivalent to including control variables in a randomized experiment (Neuenkirch and Neumeier, 2016).

Firstly, we verify the effectiveness of entropy balancing in constructing the counterfactual group. Descriptive statistics on the control variables considered in the analysis are presented in panel A of Table C6. This panel provides information on the sample means before weights for all control variables between country-year observations with EITI implemented, which represent the treatment group (column (1)), and country-year observations without EITI implemented, the potential synthetic control group (column (2)). Column (3) shows the differences in means between these two groups. The t-test values and corresponding p-values (columns (4) and (5)) indicate that the differences between the treatment and control groups are significant at the 1% level for the majority of the considered variables. From the first stage of the entropy balancing method, we construct a synthetic control group that is as comparable as possible to the treatment group concerning all control variables considered. This is achieved by reweighting the untreated observations using these control variables. Panel B of Table C6 shows the results. Columns (1) and (2) summarize the results for the sample means of the control variables for the treated and untreated groups, respectively. Columns (4) and (5) indicate that entropy balancing eliminated differences between the means of variables for the treatment and control groups because no differences between the variables are significant.

Secondly, the results of estimations performed in the second step are reported in column (3) of Table C7. Once again, the results remain consistent with our main findings and indicate a robust negative and statistically significant effect of EITI implementation on the debt-to-GDP ratio.

Based on the results of these different specifications, we can conclude that our results are robust to the choice of estimation method since the change in methods confirms our conclusions concerning the estimated effect of EITI implementation on the debt-to-GDP ratio.

3.7 Transmission channels

In Sections 3.5 and 3.6, the results have shown that implementing the EITI reduces the government's debt-to-GDP ratio. This section explores the mechanisms behind these effects. Based on the conceptual framework developed in Section 3.2,

we empirically test four possible channels: the rise in government resources and total revenues, the improvement of the investment climate, the increase in private domestic investment and foreign direct investment inflows, and economic growth.

Table 3.4: EITI and Government Debt-to-GDP ratio
Validity of transmission channels

Panel A: Relationship between						
the channel and the Debt-to-GDP ratio	(1)	(2)	(3)	(4)	(5)	(6)
Resource revenue (% of GDP)	-0.0384** (0.0189)					
Government total revenue (% of GDP)		-0.0250** (0.0111)				
Investment climate			-0.2772** (0.1267)			
Foreign direct investment (% of GDP)				-0.0057*** (0.0027)		
Private domestic investment (% of GDP)					-0.0124** (0.0061)	
Economic growth (GDP per capita growth rate)						-0.0086** (0.0033)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country & Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	876	1083	1199	1400	900	1454
R ²	0.4056	0.3234	0.2862	0.3073	0.3570	0.3124
Panel B: Effect of the EITI						
implementation on the channel	(1)	(2)	(3)	(4)	(5)	(6)
	Resource revenue	Total revenue	Investment climate	Foreign direct investment	Private domestic investment	Economic growth
<i>DID_M</i>	2.0112** (0.8257)	1.7455** (0.8538)	0.1039*** (0.0322)	2.3146** (1.1491)	3.2438*** (0.8426)	1.5920** (0.8027)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Country & Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Placebo joint-test p-value	0.5412	0.3364	0.1082	0.2909	0.6903	0.8877

Note: Panel A presents the relationship between the different potential channels and government debt-to-GDP ratio based on panel Fixed Effects (FE) estimations. Panel B reports the effect of EITI implementation on the potential channels based on the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#). Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

To test these channels, we adopt a two-step approach.¹⁶ In the first step, we test the relationship between the potential channel and debt-to-GDP ratio by performing a panel fixed effects (FE) estimation, controlling for country and year-fixed effects (Panel A of Table 3.4). In the second step, we analyze the effects of the EITI implementation on channels using the dynamic heterogeneity-robust

¹⁶Similar approach was also implemented by [Gutmann et al. \(2023\)](#), [Lu et al. \(2023\)](#), and [Pafadnam \(2024\)](#).

difference-in-differences estimator (Panel B of Table 3.4). Our intuition is that if the potential channel negatively (respectively positively) and significantly affects the debt-to-GDP ratio, and implementing the EITI has a positive (respectively negative) and significant effect on this channel, then this channel represents a valid channel through which EITI implementation affects the government's debt-to-GDP ratio. As highlighted by [Gutmann et al. \(2023\)](#), evaluating the transmission channels based on a uniform empirical framework compared to those employed in the main analysis ensures a reasonable identification of causal effects, which are comparable and cannot result from carefully selected model specifications. However, the fact that EITI implementation affects a potential channel and that this channel affects the debt-to-GDP ratio is a necessary but not sufficient condition for establishing the validity of the channel. It is also important to note that our objective is to explore potential transmission channels that may explain the EITI's effects on the government's debt-to-GDP ratio.

The results in Panel A indicate that resource revenue, total revenue, investment climate, private domestic investment, foreign direct investment, and economic growth are negatively correlated with the debt-to-GDP ratio. Furthermore, the results in Panel B show the average effects of EITI implementation on these channels and indicate a positive and statistically significant effect of implementing the EITI on each channel. In summary, these results provide evidence that the increase in government resources and total revenue, the improvement of the investment climate, the rise in private domestic investment and foreign direct investment, and economic growth may represent the main channels through which implementing the EITI reduces the debt-to-GDP ratio.

3.8 Conclusion

This study evaluates the dynamic treatment effects of the EITI implementation on the government debt-to-GDP ratio, using a sample of 69 natural resource-dependent developing countries from 1995 to 2021. To properly account for the design in EITI implementation, with units joining at different dates, some of which move in and out of treatment status, our empirical strategy relies on the dynamic heterogeneity-robust difference-in-differences estimation method. Our results show that, overall, implementing the EITI reduces the debt-to-GDP ratio in resource-dependent developing member countries compared to non-member countries. More interestingly, we show that the effects of EITI implementation are negative and

significant over the implementation period.

Our findings are robust to several robustness checks, such as excluding potential outliers, considering alternative estimation samples, including additional control variables, exploring alternative dependent variables, and employing alternative estimation methods. Finally, we provide evidence that the improvement in investment climate, the rise in resource revenue and total government revenue, and the increase in foreign direct investment inflows and private domestic investment may represent valid transmission channels through which the EITI implementation reduces the debt-to-GDP ratio in resource-dependent developing member countries.

This paper has clear economic policy implications. Natural resource-dependent developing countries should implement the EITI Standard in order to reduce their debt levels. Indeed, the EITI can be used as an instrument to improve transparency and accountability in the management of natural resources, which will help to ensure the efficient use of additional resource revenue collected and enable a reduction in debt accumulation, not only in the short-term but also in the medium and long terms. In addition, the EITI implementation will allow these countries to increase private investment (both domestic and foreign), which can stimulate economic growth and reduce borrowing.

C EITI implementation process and selection of additional control variables

C.1 The EITI implementation process

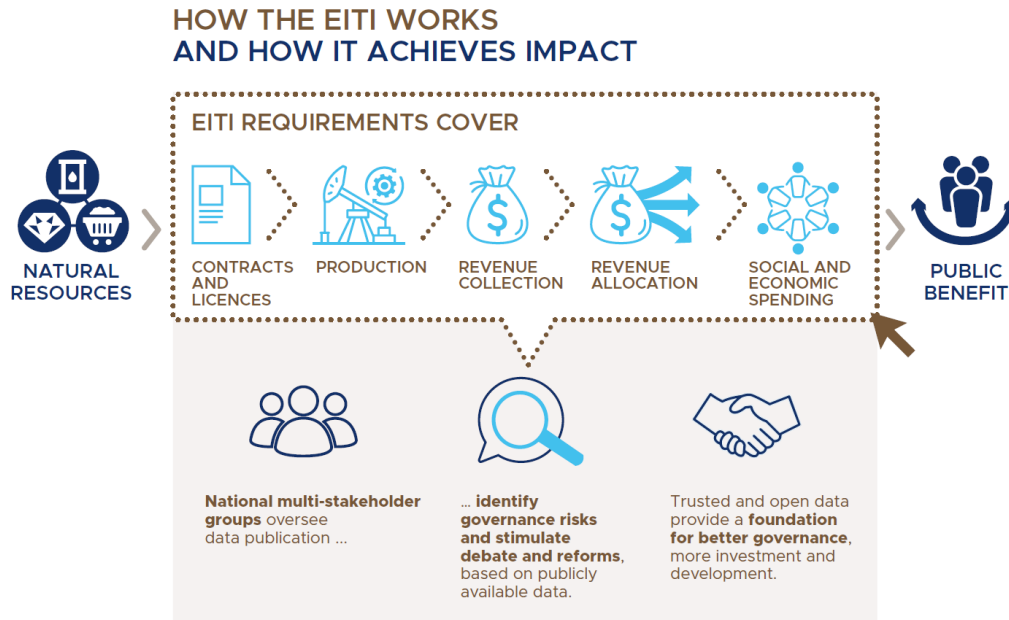
The EITI defines the process for countries seeking to join the institution and implement the EITI Standard (EITI, 2016). Firstly, the government of a country seeking to implement the EITI Standard must publicly announce its commitment to joining the EITI. It must then appoint a government official to lead the membership process, establish a national EITI Secretariat, and form an independent and active multi-stakeholder group (MSG). The MSG must include representatives from government, civil society, and extractive companies, with the task of monitoring the implementation of the Standard and drawing up a work plan detailing the country's objectives with national reforms and development priorities. As noted by Sovacool et al. (2016), the key to the EITI is its “multi-stakeholder” transparency approach. Then comes the candidate stage, in which the country submits a formal application to the EITI Board (EITI, 2019). If the EITI Board determines that the Standard's implementation requirements have been satisfied, the country's application is validated. To become a fully compliant country, the EITI multi-stakeholder group and national secretariat must prepare the required documents and data on the extractive sector. After this, an independent consultant prepares a validation report, which is submitted to the EITI board within two and a half years. The EITI board, after reviewing the documents, decides whether the country is compliant or not. When the country is declared compliant, it will have to publish regular reports according to the deadlines fixed by the EITI Board. In practice, however, the deadline for achieving compliance status is not always met. Most countries achieve compliance late in the engagement process but publish their EITI reports annually and comply with the Standard's requirements. Sanctions can be taken against countries that can be suspended from the organization for four main reasons.¹⁷ However, the suspension can be lifted when the conditions for lifting the suspension are met.

C.2 Selection of additional control variables

We explain the selection of additional control variables in the robustness analysis included in Subsection 3.6.1.

¹⁷More details on these suspension episodes and their impact on the analysis are discussed in Section 3.4 of the paper.

Figure C1: EITI process in the extractive sector value chain



Source: reused from [EITI \(2019\)](#), under EITI copyright.

Firstly, membership in a global organization promoting better governance could influence the decision to join the EITI, and thus the effects of its implementation. We control for other organizations that promote better governance in the extractive sector at the state level. These are the Kimberly Process (KP), the International Conference on the Great Lakes Region (ICGLR), and the Organization of Petroleum Exporting Countries (OPEC). The KP, created in 2003, is a major initiative for better global governance in the diamond sector. The ICGLR is composed of 12 African countries and aims to promote peace, security, democracy, and development in the Great Lakes Region. OPEC brings together the world's major oil producers. These countries are traditionally associated with the resource curse ([Sovacool et al., 2016](#)). OPEC membership reduces the likelihood of EITI membership ([Pitlik et al., 2010](#)). This could be explained either by the fact that OPEC members consider that they already have a common system of transparency, notably through the publication of their crude oil production, or by the more restrictive nature of the EITI, which would strongly limit the incentives for under-reporting and would avoid any "free-riding" behavior ([Pitlik et al., 2010](#)). The lists of Kimberley Process, ICGLR, and OPEC member countries are available in Appendix B (Tables [C4](#) and [C5](#)).

Secondly, other country-level policies and major international events can also influence government debt. Indeed, we control by fiscal rules implementation and IMF programs. [Combes et al. \(2018\)](#) provide evidence that fiscal rules improve fiscal performance, which can affect the level of public debt. Moreover, transparency and accountability in the extractive sector have received increasing international attention and have been identified as a mechanism to mitigate the negative effects of the global financial crises ([Mejía Acosta, 2013](#)). Some countries made significant progress in implementing the EITI during the economic crisis between 2008 and 2009. The period 2003-2008 was also marked by a generalized rise in world mineral prices qualified as a "commodity super-cycle" ([Chávez and Rodríguez-Puello, 2022](#)), and membership of most of the EITI countries in the sample, so it is important to control for a dummy variable that is characteristic of this period.

Thirdly, the influence of additional economic variables must be taken into account in our analysis. We control for exchange rate, since [Awan et al. \(2015\)](#) found a positive relationship between exchange rate and debt. Moreover, Official Development Assistance (ODA) is used to measure a country's dependence on international aid and assistance. Countries that are more dependent on ODA are more likely to implement the EITI ([David-Barrett and Okamura, 2016](#); [Kasekende et al., 2016](#); [Lujala, 2018](#)). The international community perceives the commitment to join the EITI positively and can reward these countries with increased ODA flows. [Awan et al. \(2015\)](#) found a positive but no statistically significant effect of ODA on debt. We also consider the level of financial development, which could influence a country's domestic capacity to implement the EITI since strong financial institutions, by promoting better governance and information availability, facilitate achieving a transparent economic system ([Dutta and Mukherjee, 2018](#)). [Forslund et al. \(2011\)](#) also found a positive and significant relationship between financial development and government debt, specifically for low-income countries. Domestic public investment can boost economic growth, which will lead to a reduction of government debt ([Omrane Belguith and Omrane, 2017](#)). Following [Cooray et al. \(2017\)](#), we include interest payments on debt to take into account debt-servicing costs. The authors also found that the higher the interest payment, the higher the ratio of public debt to GDP. We also include initial government debt as an additional control variable. In addition, we control for population growth, which can influence a country's decision to join the EITI in the sense that a larger population is more likely to hold leaders accountable and, therefore, to call for anti-corruption and governance improvement policies. [Ampofo et al. \(2021\)](#) also showed that population growth has a negative

effect on public debt.

Finally, we control for additional institutional and conflict variables. On the one hand, we include democracy index, political rights, and conflicts. The level of democracy is positively correlated with the likelihood of joining the EITI (Pitlik et al., 2010; Öge, 2016a; Lujala, 2018). Governments with popular support and higher law and order are also more likely to initiate reforms toward greater transparency (Lujala, 2018). On the other hand, conflicts may influence EITI implementation and government debt. A country's experience of conflict is a crucial determinant of EITI membership (Lujala, 2018), mainly when these conflicts are centered around natural resources. Berman et al. (2017) have found that implementing the EITI helps to mitigate the negative effect of rising mineral prices on the occurrence of conflict.

C.3 Study sample, descriptive statistics, robustness, and sources of data

Table C1: List of countries in the study sample

Angola	Chile	Ghana	Mongolia	Suriname
Armenia	Cote d'Ivoire	Guinea	Mozambique	Syrian Arab Republic
Azerbaijan	Cameroon	Guinea-Bissau	Mauritania	Chad
Burundi	Congo, Dem. Rep	Guyana	Malaysia	Togo
Benin	Congo, Rep.	Indonesia	Namibia	Tajikistan
Burkina Faso	Colombia	India	Niger	Timor-Leste
Bulgaria	Cabo Verde	Iran, Islamic Rep	Peru	Tanzania
Bosnia and Herzegovina	Algeria	Iraq	Papua New Guinea	Uganda
Belarus	Ecuador	Jamaica	Paraguay	Venezuela, RB
Bolivia	Egypt, Arab Rep.	Kazakhstan	Russia Federation	Yemen, Rep.
Brazil	Eritrea	Kyrgyz Republic	Rwanda	South Africa
Bhutan	Ethiopia	Lao PDR	Sudan	Zambia
Botswana	Gabon	Lebanon	Senegal	Zimbabwe
Central African Republic	Georgia	Mali	Sierra Leone	

Source: Author's construction.

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Table C2: EITI members with important dates and their status at the end of the study period

EITI Country	Commitment	Creation of the multi-stakeholder group	candidate validation	Compliance	Suspension/withdrawal period	Status at 31/12/2021
Angola	August 2020	June 2021	June 16, 2022	-	-	Candidate validated
Armenia	January 2017	November 2016	September 03, 2017	-	-	Candidate validated
Azerbaijan	June 2003	November 2005	September 2005	February 2009	March 2017-	Suspended
Burkina Faso	July 2007	December 2008	May 15, 2009	February 2013	-	Compliant
Central African Republic	August 2007	July 2008	November 21, 2008	March 2011	2013-2021	Candidate validated
Cote d'Ivoire	May 2007	February 2008	May 12, 2008	May 2013	-	Compliant
Cameroon	March 2005	June 2005	September 27, 2007	October 2013	-	Compliant
Congo, Dem. Rep.	January 2005	November 2005	September 2007	July 2014	April 18, 2013-July 2, 2014	Compliant
Congo, Rep.	June 2004	October 2006	September 27, 2007	February 2013	-	Compliant
Colombia	May 2013	February 2014	October 15, 2014	-	-	Candidate validated
Ecuador	March 2018	June 2020	October 15, 2020	-	-	Candidate validated
Ethiopia	August 2009	July 2009	March 19, 2014	-	-	Candidate validated
Gabon	May 2004	July 2005	September 2007	-	February 2013-October 2021	Suspended
Ghana	June 2003	February 2005	September 27, 2007	October 2010	-	Compliant
Guinea	April 2005	February 2012	September 27, 2007	July 2014	December 2009-March 2011	Compliant
Guyana	May 2010	February 2017	October 25, 2017	-	-	Candidate validated
Indonesia	December 2008	June 2010	November 24, 2010	October 2014	February-December 2015	Compliant
Iraq	March 2009	September 2010	10 February 2010	December 2012	-	Compliant
Kazakhstan	June 2005	October 2005	September 27, 2007	October 2013	-	Compliant
Kyrgyz Republic	May 2004	July 2008	September 27, 2007	March 2011	-	Compliant
Mali	August 2006	June 2007	September 22, 2007	August 2011	-	Compliant
Mongolia	April 2006	January 2006	September 2007	October 2010	-	Compliant
Mozambique	May 2008	April 2009	May 15, 2009	October 2012	-	Compliant
Mauritania	September 2005	December 2006	September 27, 2007	February 2012	-	Compliant
Niger	March 2005	July 2005	September 2007	March 2011	October 2017-January 2019	Re-commitment
Peru	May 2005	May 2006	September 27, 2007	February 2012	-	Compliant
Papua New Guinea	April 2013	November 2013	March 19, 2014	-	-	Candidate validated
Senegal	February 2012	January 2013	October 17, 2013	-	-	Candidate validated
Sierra Leone	October 2007	June 2007	February 2008	April 2014	-	Compliant
Suriname	February 2016	December 2016	May 24, 2017	-	February-June 2019	Candidate validated
Chad	September 2007	February 2010	April 16, 2010	October 2014	-	Compliant
Togo	December 2009	March 2010	October 10, 2010	May 2013	-	Compliant
Tajikistan	August 2012	August 2012	February 26, 2013	-	-	Candidate validated
Timor-Leste	May 2007	May 2007	February 22, 2008	July 2010	March-June 2017	Compliant
Tanzania	November 2008	November 2009	February 16, 2009	December 2012	September-December 2015	Compliant
Uganda	February 2019	March 2009	August 2020	-	-	Candidate validated
Yemen, Rep.	February 2007	August 2007	September 2007	March 2011	October 2015-	Suspended
Zambia	July 2008	September 2008	May 15, 2009	September 2012	-	Compliant

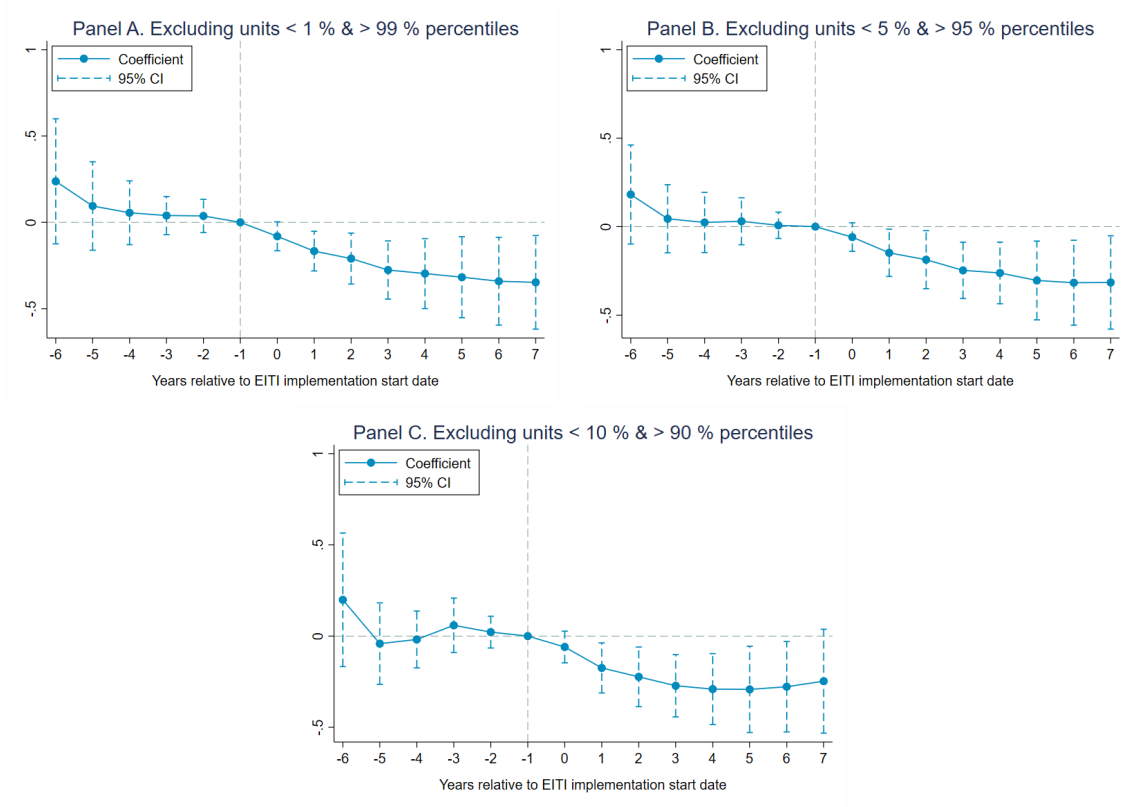
Source: Author's construction from <https://eiti.org/countries>.

Table C3: Descriptive statistics

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Debt-to-GDP ratio (log)	1608	3.7634	0.8080	-6.2834	5.8796
Control of corruption index	1584	-0.6108	0.6278	-1.7987	1.6184
Commodity price index (log)	1852	4.2670	0.3956	2.7914	5.0854
GDP per capita growth rate	1843	2.2504	5.9824	-38.5382	77.0896
Primary balance	1717	-0.8603	5.8786	-57.2231	41.0323
Inflation	1843	19.8600	142.4334	-28.7601	4800.532
Trade openness (log)	1753	4.1290	0.5355	-3.8633	5.3955

Source: Author's construction.

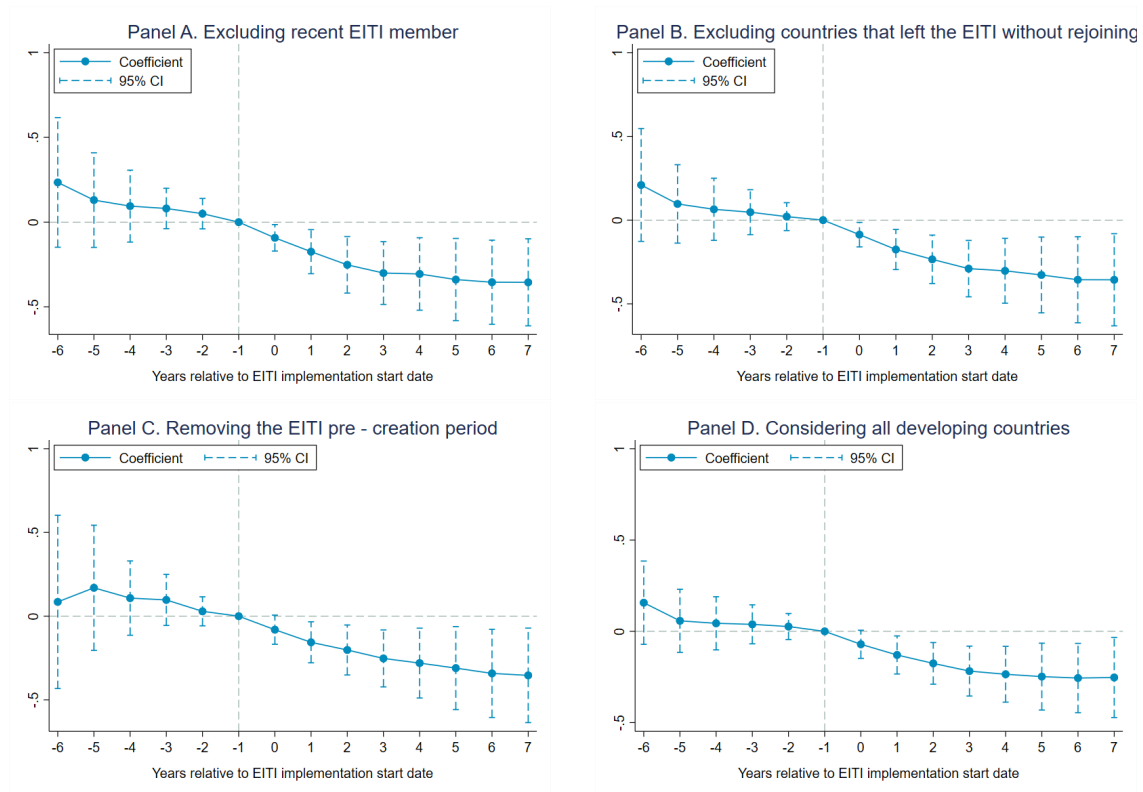
Figure C2: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Representation of the EITI dynamic effects on debt-to-GDP ratio with the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications.

Source: Author's construction

Figure C3: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Representation of the EITI dynamic effects on debt-to-GDP ratio with the dynamic heterogeneity-robust DID estimator of De Chaisemartin and d'Haultfoeulle (2020; 2024), applying 100 bootstrap replications.

Source: Author's construction

Table C4: List of Kimberley Process (KP) and ICGLR members

Kimberley Process				ICGLR members
Country	Membership date	Country	Membership date	Country
Angola	2003	Kazakhstan	2012	Angola
Armenia	2003	Kyrgyz Republic	2021	Burundi
Bulgaria	2003	Lao PDR	2003	Central African Republic
Brazil	2003	Lebanon	2003	Congo, Dem. Rep.
Botswana	2003	Mali	2003	Congo, Rep.
Central African Republic	2003	Mozambique	2021	Rwanda
Cote d'Ivoire	2003	Malaysia	2003	Sudan
Cameroon	2012	Namibia	2003	Tanzania
Congo, Dem. Rep.	2003	Russian Federation	2003	Uganda
Congo, Rep.	2003	Sierra Leone	2003	Zambia
Gabon	2018	Togo	2003	
Ghana	2003	Tanzania	2003	
Guinea	2003	Venezuela	2003	
Guyana	2003	South Africa	2003	
Indonesia	2005	Zimbabwe	2003	
India	2003			

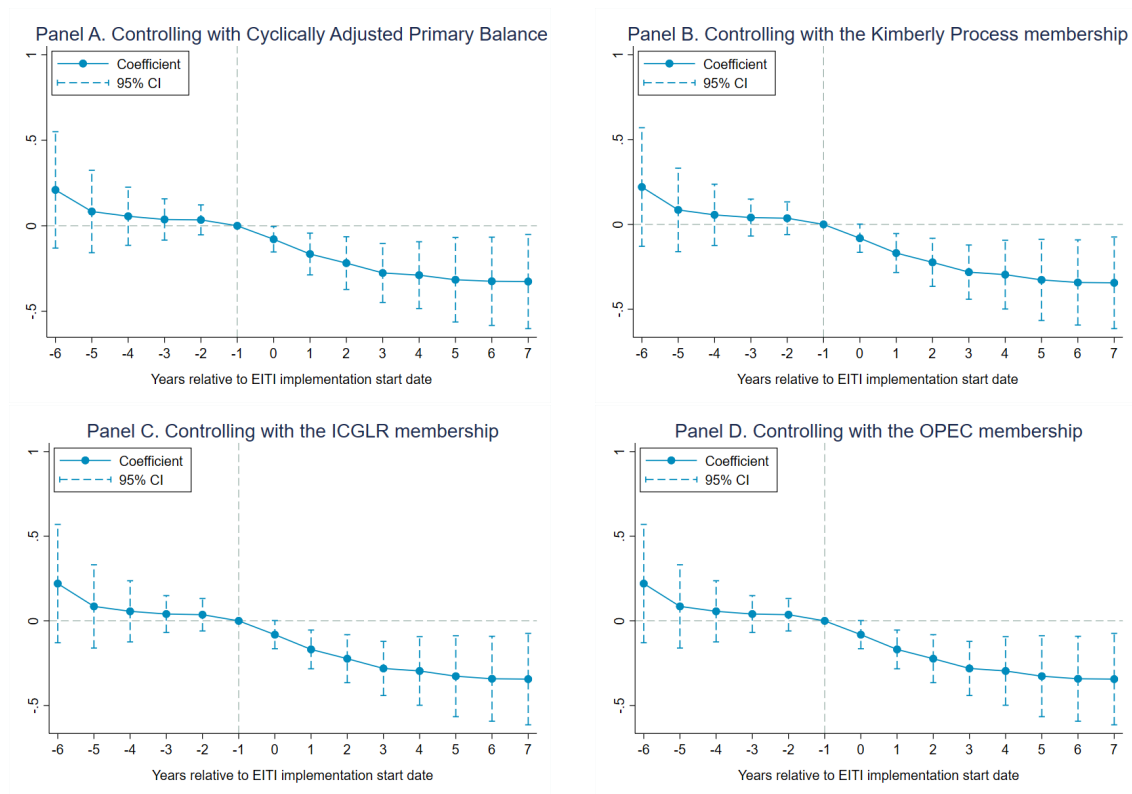
Source: Author's construction from <https://www.kimberleyprocess.com/en>; and <https://www.icglr.org/index.php/fr/>.

Table C5: List of countries in the sample that are members of OPEC and OPEC⁺

Country	Membership date	Withdrawal date	Status in 2021
Angola	2007	-	Member
Congo, Rep	2018	-	Member
Algeria	1969	-	Member
Ecuador	1973 and 2007	1992 and 2020	Member
Gabon	1975 and 2016	1995	Member
Indonesia	1962 and 2016	2008 and 2016	Retired
Iran, Islamic Rep.	1960	-	Member
Iraq	1960	-	Member
Venezuela	1960	-	Member

Source: Author's construction from
https://www.opec.org/opec_web/en/about_us/25.htm.

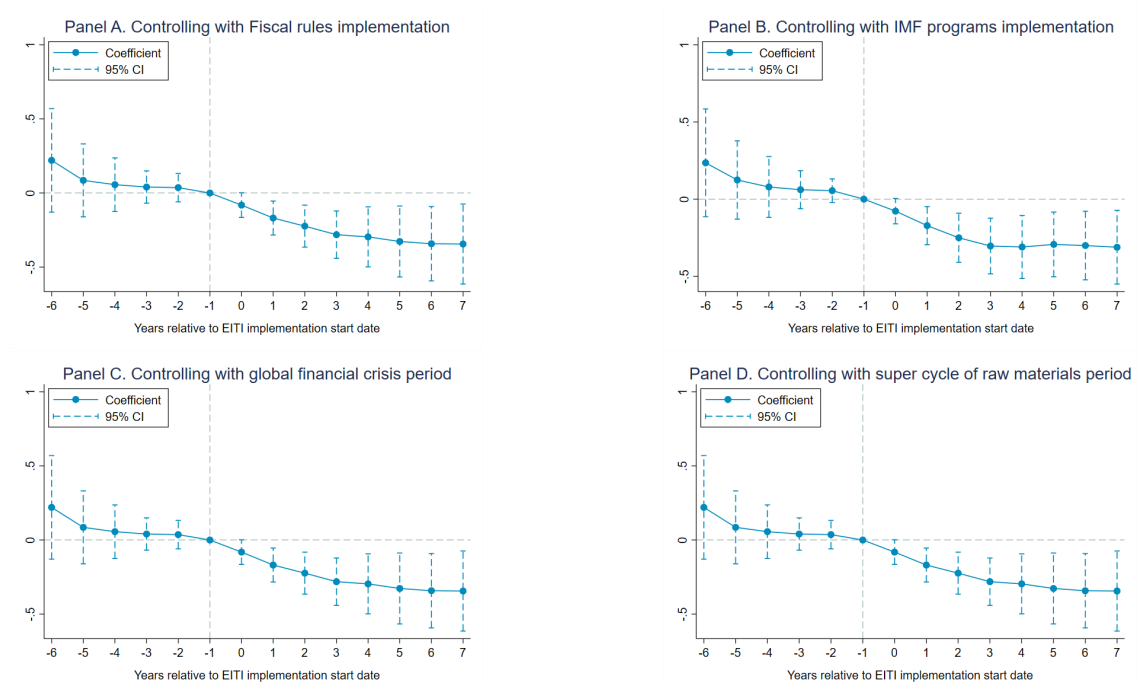
Figure C4: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Representation of the EITI dynamic effects on debt-to-GDP ratio with the dynamic heterogeneity-robust DID estimator of De Chaisemartin and d'Haultfoeulle (2020; 2024), applying 100 bootstrap replications.

Source: Author's construction.

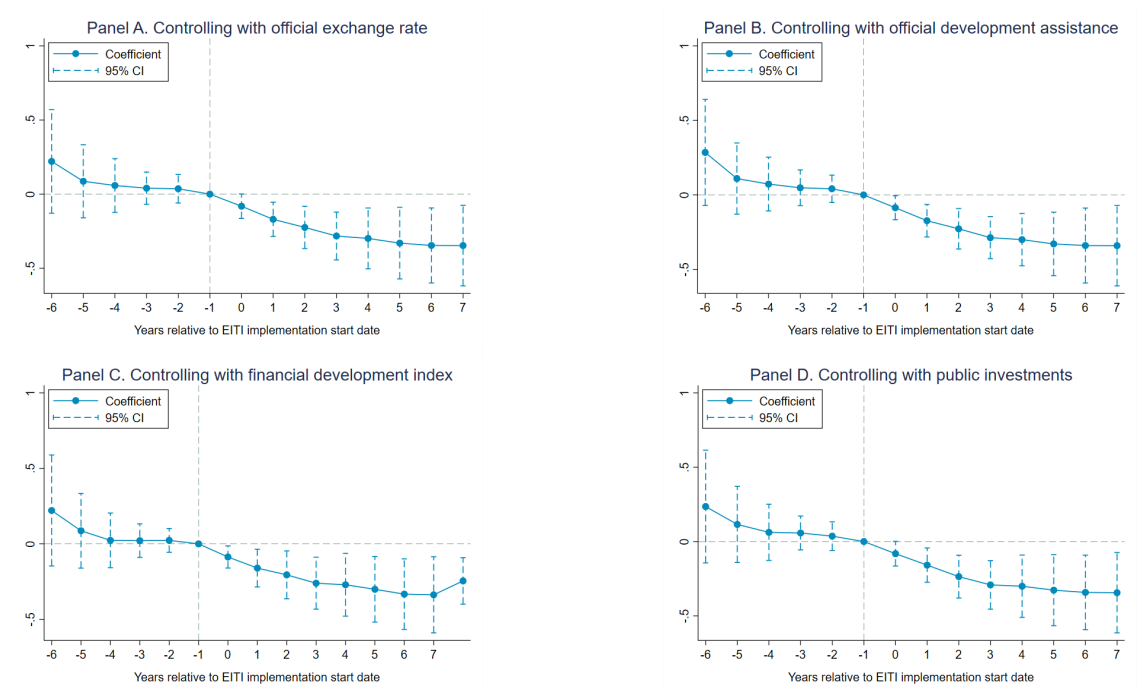
Figure C5: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Control variables are also included. The placebo joint test is not significant.

Source: Author's construction.

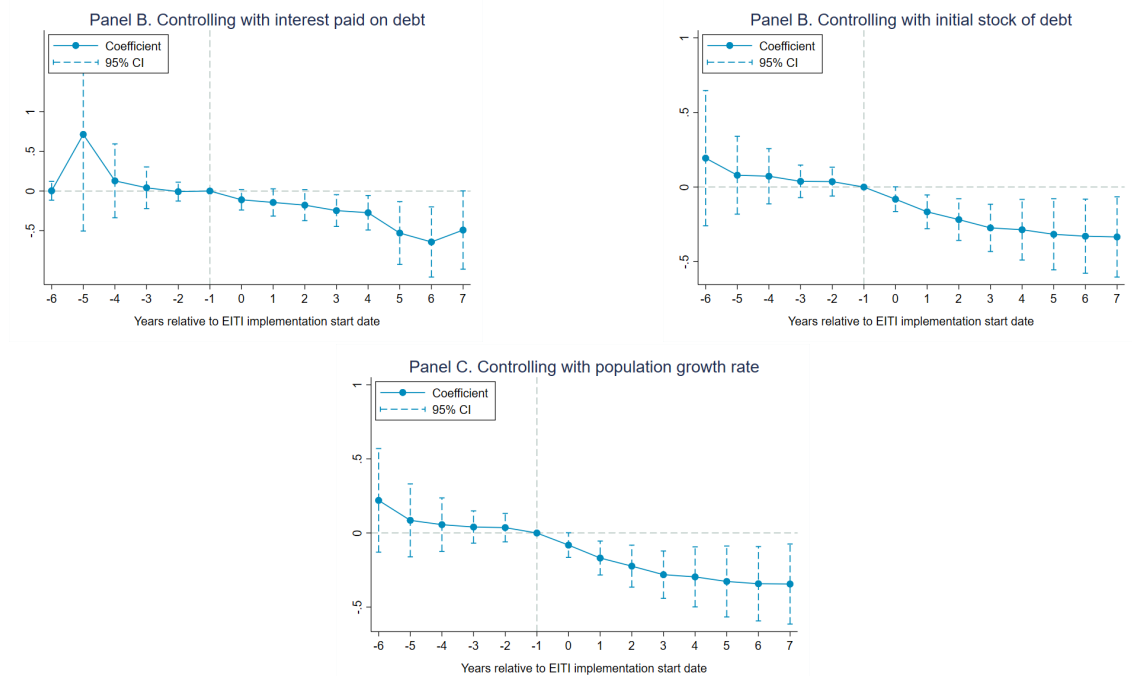
Figure C6: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Control variables are also included. The placebo joint test is not significant.

Source: Author's construction.

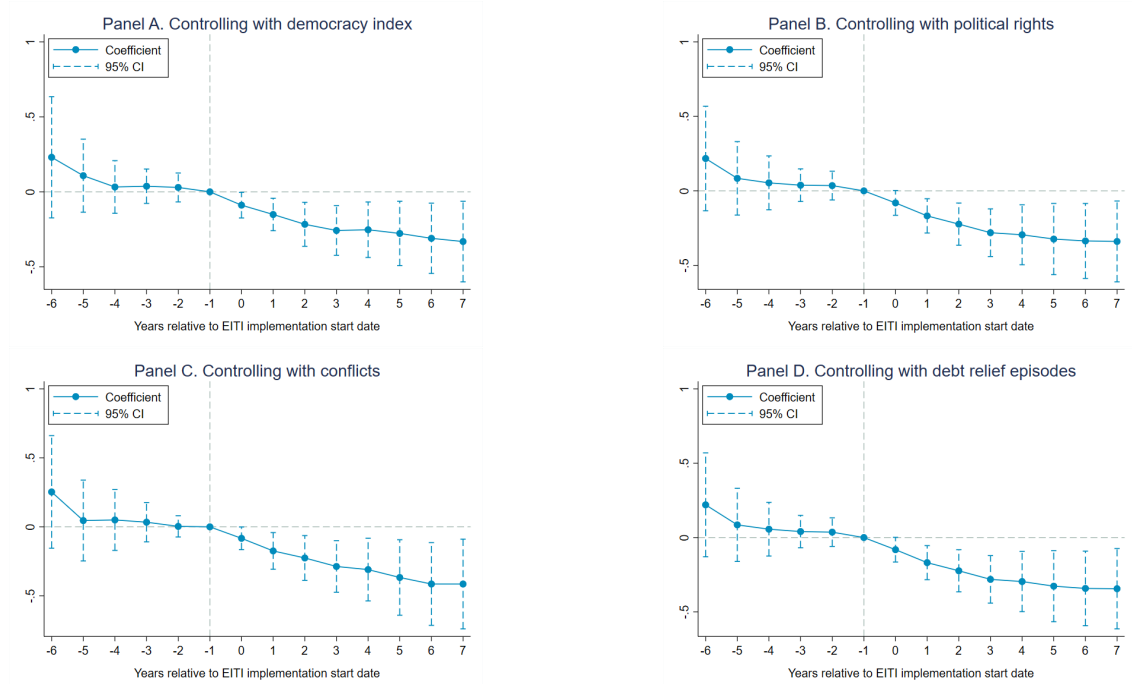
Figure C7: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Control variables are also included. The placebo joint test is not significant.

Source: Author's construction.

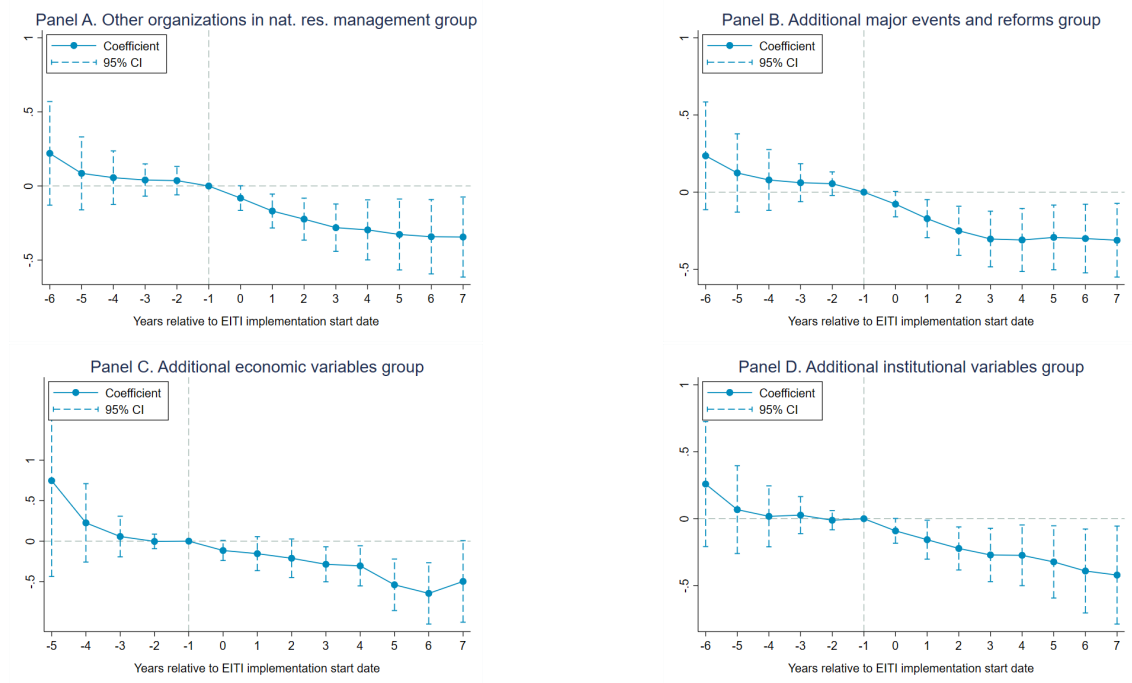
Figure C8: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Control variables are also included. The placebo joint test is not significant.

Source: Author's construction.

Figure C9: Robustness analysis of the EITI dynamic effects on debt-to-GDP ratio



Note: Representation of the EITI dynamic effects on debt-to-GDP ratio with the dynamic heterogeneity-robust DID estimator of [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#), applying 100 bootstrap replications.

Source: Author's construction.

Table C6: Entropy balancing method: descriptive statistics before and after weighting

	[1]	[2]	[3] = [2] - [1]	[4]	[5]
	EITI	Non-EITI	Difference	T-test	p-value
Panel A: Descriptive statistics	mean	mean			
Control of corruption index	-0.80	-0.49	0.31	-10.47	0.00
Commodity price index	4.46	4.29	-0.17	10.94	0.00
GDP per capita growth rate	2.37	2.11	-0.26	0.90	0.37
Primary balance	-0.89	-0.74	0.15	0.39	0.70
Inflation	6.99	14.09	7.10	2.28	0.02
Trade openness (logarithm)	4.18	4.14	-0.04	1.71	0.09
Observations	418	856			
	[1]	[2]	[3] = [2] - [1]	[4]	[5]
	EITI	Non-EITI	Difference	T-test	p-value
Panel B: Covariate balancing	mean	mean			
Control of corruption index	-0.80	-0.80	0.00	00	1.00
Commodity price index	4.46	4.46	0.00	-0.03	0.98
GDP per capita growth rate	2.37	2.37	0.00	0.00	1.00
Primary balance	-0.89	-0.89	0.00	0.00	1.00
Inflation	6.99	6.99	0.00	0.01	0.99
Trade openness (logarithm)	4.18	4.18	0.00	0.00	1.00
Observations	451	910			
Total of weights	451	451			

Source: Author's construction.

Table C7: EITI and Government debt-to-GDP ratio (Alternative estimation methods)

	Ordinary DID results	Panel Instrumental variables results	Entropy balancing results
Treatment variable: EITI	(1)	(2)	(3)
Panel A: first-stage (Instruments)			
NeighbourEITI		0.1508*** (0.0393)	
Lagged EITI		0.7320*** (0.0361)	
Dependent variable: Government debt-to-GDP ratio	(1)	(2)	(3)
Panel B: regression results			
EITI	-0.1909** (0.0790)	-0.1842*** (0.0541)	-0.1585*** (0.0455)
Control of corruption index	-0.0686 (0.1145)	0.0488 (0.0670)	0.1597 (0.1031)
Commodity price index (logarithm)	-0.2105 (0.1603)	-0.5099*** (0.0579)	-0.1819* (0.0989)
GDP per capita growth rate	-0.0092* (0.0049)	-0.0154*** (0.0040)	-0.0085* (0.0050)
Primary balance	-0.0117*** (0.0044)	-0.0153*** (0.0036)	-0.0133*** (0.0044)
Inflation	0.0003*** (0.0001)	0.0002*** (0.0001)	0.0009 (0.0016)
Trade openness (logarithm)	-0.1700 (0.1603)	-0.2681*** (0.1017)	-0.2836* (0.1542)
Observations	1308	1286	1308
Kleibergen-Paap F-stat	-	220.115	-
Stock-Yogo critical values (10%)	-	19.93	-
Hansen test (p-value)	-	0.1015	-
Control variables	Yes	Yes	Yes
Country and Year fixed effects	Yes	Yes	Yes
Share of negative weights in the total weighting	2.4%	-	-
R ²	0.7378	0.2100	0.7629

Note: Panel A presents the first-stage results (with NeighbourEITI and lagged EITI used as instruments). Panel B presents the second-stage results (with EITI as the treatment variable). Robust standard errors are in parentheses. * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Source: Author's construction.

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Table C8: Sources and definition of data

Variables	Description	Sources
Government debt		
Government debt	General government gross debt as a share of GDP.	World Economic Outlook (WEO)- International Monetary Fund (IMF).
Treatment variable		
<i>EITI</i>	Dummy variable equal to 1 if the country <i>i</i> implements the EITI in year <i>t</i> and 0 otherwise.	Author's construction based on information available at (https://eiti.org/countries) and Lujala (2018).
Control variables in the main analysis		
Corruption control	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e., ranging from approximately -2.5 to 2.5.	World Governance Indicators (WGI).
Commodity Price Index	The commodity export price index is an index for a commodity export bundle of 45 commodities (12 are energy and metal commodities). Individual commodities weighted by ratio of exports to total commodity exports. Time-invariant weights based on average trade flows and output over 1980-2015 are used. For every country, every commodity, and for each year, the weights are expressed as the exports value of the commodity by the country in the year, divided by the country's total commodity exports in this year.	IMF, Gruss and Kebhaj (2019).
GDP per capita growth rate	Annual GDP growth rate per capita, in percentage points.	World Development Indicators (WDI).
Primary balance	Overall primary balance, % of GDP.	World Economic Outlook (WEO) - IMF.
Inflation, GDP deflator (annual %)	Inflation as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole.	World Development Indicators (WDI).
Trade openness	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Development Indicators (WDI).
Control variables in robustness, transmission channels analysis		
Cyclically adjusted primary balance	Cyclically adjusted primary balance % of GDP (government debt sustainability).	Author's construction based on Fedelino et al. (2009).
Kimberley Process	Dummy variable equal to 1 if the country <i>i</i> is member of Kimberley Process in year <i>t</i> .	Author's construction based on information available at https://www.kimberleyprocess.com/en .
ICGLR	Dummy variable equal to 1 if the country <i>i</i> is member of the International Conference on the Great Lakes Region in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.icglr.org/index.php/fr/ .
OPEC	Dummy variable equal to 1 if the country <i>i</i> is member of the Organization of the Petroleum Exporting Countries in year <i>t</i> and 0 otherwise.	Author's construction based on information available at https://www.opec.org/opec_web/en/about_us/25.htm .
Fiscal rule	Dummy variable equal to 1 if the country <i>i</i> applies a fiscal rule in year <i>t</i> . A fiscal rule is a long-lasting constraint on fiscal policy through numerical limits on budgetary aggregates. Fiscal rules typically aim at correcting distorted incentives and containing pressures to overspend, particularly in good times, so as to ensure fiscal responsibility and debt sustainability.	International Monetary Fund (IMF).
IMF programs	Dummy variable equal to 1 if the country <i>i</i> benefits from an IMF program in year <i>t</i> .	International Monetary Fund (IMF).
Global financial crisis	Dummy variable equal to 1 during the period of the financial crisis (years 2007, 2008, and 2009).	Author's construction.
Commodities super-cycle period	Dummy equal to 1 for commodity super-cycle years (2003 to 2008).	Author's construction.
Exchange rate	Exchange rate, national currency/USD (market + estimated).	Penn World Table, version 10.0, www.ggd.net/pwt .

Source: Author's construction.

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Table C9: Sources and definition of data

Variables	Description	Sources
ODA	All Official development assistance (ODA), expressed as a percentage of GDP.	World Development Indicators (WDI).
Financial development	Degree of development of financial institutions and financial markets in terms of depth, access, and efficiency.	International Monetary Fund (IMF) https://data.world/imf/financial-development-fd .
Public investments	General government domestic, expressed as a percentage of GDP.	IMF Investment and Capital Stock dataset.
Interest paid on public debt	Interest payments (% of revenue).	World Development Indicators (WDI).
Population growth	Annual population growth rate for year t is the exponential rate of growth of midyear population from year $t-1$ to t , expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship.	World Development Indicators (WDI).
Polity2	The polity score is computed by subtracting the p_autocscore from the p_democ score; Index ranges from +10 (strongly democratic) to -10 (strongly autocratic).	Polity IV dataset https://www.systemicpeace.org/inscrdata.html .
Political rights	Political Rights Rating - Political rights enable people to participate freely in the political process, including the right to vote freely for distinct alternatives in legitimate elections, compete for public office, join political parties and organizations, and elect representatives who have a decisive impact on public policies and are accountable to the electorate.	Freedom House. 2024. "Freedom in the World 2024".
Internal conflict index	This is an assessment of political violence in the country and its actual or potential impact on governance.	International Country Risk Guide (ICRG).
Bilateral and multilateral debt restructuring	dummy variable equal to 1 in years during which bilateral and multilateral debt restructuring negotiations and moratoria occurred for each country.	Author's construction based on Asonuma et al. (2016; 2023) , Djimeu (2018) and Horn et al. (2022a) .
Regulatory quality	Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	World Governance Indicators (WGI).
Government total revenue	Government total domestic revenue (resource revenue and non-resource revenue) in percentage of GDP, excluding grants and social contributions.	Government Revenue Dataset. https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Government resource revenue	Total resource revenue in percentage of GDP.	Government Revenue Dataset https://doi.org/10.35188/UNU-WIDER/GRD-2022 .
Foreign direct investment	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor It is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital as shown in the balance of payments. It is expressed as a percentage of GDP.	World Development Indicators (WDI).
Private investments	Private domestic investment, expressed as a percentage of GDP.	IMF Investment and Capital Stock dataset.

Source: Author's construction.

CHAPTER 4

Public Debt Consolidation in Sub-Saharan Africa

This chapter is a joint work with Thibault Lemaire (IMF). ¹²

Abstract

High debt ratios and interest payments have led to questions on sustainable development prospects in sub-Saharan Africa, but this view overlooks the region's heterogeneity and important economic developments in the recent past. This paper sheds light on public debt dynamics in the region between 2000 and 2023. Using a combination of quantitative and historical data for 39 countries, an accounting framework and a panel data empirical strategy, it shows that debt consolidation in the region has been much more prevalent than usually thought, even outside debt restructuring episodes. It highlights the importance of macroeconomic stability for debt consolidation, characterized by high growth, sound public finances, a relatively stable and well-aligned exchange rate, and limited stock-flow adjustments. Both a supportive external environment and domestic public policies contribute to the occurrence of debt consolidation.

Keywords: • Public debt • Debt consolidation • Exchange rate • Developing countries • Africa

JEL Classification: F31, F34, H63, N17, O19.

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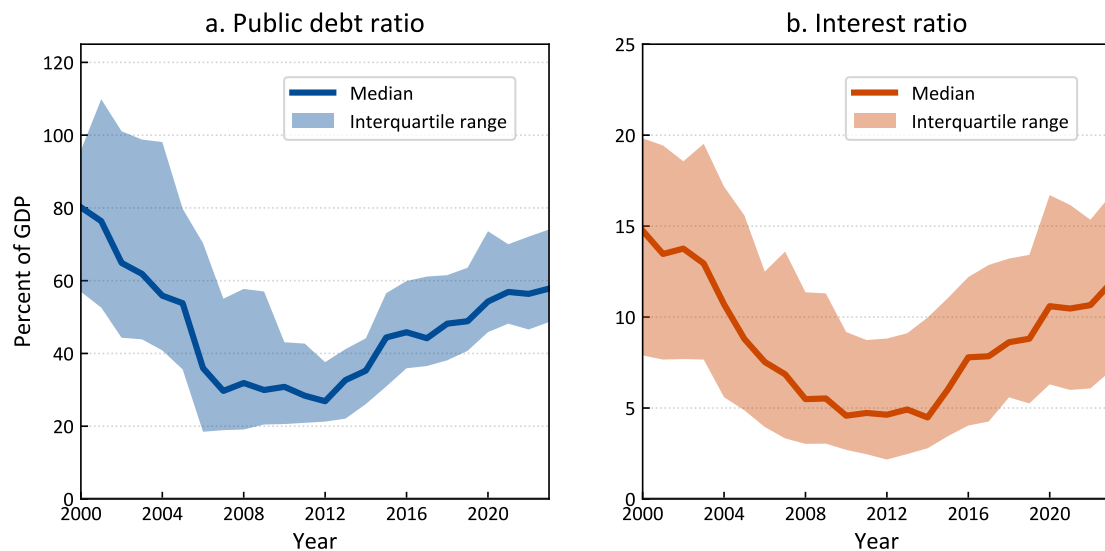
A version of this work was presented in a seminar at the International Monetary Fund (IMF) and published as a Note in the April 2025 IMF Regional Economic Outlook (REO) for Sub-Saharan Africa. The views expressed in this document are those of the authors. We appreciate all comments and suggestions.

²In the published version of this paper, we did not include the EITI. Including the EITI in the logit regression performed in the econometric analysis of this chapter (univariate regression) yields results consistent with the first three chapters, as the coefficient is positive and statistically significant, suggesting that the EITI is positively correlated with the probability of being in a debt stabilization and consolidation phase. Given the structure of the control variables, this effect disappears when all of these variables are included (which can be explained by the presence of confounding factors among certain variables).

4.1 Introduction

Public debt ratios in sub-Saharan Africa have broadly stabilized in recent years, but after a period of sharp increase, and they remain elevated compared with the pre-Covid period and the early 2010s' (Fig. 4.1, panel (a)). At the same time, the ratio of interest payments over revenues (excluding grants) is already high in the region (at about 12%, three times higher than in advanced economies) and continues to increase (Fig. 4.1, panel (b)). These high debt ratios and interest payments constrain countries' ability to meet urgent development needs. This dynamics has also led many to question sub-Saharan African countries' ability to stabilize their debt ratio. Although baseline projections point towards a continued stabilization of debt ratios in the region, vulnerabilities and uncertainty persist around these projections. Debt ratios could increase if shocks to global growth, global financial conditions and official development assistance materialize. Other domestic and global shocks, such as instability, conflicts, commodity prices and natural disasters, could also put debt stabilization at risk in the region and weigh on economic and development perspectives in the region.

Figure 4.1: Sub-Saharan Africa: Public Debt and Interest Payments Ratios, 2000–23



Source: IMF, World Economic Outlook database (October 2024); elaborated by the authors.

Note: The sample includes all SSA countries.

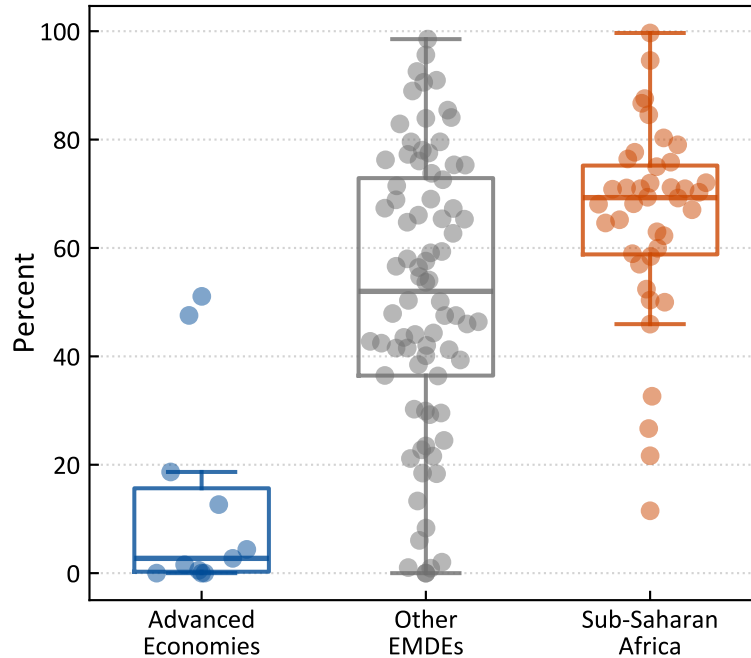
This paper explores the conditions that favored the occurrence of debt stabilization and consolidation in the region by looking back at the first quarter of the 21st Century. More specifically, it asks a set of questions. Have sub-Saharan African

countries been able to stabilize their debt ratios between 2000 and 2023, even in the absence of debt restructuring? How were the debt ratio dynamics during such episodes, and what factors contributed to debt stabilization in the region? And finally, what factors are associated with — or help predict — the occurrence of debt consolidation episodes in the region? Theoretical arguments abound in the debate on public debt in the region and in low- and middle-income countries, but stylized facts and empirical evidence are scarce.

The literature on public debt consolidation is relatively scarce due to the limitations inherent in public debt data, particularly in developing countries. This paper relates more closely to quantitative assessments of historical debt stabilization and consolidation episodes. A strand of this literature has focused on long periods of debt consolidation in advanced economies and major emerging market economies. This is the case in [Eichengreen and Esteves \(2022\)](#). A study of debt dynamics in sub-Saharan Africa cannot cover past centuries due to the recent emergence of contemporary African states, mostly in the 1960s' and 1970's, and the limitation of debt data and macroeconomic statistics before the turn of the Century. Furthermore, debt dynamics during consolidation episodes in sub-Saharan Africa might be very different to that in advanced and other developing countries. For example, [Fig. 4.2](#) shows that the share of public debt denominated in foreign currency is much higher in sub-Saharan African, with a median of about 70%, than in other developing countries (where the median is closer to one half) and in advanced economies (where the median is close to 0). This fact has great implications regarding the role of the exchange rate in the dynamics of public debt. [Arslanalp et al. \(2024\)](#) is another closely related paper which takes a different approach by looking at a single country, Jamaica. It highlights both the possibility and the difficulty to achieve debt consolidation in a developing country.

This paper contributes to the literature in several ways. First, it sheds light on historical debt dynamics in sub-Saharan Africa, a region that has received relatively low scrutiny, and documents new stylized facts on debt stabilization and consolidation episodes. Second, it provides insights on the macroeconomic and fiscal factors associated with debt dynamics in the region, highlighting in particular the role of the exchange rate, which has often been overlooked in the literature but has a great importance in the region and in other developing countries. Third, it represents a first attempt at identifying the factors associated with debt stabilization and consolidation episodes in the region.

Figure 4.2: Sub-Saharan Africa: Public Debt and Interest Payments Ratios, 2000–23



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Each dot corresponds to one country. The boxes show the first and the third quartiles, with a line at the median. The whiskers extend from the box to the farthest data point lying within 1.5 times the inter-quartile range from the box.

This paper uses several approaches to shed light on debt stabilization and consolidation in sub-Saharan Africa between 2000 and 2023. Some data are unavailable for six countries of the region, limiting the sample to 39 countries. Following [Eichengreen and Esteves \(2022\)](#), it combines quantitative and historical information to identify debt consolidation episodes, adopting a unique definition adapted to data constraints and the region unique recent history. This paper also borrows the accounting approach in [IMF \(2022\)](#) to decompose public debt dynamics into six contributors, namely real GDP growth, inflation, the nominal effective interest rate, exchange rate variations, primary balances and stock-flow adjustments. Finally, it uses the panel of 39 countries to empirically explore the correlates of debt stabilization and consolidation episodes in the region, relying on a logistic regression framework. The macroeconomic data, comprising public debt ratios and the contributors to public debt dynamics, come mainly from the WEO October 2024 database, published by the IMF. These data are complemented by several other sources to assess the

factors contributing to debt stabilization and consolidation. It should be noted that the econometric design does not allow for causal interpretation. That said, this econometric analysis provides insight into the stylized facts and mechanisms that characterize debt stabilization and consolidation episodes.

The results show that debt stabilization and consolidation has been far from rare in sub-Saharan Africa between 2000 and 2023, even outside of debt restructuring episodes: There have been 61 debt stabilization and consolidation episodes in the region during that period, representing a quarter of total country-year observations. These episodes have happened in all groups of countries, both during and after the commodity super-cycle that ended in 2014. The results of the accounting exercise also supports that debt stabilization and consolidation has been achieved through macroeconomic stability. A combination of high growth and sound public finances has contributed to debt reductions, with relatively stable, well-aligned exchange rates and limited stock-flow adjustments. Finally, the results also suggest that debt stabilization and consolidation episodes are supported by a positive external environment, but also by domestic policy action.

The remainder of this paper is organized as follows. Section 4.2 details how public debt stabilization and consolidation episodes are defined and identified and presents key stylized facts. Section 4.3 introduces the debt decomposition methodology and discusses the key contributors to debt stabilization in sub-Saharan Africa. Section 4.4 discusses key country cases. Section 4.5 details the empirical framework to explore the correlates of debt stabilization and consolidation episodes and discusses the results. Finally, Section 4.6 concludes.

4.2 Debt Stabilization and Consolidation Episodes

This section identifies debt consolidation and stabilization episodes in 39 countries in sub-Saharan African between 2000 and 2023. The following countries are not included in the sample due to data availability constraints: Burkina Faso, Eritrea, Liberia, Madagascar, Nigeria and São Tomé and Príncipe . The data on debt-to-GDP ratios and debt components listed in Appendix Table D1 are from the October 2024 IMF World Economic Outlook database, and the unavailability of data for some components before 2000 restricts the sample to the period 2000–2023.

4.2.1 Episodes Identification

We define debt stabilization and consolidation episodes as periods during which the debt-to-GDP ratio strictly falls for at least two years. This short minimum duration of the episode and the absence of criterion of minimum decrease in the debt ratio, beyond the fact that it is strictly falling over the period, is driven by the absence of long time series for debt-to-GDP ratio in sub-Saharan African countries. It also allows to shed light on important policy priorities when debt ratios are high and debt service costly by assessing the public debt dynamics during past episodes of stabilization and consolidation. This definition allows to capture both very intense and limited debt ratio reductions, during both long and short periods of time.

Several additional considerations underlie this choice. The first one, as mentioned by [Eichengreen and Esteves \(2022\)](#), recognizes that it is unreal to expect the debt-to-GDP ratio to fall each year during a debt stabilization and consolidation episode. Indeed, some reasons may lead to a pause in consolidation efforts, such as exogenous shocks or an unexpected decrease in nominal GDP.

We therefore follow their methodology to deal with these hiccups during debt consolidation episodes. More specifically, we first identify all periods during which the debt-to-GDP ratio decreased over at least 2 years. Second, during these debt reduction episodes, we allow for 1-year increases of up to 6 percentage points of GDP, or cumulative increases of 6 percentage points of GDP during two consecutive years.

However, we impose two additional restrictions on these hiccups: first, during an episode, a 2-year cumulative increase higher than the immediate precedent reduction ends the episode in that precedent year of debt reduction. Second, we do not allow, during the same episode, a second 1-year increase nor a cumulative increase over two consecutive years higher than the precedent one. Moreover, in all cases, any increase in the debt-to-GDP ratio during three consecutive years ends the episode in the last year of debt reduction.

The second consideration takes into account the fact that bilateral and multilateral debt restructuring and moratoria have significantly reduced public debt ratios in sub-Saharan Africa ([Shenai and Bolhuis, 2023](#); [Chuku et al., 2023](#)). In order to shed light on the dynamics of past episodes of debt consolidation and stabilization in the region that responded to shocks and domestic policies, we exclude all debt reduction periods that occurred during bilateral and multilateral debt restructuring negotiations and moratoria. We identify these periods using data on debt restructuring with China

from [Horn et al. \(2022b\)](#). We also retrieve data from the same dataset and from [Djimeu \(2018\)](#) to identify restructuring with the Paris Club and multilateral debt treatment (HIPC and MDRI), respectively. Additionally, we use data from [Asonuma and Trebesch \(2016\)](#) [Asonuma and Trebesch \(2016\)](#) and [Asonuma et al. \(2023\)](#) to identify restructuring negotiations with private creditors.

We exclude all years during debt restructuring episodes that include a face value reduction. This includes restructuring during HIPC and MDRI Initiatives, bilateral debt restructurings with China, multilateral debt restructurings with the Paris Club, and debt restructurings with private creditors.³ We exclude years during symbolic debt restructuring with China (as defined in [Horn et al., 2022b](#)) only when the total amount of debt restructured is greater than 1.5 percent of GDP.⁴

Finally, in order to decompose changes in debt-to-GDP ratios into their components, it is crucial to have available data for all components considered. Indeed, during a debt consolidation episode, the sum of cumulative values for all component must be equal to the value of the cumulative change in debt-to-GDP ratio and as a consequence, missing values cannot be allowed. We thus exclude all years during debt stabilization and consolidation episodes for which there are missing data for at least one variable used to construct the debt decomposition components.

The final list of debt stabilization and consolidation episodes in the sample therefore consists of debt reduction episodes outside debt treatment episodes for 39 sub-Saharan African countries. The full list of these episodes is available in Appendix Table D4.

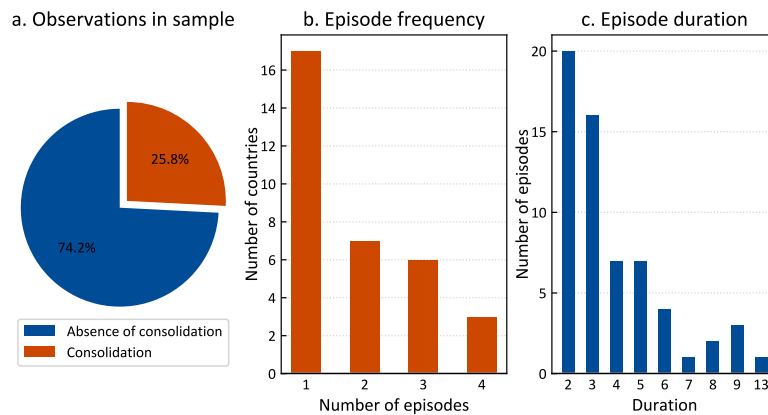
4.2.2 Results

Following the strategy described above, we have identified 61 episodes of debt stabilization and consolidation in sub-Saharan Africa between 2000 and 2023.

As shown in Fig. 4.3, more than a quarter of country-year observations in the sample fall within such an episode (panel (a)), highlighting the capacity of countries in SSA to stabilize and consolidate their debt ratio during the period. Panel (b) shows that 33 countries experienced at least one episode of debt stabilization and consolidation during the period. Importantly, 17 countries registered only one episode, while 13

³The Debt Service Suspension Initiative, established in May 2020 and which lasted until end-December 2021, is excluded from this list since it did not entail face value reduction.

⁴As indicated by [Horn et al. \(2022b\)](#): "These events [...] involve very small amounts".

Figure 4.3: Consolidation Episodes: Sample Composition

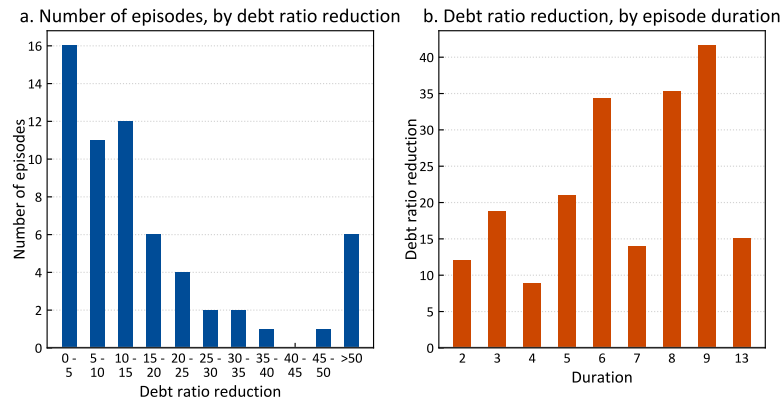
Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: The duration of consolidation episodes and periods of debt increase is in years. Only periods of debt increase whose duration matches those of consolidation episodes are reported.

reached two or three episodes. Botswana, Mozambique, and Mauritius were the only countries to experience 4 episodes (the maximum number of episodes observed in a single country). 36 episodes were particularly short, as they lasted two to three years only, but 25 episodes lasted for four years or more, up to 13 years (panel (c)). In addition to being relatively prevalent, debt stabilization and consolidation has often proved to be lasting in the region. To put these numbers in context, Appendix Fig. 4.2 shows the number of periods of debt increases that lasted for at least 2 to 13 years.

Countries embarking on a debt consolidation path can assess their progress in two dimensions – how long, and how large has the episode been. Fig. 4.4 shows this second dimension. 16 episodes ended with a modest debt ratio reduction, lower than 5 percentage points of GDP (panel (a)), while 23 episodes had a more substantial reduction of 5 to 15 percentage points. Importantly, 16 episodes led to a debt ratio reduction from 15 up to 50 percentage points of GDP. The remaining six episodes led to a debt ratio reduction greater than 50 percentage points – all but one of them occurred in oil-exporting countries. Panel (b) evidences that longer episodes tend to be associated with larger debt ratio reductions, suggesting that longer, sustained efforts bring a higher pay-off.

Fig. 4.5 represents episodes characteristics – namely their prevalence, their duration and their debt ratio reduction, depending on their starting years. Panel (a) shows

Figure 4.4: Debt Reduction During Consolidation Episodes

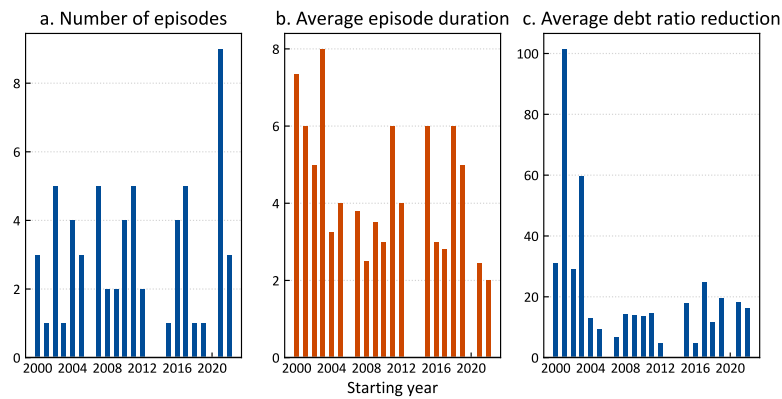
Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Debt ratio reduction in percent of GDP, episode duration in years.

that 9 episodes started in 2021, the year when the region and the world recovered from the macroeconomic shock of the Covid-19 pandemic. 37 episodes started before or in 2014, during the commodity super cycle when the region as a whole experienced a sharply falling debt ratio in a context of strong economic growth and the HIPC initiative. However 24 additional episodes started afterwards, when the region experienced lower growth, a more difficult external environment and an overall increase in its debt ratio.

The average episode duration is relatively similar before and after 2014, excluding the episodes starting from 2021 since they are limited by the sample time frame, as shown in Fig. 4.5 panel (b). Episodes starting before 2014 lasted 4.5 years on average (3.9 years excluding years 2000-03), while episodes starting between 2015 and 2019 have lasted for an average of 3.6 years, slightly shorter. This fact discards the possibility that the commodity super cycle would be the only explanation of debt ratio reduction in the region.

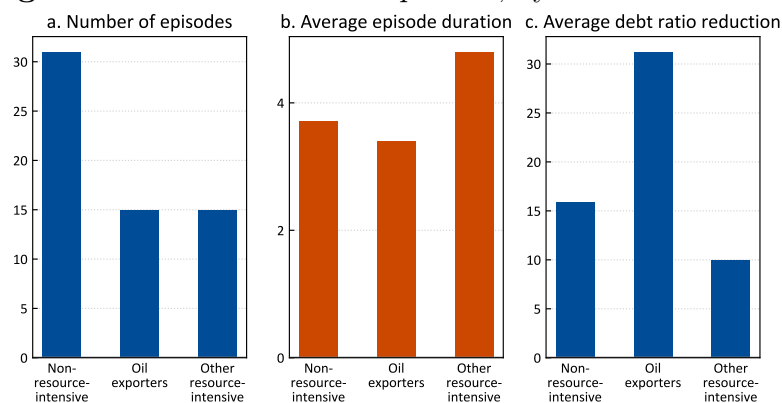
The average total debt ratio reduction during consolidation episodes shows a different pattern (Fig. 4.5, panel (c)). The episodes starting in the early 2000s resulted in larger debt ratio reductions than those starting after 2004. This is primarily driven by two outliers, Angola in 2001 and Gabon in 2003. These two oil exporters achieved debt ratio reductions amounting to 102 and 60 percentage points of GDP, respectively, as their economies had particularly high debt ratios and benefited from high oil prices and improved macroeconomic performances. Other episodes, starting in 2000 and 2002, saw larger average debt ratio reduction than any other year in

Figure 4.5: Consolidation Episodes: by Start Year

Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Average episode duration in years, average debt ratio reduction in percent of GDP.

the sample. The other episodes that started during the commodity super cycle led on average to a debt ratio reduction between 5 and 14 percentage points of GDP, while those starting after 2014 led to 5 to 25 percentage points reductions. This further shows that other factors than the commodity super cycle and a particularly favorable external environment must be considered to explain debt ratio reductions in the region.

Figure 4.6: Consolidation Episodes, by Sectoral Structure

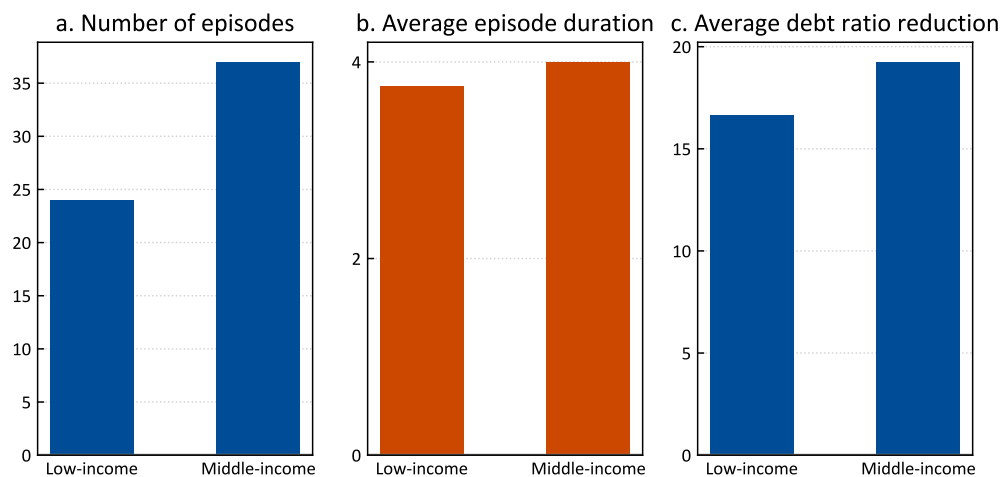
Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. Average episode duration in years, average debt ratio reduction in percent of GDP.

Fig. 4.6 represents episodes characteristics by sectoral structure group- namely non-resource-intensive, oil exporters, and other resource-intensive. While oil-exporting

groups and other resource-intensive countries have 15 episodes each, non-resource-intensive countries registered the highest number of episodes over the period (31), as shown in panel (a). It should be noted, however, that the non-resource-intensive group is the most represented among countries with at least one episode. Panel (b) of Fig. 4.6 shows that other resource-intensive countries display the highest average episode duration, followed by non-resource-intensive countries. Regarding the average total debt ratio reduction during consolidation episodes (Fig. 4.6, panel (c)), there is a significant difference between the various groups of countries. Despite the lower average episode duration observed in oil exporters, these countries achieved a larger debt ratio reduction, greater than the total average debt reduction recorded in the other two groups. As mentioned above, this is primarily driven by two outliers (Angola and Gabon), both oil exporter countries. Other resource-intensive countries, which registered the highest average episode duration, achieved the lowest average debt ratio reduction, at 10% of GDP, compared with 16% for non-resource-intensive countries.

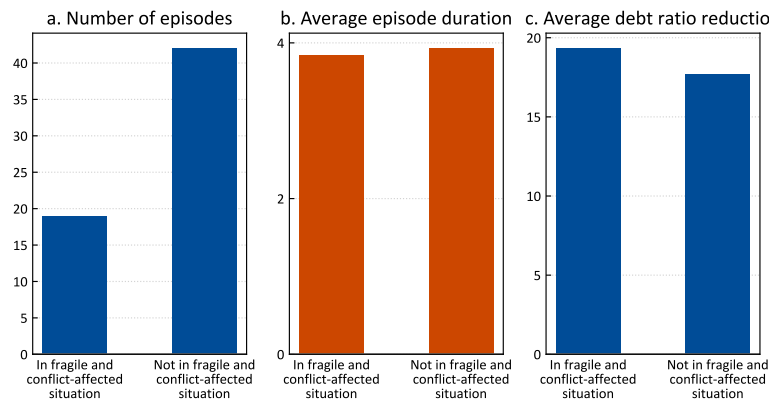
Figure 4.7: Consolidation Episodes, by Income Category



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. Average episode duration in years, average debt ratio reduction in percent of GDP.

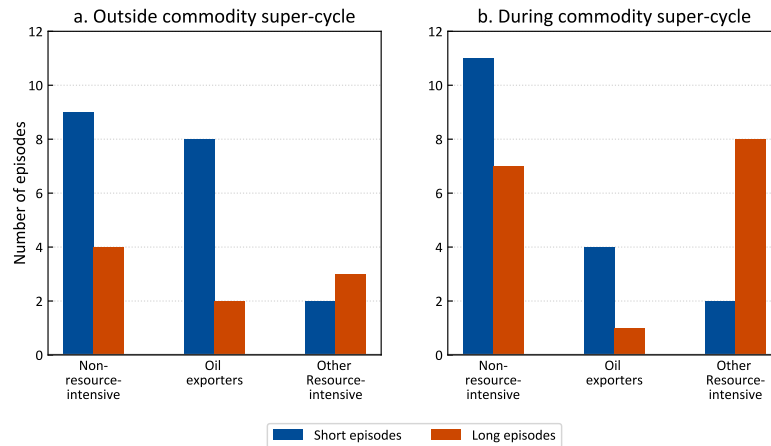
Fig. 4.7 shows episodes characteristics by income level groups. Panel (a) indicates that low-income countries had fewer episodes. This highlights that these countries face more difficulties in debt reduction due to their greater development challenges. In addition to recording more episodes, middle-income countries achieved larger average episode duration (Fig. 4.7, panel (b)) and larger average debt ratio reduction (Fig. 4.7, panel (c)).

Figure 4.8: Consolidation Episodes, by Fragility Status

Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors. Note: Country groupings correspond to the IMF classification. Average episode duration in years, average debt ratio reduction in percent of GDP.

As shown in panel (a) of Fig. 4.8, countries that are not in fragile and conflict-affected situation recorded more episodes, twice as many as countries in fragile and conflict-affected situation. This can be explained by the greater security challenges observed in the latter group of countries, which penalize their debt reduction efforts. Panel (b) of Fig. 4.8 shows any difference in the average episode duration between these two groups. However, the average debt ratio reduction shows a different pattern (Fig. 4.8, panel (c)). The episodes achieved in fragile and conflict-affected situation led to a larger average debt ratio reduction than those observed in countries that are not in fragile and conflict-affected situation. Although debt reduction episodes are rarer in countries in fragile and conflict-affected situation, the rewards associated with successful episodes are greater.

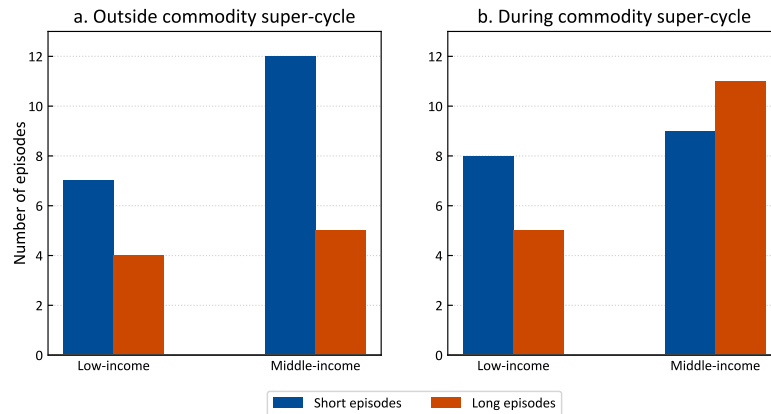
Fig. 4.9 represents episodes characteristics by sectoral structure group, depending on their length and on whether these episodes occurred outside (Panel (a)) or during (Panel (b)) commodity super-cycle. Short episodes are those lasting three years or less, while those lasting more than three years are classified as long episodes. Non-resource-intensive countries and oil exporters present the same dynamic- these groups had more short episodes during and outside commodity super-cycle. In other resource-intensive countries, even though long episodes slightly exceed short episodes outside commodity super-cycle (2 short episodes and 3 long episodes), this gap becomes much greater during commodity super-cycle (2 and 8, respectively). This suggests that other resource-intensive countries took better advantage of commodity

Figure 4.9: Consolidation Episodes and Commodity Cycle, by Sectoral Structure

Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. Short episodes correspond to those that last three years or less, long episodes correspond to those that last more than three years.

super-cycle to achieved longer episodes.

Figure 4.10: Consolidation Episodes and Commodity Cycle, by Income Category

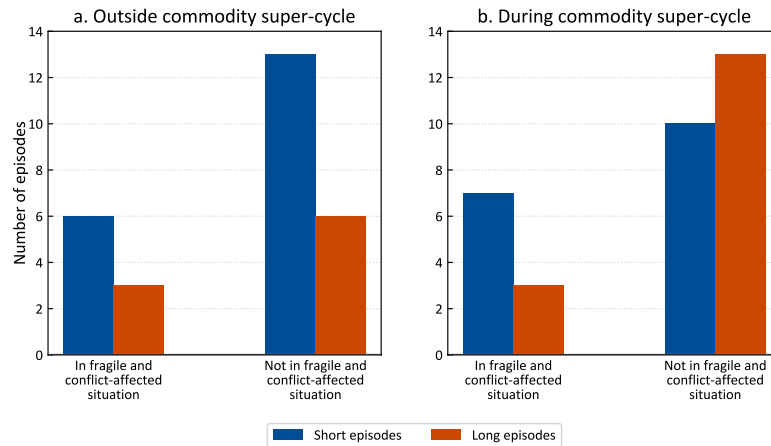
Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. Short episodes correspond to those that last three years or less, long episodes correspond to those that last more than three years.

Middle-income countries are those that benefited the most from the commodity super-cycle, as shown by panels (a) and (b) of Fig. 4.10. Indeed, while short episodes were more than twice as high as long episodes in middle-income countries outside the commodity super-cycle, the trend was reversed during the commodity super-cycle,

as these countries managed to achieve more long episodes than short ones. Poor countries, however, experienced more short episodes than long ones, both during and outside the commodity super-cycle.

Figure 4.11: Consolidation Episodes and Commodity Cycle, by Fragility Status



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. Short episodes correspond to those that last three years or less, long episodes correspond to those that last more than three years.

Panels (a) and (b) of Fig. 4.11 show that countries in fragile and conflict-affected situation recorded more short episodes than long episodes during and outside the commodity super-cycle. The results for countries not in fragile and conflict-affected situation reveal a different pattern. While these countries experienced more short episodes than long episodes outside the commodity super-cycle, the trend was reversed during the commodity super-cycle, as these countries managed to achieve more long episodes than short ones. This shows that fragility and conflict in the countries concerned are an obstacle to achieving long debt reduction episodes.

4.3 Decomposition of Public Debt Stabilization and Consolidation Episodes

In this section, we examine the dynamics of public debt consolidation and stabilization episodes by decomposing the changes in debt-to-GDP ratio during these episodes into several macroeconomic contributors. In other words, its aims to present an accounting decomposition of debt-to-GDP dynamics during debt consolidation episodes.

The public debt decomposition exercise is based on the methodology introduced in IMF (2022). This methodology uses macroeconomic variables in nominal terms, and therefore allows to decompose changes in debt-to-GDP ratios into the effects of nominal interest payments, inflation, real GDP growth, primary balance, and stock-flows adjustments. Importantly in the context of sub-Saharan African economies, this methodology also allows to quantify the effects of exchange rate movements on the debt ratio dynamics. Appendix Table D1 lists all the variables and sources used in this section and the rest of the paper, and Appendix Table D2 provides descriptive statistics.

4.3.1 Decomposition Methodology

The nominal public debt ratio can be expressed as in equation (4.1):

$$D_t = \frac{e_t}{e_{t-1}} D_{t-1}^f + D_{t-1}^d + i_t D_{t-1} - PB_t + SFA_t \quad (4.1)$$

where D_t is the nominal stock of public debt in year t , D_{t-1}^f the stock of foreign debt in the previous year and D_{t-1}^d the stock of domestic debt the previous year. Therefore, $D_t \equiv D_t^f + D_t^d$. The primary balance is denoted PB_t , and SFA_t corresponds to stock-flow adjustments. All these variables are expressed in local currency units. The effective interest rate paid in year t on the stock of public debt in $t - 1$ is denoted by i_t , and e_t is nominal exchange rate so that $\frac{e_t}{e_{t-1}}$ is the change in nominal exchange rate in year t .

These nominal variables can be expressed in percent of GDP following equation (4.2):

$$\frac{D_t}{Y_t} = \frac{e_t}{e_{t-1}} \frac{D_{t-1}^f}{Y_t} + \frac{D_{t-1}^d}{Y_t} + i_t \frac{D_{t-1}}{Y_t} - \frac{PB_t}{Y_t} + \frac{SFA_t}{Y_t} \quad (4.2)$$

where Y_t is the nominal GDP in year t .

By denoting the change in nominal exchange rate $(1 + \epsilon_t) \equiv \frac{e_t}{e_{t-1}}$ and observing that the nominal GDP in year t can be expressed in function of the previous year's GDP by $Y_t = (1 + g_t)(1 + \pi_t)Y_{t-1} = \rho_t Y_{t-1}$, where g_t is the real growth rate, π_t the inflation rate and $\rho_t = (1 + g_t)(1 + \pi_t)$, the previous equation can be rearranged as in equation (4.3):

$$d_t = (1 + \epsilon_t) \frac{d_{t-1}^f}{\rho_t} + \frac{d_{t-1}^d}{\rho_t} + i_t \frac{d_{t-1}}{\rho_t} - pb_t + sfa_t \quad (4.3)$$

Then, the change in the debt-to-GDP ratio in year t , denoted Δd_t , can be expressed as in equation (4.4):

$$\begin{aligned}\Delta d_t &\equiv d_t - d_{t-1} \\ &= \frac{(1 + \epsilon_t)d_{t-1}^f}{\rho_t} + \frac{d_{t-1}^d}{\rho_t} + \frac{i_t d_{t-1}}{\rho_t} - \frac{d_{t-1}^d + d_{t-1}^f}{\rho_t} - \frac{(d_{t-1}^d + d_{t-1}^f)(\rho_t - 1)}{\rho_t} - pb_t + sfa_t\end{aligned}\quad (4.4)$$

where $d_{t-1} = (d_{t-1}^d + d_{t-1}^f) \frac{\rho_t}{\rho_t} = \frac{(d_{t-1}^d + d_{t-1}^f)(1 + \rho_t - 1)}{\rho_t}$.

Consolidating terms gives equation (4.5):

$$\Delta d_t = \frac{\epsilon_t d_{t-1}^f}{\rho_t} + \frac{(i_t - [\rho_t - 1])d_{t-1}}{\rho_t} - pb_t + sfa_t \quad (4.5)$$

Equation (4.5) can then be developed and rearranged as indicated in equation (4.6) to express the debt dynamics in terms of nominal exchange rate, nominal effective interest rate, inflation rate and real GDP growth rate, in addition to primary balance and stock-flow adjustments:

$$\Delta d_t = \frac{1}{\rho_t} \left[\epsilon_t d_{t-1}^f + i_t d_{t-1} - \pi_t d_{t-1} - g_t(1 + \pi_t)d_{t-1} \right] - pb_t + sfa_t \quad (4.6)$$

Noting that the primary balance $pb_t \equiv capb_t + cpb_t$ can be expressed as the sum of the cyclically-adjusted primary balance $capb_t$ and the cyclical primary balance cpb_t , equation (4.6) can be furthered rearranged as in equation (4.7):

$$\Delta d_t = \frac{1}{\rho_t} \left[\epsilon_t d_{t-1}^f + i_t d_{t-1} - \pi_t d_{t-1} - g_t(1 + \pi_t)d_{t-1} \right] - capb_t - cpb_t + sfa_t \quad (4.7)$$

The decomposition of the primary balance follows Fedelino et al. (2009). It allows to obtain a proxy ($capb$) of the structural balance that reflects the government's efforts to improve public finances and consolidate debt ratios, beyond the effects of short-term macroeconomic fluctuations. The cyclically-adjusted primary balance is computed following equation (4.8):

$$capb_t = \frac{1}{Y_t^p} \left[R_t \left(\frac{Y_t^p}{Y_t} \right) - G_t \right] \quad (4.8)$$

where R and G are the general government revenue and primary expenditure, respectively, and Y^p is the potential GDP, obtained as the trend component of the

nominal GDP Y using the Hodrick-Prescott filter⁵.

Then, the cyclical primary balance cpb_t is obtained following equationn (4.9):

$$cpb_t \equiv \frac{CPB_t}{Y_t} = \frac{PB_t}{Y_t} - \frac{CAPB_t}{Y_t^p} = pb_t - capb_t \quad (4.9)$$

Equation (4.7) allows to interpret the public debt ratio dynamics during debt consolidation episodes, as indicated in equation (4.10):

$$\begin{aligned} \Delta d_t = & \underbrace{\frac{\epsilon_t d_{t-1}^f}{\rho_t}}_{\text{Valuation effect}} + \underbrace{\frac{i_t d_{t-1}}{\rho_t}}_{\text{Nominal interest rate effect}} - \underbrace{\frac{\pi_t d_{t-1}}{\rho_t}}_{\text{Inflation effect}} - \underbrace{\frac{g_t(1 + \pi_t) d_{t-1}}{\rho_t}}_{\text{Real GDP growth effect}} \\ & - \underbrace{\left(capb_t + cpb_t \right)}_{\text{Primary balance}} + \underbrace{sfa_t}_{\text{Stock-flow adjustments}} \end{aligned} \quad (4.10)$$

The yearly change in the debt ratio and the contributors evidenced in equation (4.10) can be summed over consecutive years in order to obtain the cumulative change in the debt ratio and the cumulative contributions over debt consolidation episodes.

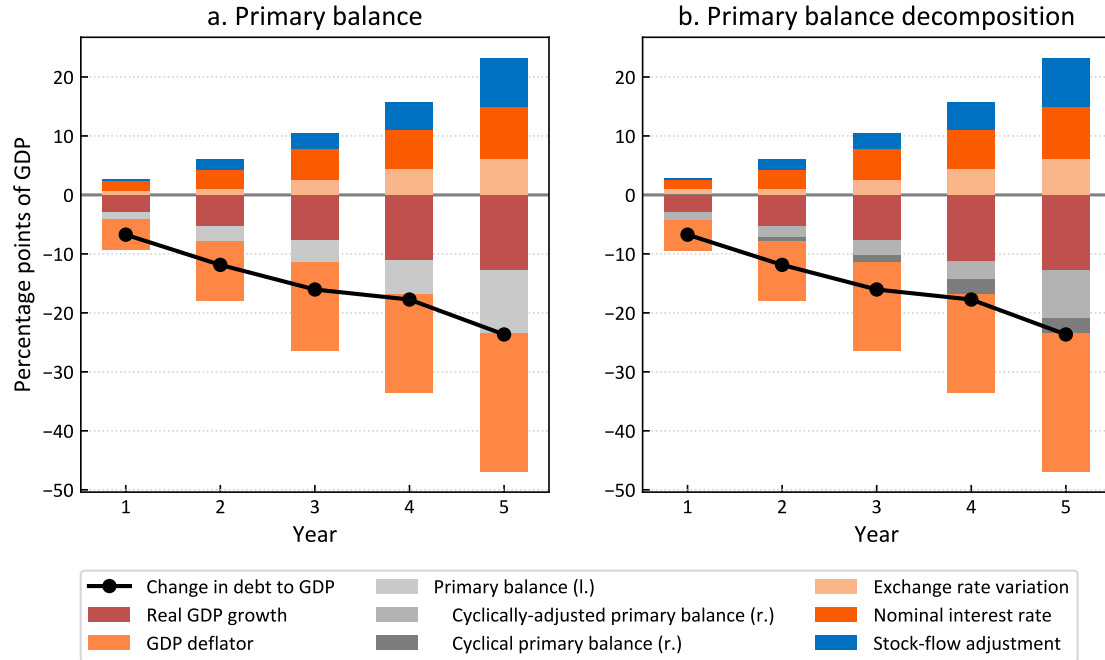
4.3.2 Results

The results presented in this section report the cumulative application of equation (4.10) over the years of debt consolidation episodes. They describe how the debt-to-GDP ratio evolved during stabilization and consolidation episodes across all episodes for each episode year. Years 1 and 2 include all debt consolidation episodes, and years 3 to 5 include all episodes that lasted at least that number of years.

Fig. 4.12 presents the average accounting decomposition of debt consolidation episodes in Sub-Saharan Africa into their main macroeconomic components. Panel (a) reports the contribution of the primary balance to changes in the debt-to-GDP ratio while panel (b) reports the decomposition of primary balance between cyclical and cyclically-adjusted primary balance, following equations (4.8) and (4.9). The results of this accounting decomposition of debt ratio dynamics during debt consolidation episodes illustrate that debt stabilization and consolidation episodes tend to occur in periods characterized by a stable macroeconomic environment.

⁵The Hodrick-Prescott filter is used on the logarithm of the nominal GDP, with a smoothing parameter $\delta = 100$.

Figure 4.12: Debt Decomposition during Public Debt Consolidation Episodes: Sub-Saharan Africa



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Each bar denotes the contributors to average debt reduction in a specific episode year. Years 1 and 2 include all debt consolidation episodes, and years 3 to 5 include all episodes that lasted at least that number of years.

First, debt consolidation appears to be associated with the combined contribution of economic growth and fiscal consolidation. As shown in Fig. 4.12 panel (b), the cyclical component of the primary balance only has a reduced contribution to debt ratio reduction, pointing to the importance of structural policies that lead to structurally sound public finances. These joint contribution of growth and the primary balance also helps identify two potentially self-defeating strategies: both public debt-led growth and poorly-calibrated fiscal consolidations may not lead to sizable debt ratio reduction by preventing one of the key components associated with successful consolidation to play a significant role.

Second, Fig. 4.12 sheds light on the ambiguous role of inflation in debt consolidation episodes. On the one hand, inflation mechanically erodes the real value of debt in domestic currency and hence contributes to the reduction in debt ratio, but on the other hand, high inflation is usually accompanied or followed by exchange rate depreciation and high interest rates, which both contribute to increase debt ratios

and hamper debt consolidation efforts.

Nigeria, which is not part of the sample due to data constraints, illustrates the ambiguous and potentially adverse role of inflation on debt dynamics. The country experienced a period of elevated inflation during and after the Covid pandemic, in 2020–22. High inflation did not help in achieving debt reduction: Instead, it led to a real exchange rate overvaluation, which eventually triggered a large currency depreciation in 2023, generating more inflation, higher borrowing costs, and as a result an increase in its public debt ratio.

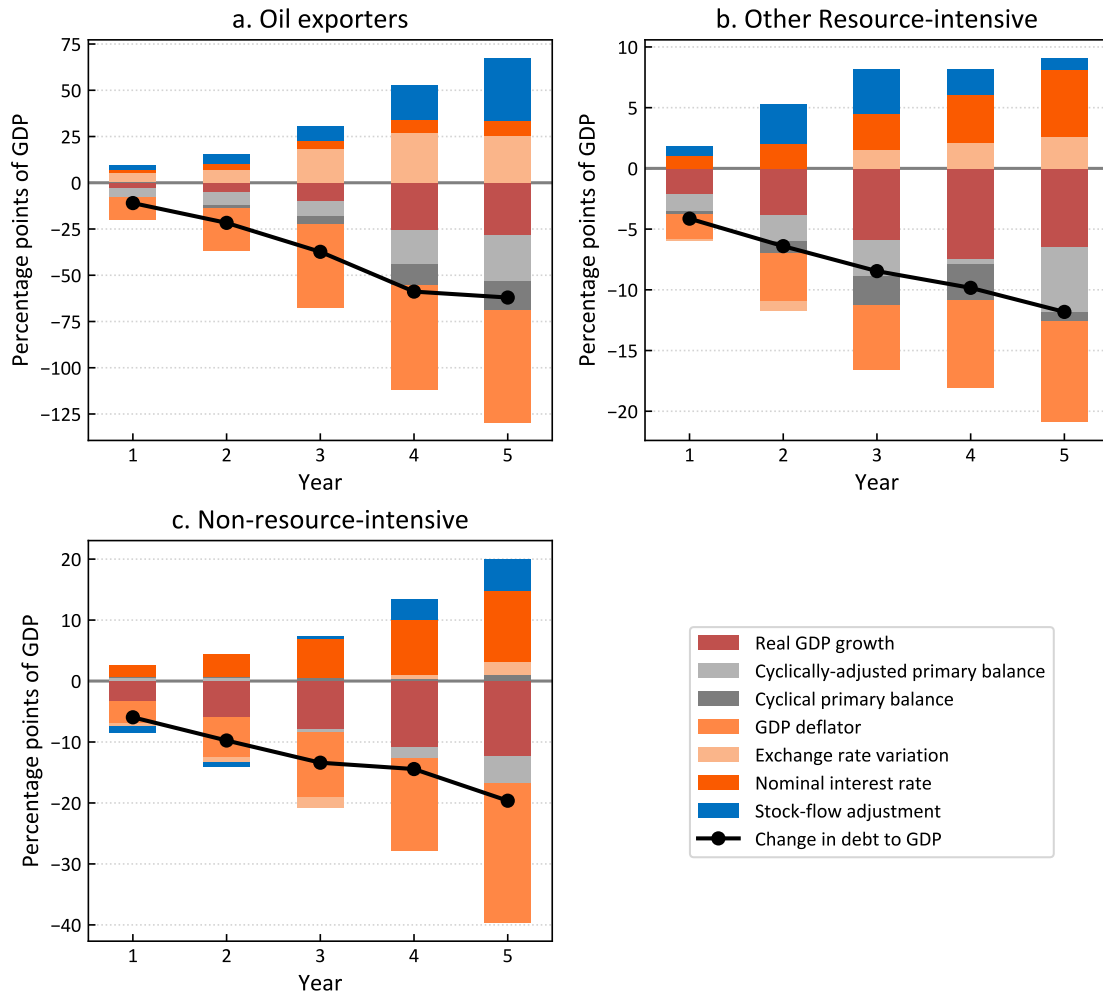
Third, exchange rate depreciation has a limited positive contribution to debt-ratio dynamics during debt consolidation episodes. This is particularly important for sub-Saharan Africa given the high share of foreign-currency-denominated public debt (Fig. 4.2). While exchange rate stability facilitates debt consolidation, maintaining an overvalued exchange rate may be counterproductive, because overvaluation can lower growth, increase future inflation, trigger future exchange rate depreciation and hamper overall macroeconomic stability.

Fourth, stock-flow adjustments have a large contribution to public debt ratio dynamics during debt consolidation episodes. This term captures below-the-line fiscal-financial operations, such as the support to struggling state-owned enterprises, the recapitalization of public banks, off-budget activities, and the clearance of arrears. Limiting such operations and ensuring sound fiscal frameworks, therefore, appear to be closely associated with more favorable debt-consolidation dynamics.

Sub-Saharan Africa's economies are diverse, in terms of productive structure, income level or fragility status, among other dimensions. The remainder of this section explores this diversity.

Fig. 4.13 reports the results for three sub-samples of countries in the region: Non-resource-intensive countries, oil exporters, and other resource-intensive countries. This comparative exercise highlights several stylized facts. First, fiscal policy's contribution appears to be greater in resource-intensive countries (both oil and non-oil) than in non-resource-intensive countries. Second, the contribution of growth is comparatively higher in non-resource-intensive and other resource-intensive countries than in oil exporters. Third, in non-resource-intensive countries, both exchange rate depreciations and stock-flow adjustments have a limited contribution to debt ratio dynamics. Fourth, debt consolidation in oil exporters tends to be associated with larger debt reductions than in other countries, mainly due to a few large episodes (such as Angola in 2001–2006, Equatorial Guinea in 2000–2008, or Gabon

Figure 4.13: Debt Decomposition during Public Debt Consolidation Episodes: by Sectoral Structure



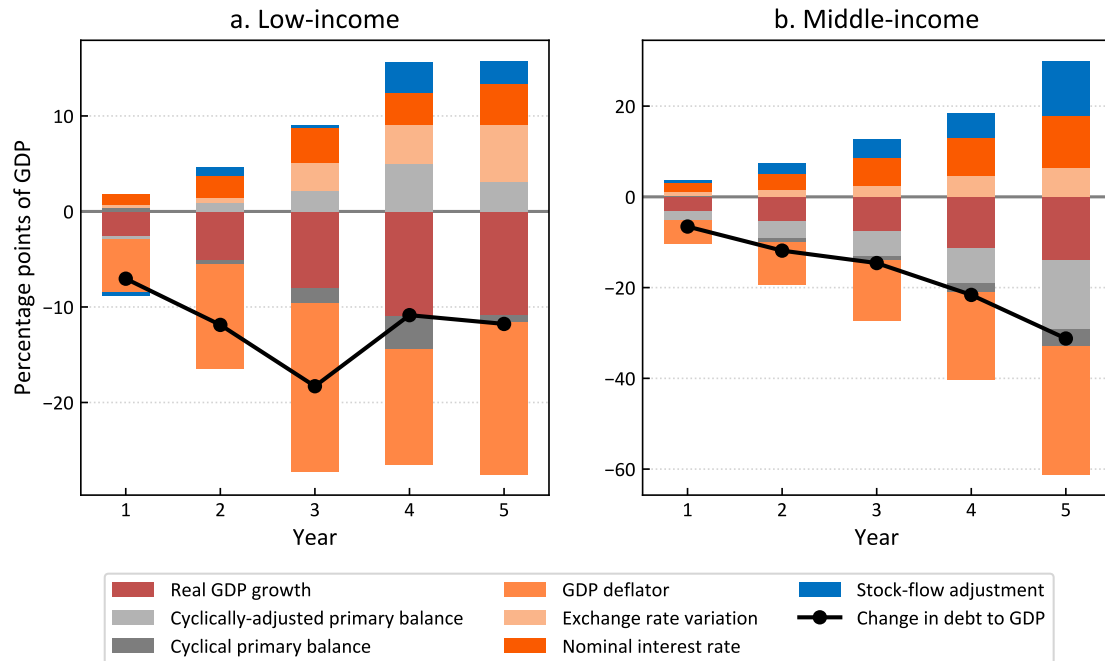
Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. See Appendix Table D3.

in 2003-2010 – see Appendix Table D4).

These results suggest that while oil exporters and, to a lower extent, other resource-intensive countries may be able to benefit from commodity price booms to consolidate their debt, non-resource-intensive countries' successful strategies tend to rely on both macroeconomic stability, characterized by strong growth, limited deficits and stable exchange rates, and sounder fiscal frameworks that limit stock-flow adjustments to offset the relatively higher contribution of effective nominal interest rate.

Fig. 4.14 shows the results of the same exercise when considering the sub-samples

Figure 4.14: Debt Decomposition during Public Debt Consolidation Episodes: by Income Level

Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. See Appendix Table D3.

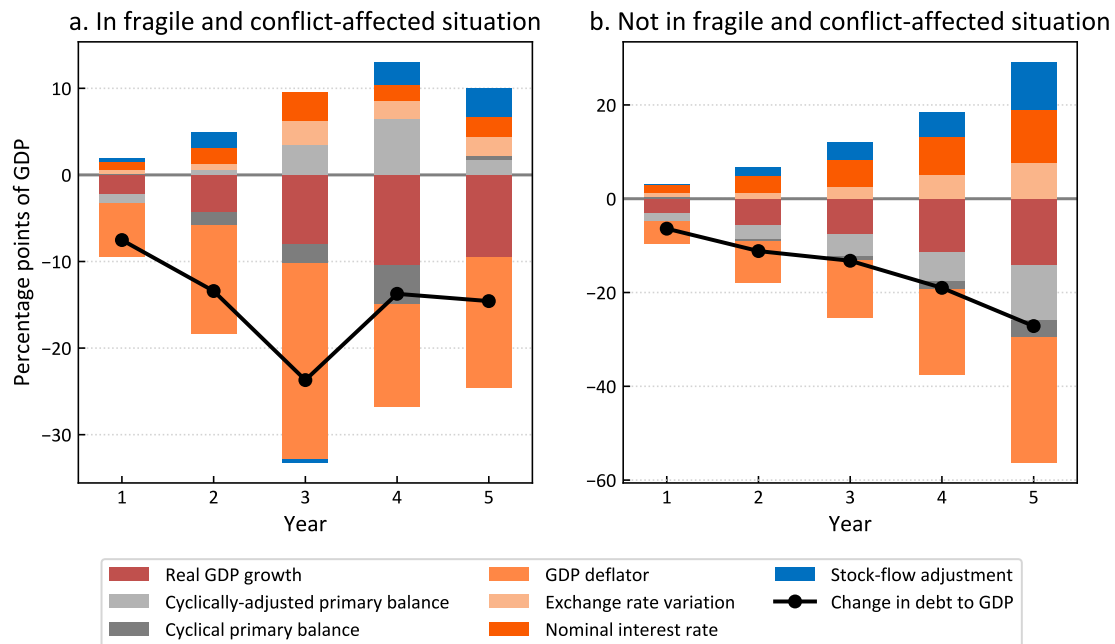
of low-income countries and of middle-income countries. First, debt consolidation in low-income countries tends to be associated with lower debt ratio reduction, on average. Second, while the contributors to debt ratio dynamics during debt consolidation in middle-income countries are balanced and relatively similar to the average profile in sub-Saharan Africa (reported in Fig. 4.12), the contributors to debt dynamics are different in low-income countries. In particular, the contribution of fiscal policy is almost absent, or slightly positive, suggesting that fiscal consolidation efforts are enough not to increase the debt ratio, but fall short of contributing to debt ratio reduction. This evidences the binding constraint of development needs in low-income countries, and the need to combine sound public finances with economic growth, the main contributor, to achieve debt consolidation.

Low-income countries also highlight the ambiguous effect of inflation's contribution: a mechanical downward pressure on the debt ratio compensated by relatively larger exchange rate depreciation, which contribute positively to the debt ratio dynamics. The limited contributions of the effective nominal interest rate underlines the

importance of concessional financing for debt stabilization in low-income countries.

Fig. 4.15 reports the results for countries in a fragile and conflict-affected situation, comparing to those that are not in such a situation. The results mirror, qualitatively, those for low-income and middle-income countries.

Figure 4.15: Debt Decomposition during Public Debt Consolidation Episodes: by Fragility Status



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Country groupings correspond to the IMF classification. See Appendix Table D3.

Countries that are not in a fragile or conflict-affected situation present a balanced contribution between growth and fiscal consolidation during debt consolidation episodes. On the contrary, successful debt consolidations in countries in fragile and conflict-affected situations tend to rely on high growth, limited contributions from exchange rate depreciations and stock-flow adjustments, and the availability of concessional financing that ensures a limited contribution from the effective nominal interest rate.

4.4 Country Cases

This section discusses four selected debt consolidation episodes to illustrate the dynamics described in Section 4.3.

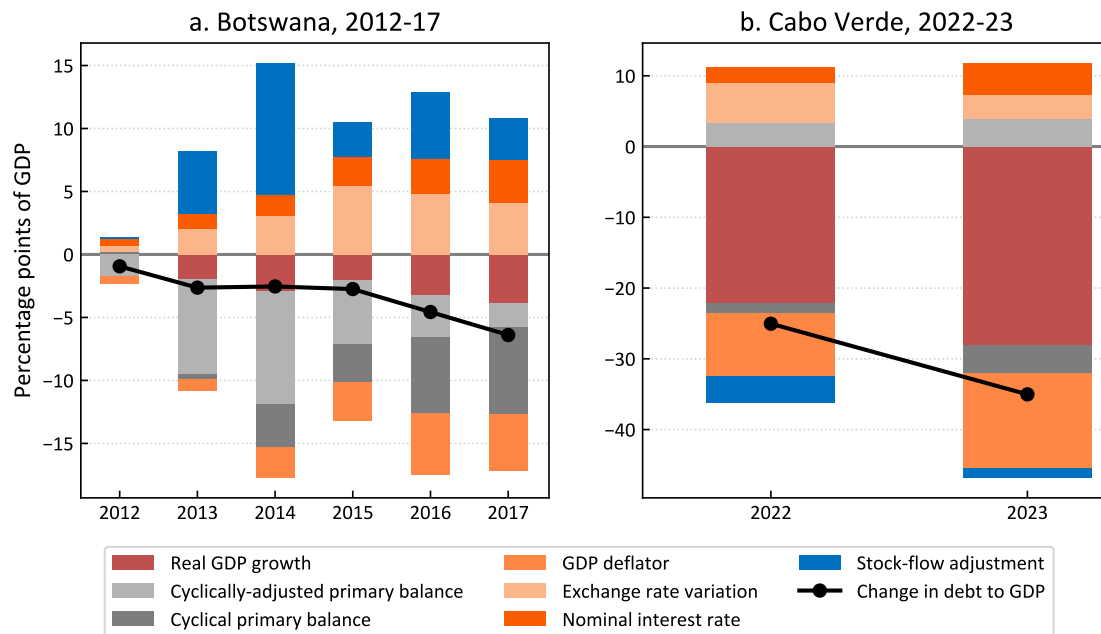
4.4.1 Botswana 2012-2017: Sound public finances

Botswana's debt ratio was already historically low at the beginning of the 2010s, at around 20.9 percent of GDP in end-2011, resulting from a prudent macroeconomic management, strong institutions, and the effective use of mineral revenues. After contracting in 2009, economic growth rebounded sharply, exceeding 6 percent in 2010 (IMF 2011 Article IV Consultation), driven both by the diamond sector—benefiting from rising rough diamond prices during the commodity super cycle—and by non mining sectors. Sound governance and natural resource management enabled Botswana to regain macroeconomic stability after the global financial crisis (IMF 2014 Article IV Consultation). Growth friendly fiscal consolidation helped the country return to a balanced budget in 2012–2013 for the first time since the crisis. The 2012 Article IV projected “a strong medium term fiscal improvement, with the primary balance expected to shift from a deficit of 6.6 percent of GDP in 2010/11 to an average surplus of 1.3 percent of GDP over 2012/13–2017/18, placing debt on track to fall to around 8 percent of GDP by 2017/18”. However, declining global demand for diamonds and copper softened growth momentum from 2015 onward.

Botswana's sound public finances contributed to the continued decline in the debt ratio between 2012 and 2017, the eighth-longest episode in the sample. Fig. 4.16 panel (a) highlights that both the primary balance and, to a lower extent, real GDP growth were major contributors to debt reduction. The primary balance was the dominant factor, supported by strong mining revenues and growth-friendly consolidation measures. Economic growth was the second key driver, reflecting the performance of both the mining and the non-mining sectors. Inflation had an ambiguous effect: while higher prices mechanically reduced the real value of debt, this effect was offset by exchange rate depreciation in 2012-2015, which added upward pressure to the debt ratio. Stock-flow adjustments also contributed positively, likely reflecting the financial weaknesses of certain public enterprises during this period (IMF 2017 Article IV Consultation). However, regarding the contribution of primary balance, this consolidation was largely driven by favorable revenue developments rather than a sustained improvement in underlying fiscal fundamentals. This suggests that headline fiscal balances and debt dynamics benefited primarily from buoyant mining revenues and Southern African Customs Union (SACU) transfers, while discretionary fiscal adjustment finally played a more limited role. In 2016, falling export demand after the end of the commodity super-cycle and rising fiscal spending resulted in a budget deficit. Additionally, the recovery in diamond sales and constrained recurrent spending helped reduce the fiscal deficit to about 1 percent

of GDP in FY2016/17, reinforcing Botswana's fiscal consolidation trajectory before external conditions deteriorated further, halting the debt consolidation phase at end-2017.

Figure 4.16: Debt Decomposition: episodes in Botswana 2012-17 and Cabo Verde 2022-23



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

4.4.2 Cabo Verde 2022-2023: Tourism recovery and fiscal consolidation

Although initially assessed as having a high risk of external and overall debt distress, Cabo Verde experienced a significant reduction in its public debt ratio in 2022 and 2023. The debt-to-GDP ratio fell from 149 percent at end-2021 to 114 percent at end-2023, declining by more than 30 percentage points (IMF World Economic Outlook, October 2024). This dramatic improvement followed earlier concerns highlighted in the IMF's 2019 Article IV Consultation, which assessed the country as facing a high risk of debt distress, before the consolidation episode. To restore macroeconomic stability, Cabo Verde implemented an eighteen-month Policy Coordination Instrument (PCI), approved by the Executive Board of the International Monetary Fund (IMF) in July 2019 and focused on fiscal consolidation and growth-enhancing reforms aimed at strengthening medium-term debt sustainability. This was followed by a 36-month Extended Credit Facility (ECF) arrangement

approved in June 2022, reinforcing the country's commitment to fiscal adjustment and structural reforms. These programmatic anchors supported the recovery and were associated with the strong macroeconomic performance observed during this period of declining debt.

Strong economic growth and improved public finances were the main contributors to Cabo Verde's debt-reduction episode between 2021 and 2023. As shown in Fig. 4.12, debt consolidation is the result of both economic growth and fiscal consolidation in SSA. In Cabo Verde, economic activity surged in 2022 with growth exceeding 15 percent (IMF 2023 Article IV Consultation), driven primarily by recovery tourism following its collapse during the COVID-19 pandemic. The revival of tourism brought a strong rebound in the services sector, supported exports, and boosted remittances, contributing to a sharp reduction in the current account deficit. As shown in Fig. 4.16 panel (b), fiscal consolidation also played a key role: the primary deficit narrowed to 1.9 percent of GDP based on credible, growth-friendly policy measures and the resumption of broad-based revenue mobilization efforts that had been interrupted by the pandemic (IMF 2023 Article IV Consultation). As a result, the primary balance stopped contributing positively to the debt ratio. Inflation contributed to reduce the debt ratio, but to a lower extent than GDP growth. Finally, stock-flow adjustments contributed to slightly lower the debt ratio, reinforcing the positive impact of the recovery in tourism and fiscal consolidation.

4.4.3 Democratic Republic of the Congo 2011-2023: Economic growth and fiscal discipline amid fragility

Entering the century with an unsustainable debt ratio, the Democratic Republic of the Congo (DRC) benefited from extensive debt relief between 2003 and 2010, which significantly reduced its debt ratio. The country benefited from the enhanced HIPC Initiative, reaching the decision point in 2003 and the completion point in 2010, the MDRI, and further debt relief granted by the Paris Club in 2010. These measures, combined with fiscal consolidation efforts, substantially improved the country's fiscal position, reducing the external debt ratio from more than 90 percent in 2009 to less than 30 percent by end 2010 (IMF 2012 Article IV Consultation). This international assistance, together with the Fund-supported program launched in 2009, was associated with strong macroeconomic performance between 2010 and 2013 (IMF 2014 Article IV Consultation). However, macroeconomic fragility persisted due to deteriorating security conditions, limited financing options, and weak domestic revenue mobilization. During this period, the DRC also benefited

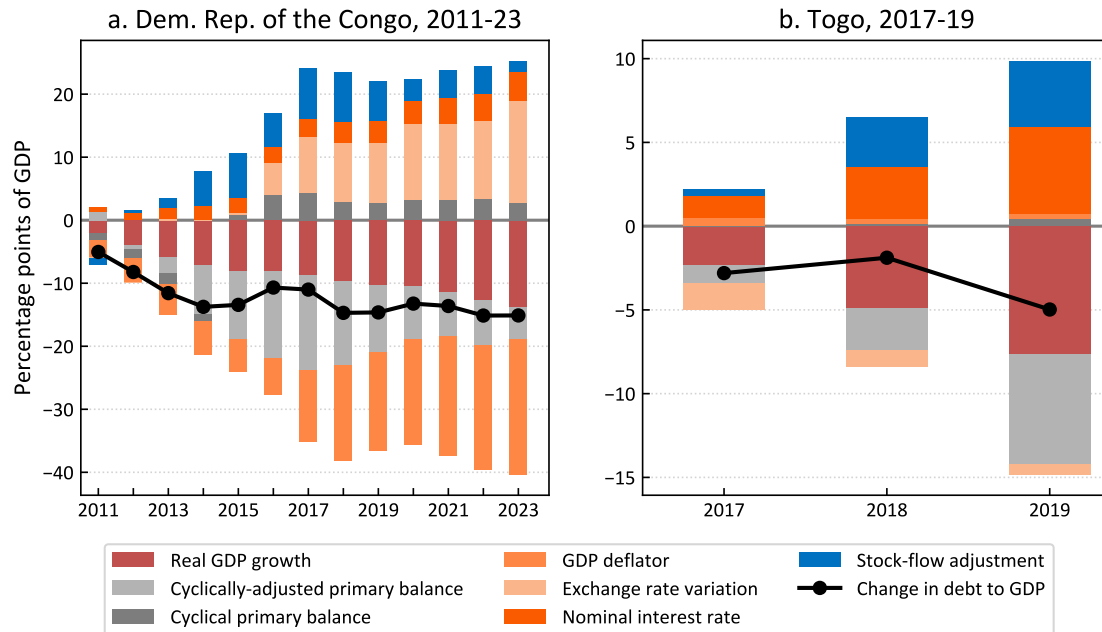
from substantial concessional support, including long maturity credits and grants.

The Democratic Republic of the Congo subsequently experienced a debt consolidation episode from 2011 to 2023 –the longest in the dataset– with economic growth and fiscal discipline as the main contributors. This thirteen-year episode is the longest among all sub-Saharan African countries between 2000 and 2023. In 2014, the country’s debt sustainability rating improved from high risk to moderate risk of debt distress, reflecting the earlier debt relief and prudent fiscal policy (IMF 2015 Article IV Consultation). The average contributors to this episode of debt consolidation are shown in Fig. 4.17 panel (a). Consistent with patterns observed in fragile and low income countries, real GDP growth drove most of the consolidation: during the first six years, growth exceeded 6 percent, supported by strong copper production, trade, construction activity, and continued FDI inflows (IMF 2014 Article IV Consultation). Although the decline in copper prices in 2016–2017 weakened the mining sector, prudent macroeconomic management helped limit the negative effects and sustain recovery (IMF 2019 Article IV Consultation). The primary balance contributed substantially to consolidation—the country even reached a primary surplus in 2014. Inflation contributed to reducing the debt ratio, but this effect was largely offset by significant exchange rate depreciation—by far the largest upward pressure on debt during the episode. Interest payments remained contained as the country benefited from concessional support. Stock-flow adjustments, including off-budget operations and support to state-owned enterprises, also contributed to increases in the debt ratio, particularly until 2017 and 2018.

4.4.4 Togo 2017–2019: Macroeconomic stability in a low-income country

Togo, a low-income country, experienced a debt consolidation episode associated with both economic growth and fiscal consolidation. During the period covered, the country recorded its only debt reduction episode during 2017–2019, with a decline of about 5 percentage points in its debt-to-GDP ratio. Economic conditions before the episode were favorable: strong growth between 2014 and 2016 was supported by infrastructure investment and robust agricultural production. However, growth slowed sharply in 2017 due to socio-political tensions. Despite this setback, the economy regained momentum from 2018 onward, driven by export-oriented sectors—including phosphate extraction, coffee and cocoa production, and cotton production—as well as strong activity in the tertiary sector (IMF 2019 Article IV Consultation). The Extended Credit Facility (ECF) arrangement approved in May

Figure 4.17: Debt Decomposition: episodes in Dem. Rep. of the Congo 2011-23 and Togo 2017-19



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

2017 played a key role in maintaining macroeconomic stability and supporting Togo's program implementation during these years. Furthermore, fiscal consolidation also contributed significantly to reducing the debt ratio. Under the ECF arrangement, the authorities committed to substantially reducing the overall budget deficit to restore long-term debt and external sustainability.

Fig. 4.17 panel (b) shows that in addition to economic growth, the primary balance contributed significantly to the reduction in the debt ratio, illustrating the role of fiscal consolidation in the country during this period. With a fixed exchange rate regime and low and stable inflation, the contribution of these variables to the debt ratio dynamics was muted during the period. The contributions of growth and fiscal consolidations were partially offset by large interest payments and stock-flow adjustments, reflecting continued weaknesses in public financial management and the financial difficulties of public banks—issues highlighted in the 2019 Article IV Consultation, which recommended completing the restructuring and privatization of these institutions.

4.5 Correlates of Debt Consolidation Episodes

4.5.1 Methodology

We aim to explore the correlates of debt consolidation in Sub-Saharan African countries. Therefore, our dependent variable is debt consolidation, a dummy variable equal to 1 for country i in year t if country i is experiencing a debt consolidation episode in year t , and 0 otherwise. As the dependent variable is binary, we estimate the model using a logistic regression to evaluate how observable country-level characteristics are associated with the probability of being in a debt-consolidation episode. More concretely, Equation (4.11) describes the empirical model estimated to explore the correlates of debt consolidation in sub-Saharan Africa:

$$DC_{it} = \beta_0 + \beta_1 X_{it} + \mu_i + \varepsilon_{it} \quad (4.11)$$

where DC_{it} represents Public Debt Consolidation episode in country i in year t , X_{it} is the vector of control variables, μ_i is a time-invariant unobserved country-specific effect capturing persistent heterogeneity across units (random effects) i that are constant over time, and ε_{it} represents an idiosyncratic error term.

Equation (11) is estimated using a random-effects logit model, which includes a country-specific, time-invariant unobserved heterogeneity. This specification allows the inclusion of time-invariant or slowly moving country-level regressors—such as governance indicators and structural reform measures—which would be absorbed under a fixed-effects logit model.

The logistic regression allows for obtaining the average marginal effects (AMEs) for each potential correlate of debt consolidation included in the regression.

The variables of interest can be classified into two groups. The first group consists of variables characterizing the macroeconomic context, such as high inflation, high growth, and exchange rate overvaluation. The second group of variables includes variables characterizing global shocks and domestic policies, such as commodity prices, oil prices, global demand, global financial conditions, governance, structural reforms, fiscal consolidation, having an IMF program, debt restructuring, and natural disasters.

The data for debt restructuring determinants are from a variety of sources. The commodity price index and oil prices are from the World Bank Commodity Prices database. Global demand is proxied by GDP growth in the G7 economies and China.

Spreads are from Bloomberg L.P. The governance index is the simple average of the six governance indicators from the World Development Indicators database. The structural reforms indicator is computed by taking the average value of three indicators capturing governance and the degree of liberalization of the external sector and business regulations, from the World Bank and the Fraser Institute. The data for fiscal consolidations are from [Comelli et al. \(2023\)](#). IMF programs indicator is a dummy variable equal to 1 if a given country benefits from an IMF program in a given year, and 0 otherwise. Debt restructuring is defined as a dummy variable equal to 1 if country i in year t experiences a bilateral or multilateral debt restructuring or moratoria, with China, the Paris Club, during multilateral debt treatment (HIPC and MDRI), and with private creditors. Natural disasters are from EM-DAT and capture the number of occurrences of climate-related natural disasters in country i during year t . High inflation is a dummy variable equal to 1 for country i in year t if its CPI inflation rate is higher than the median value for this country during the study period. Data for inflation are from the World Economic Outlook (IMF). High growth is a dummy variable equal to 1 for country i in year t if GDP growth is higher than the median value for this country during the study period. Data for GDP growth rates are also from the World Economic Outlook (IMF). Data for the real effective exchange rate (REER) are from [Darvas \(2012\)](#). We use the monthly time series that includes 120 trading partners. The REER misalignment is then proxied by the difference between the observed REER and its trend component, obtained using the Hodrick-Prescott filter with a smoothing parameter $\delta = 14400$. The misalignment for year t is then computed as the average monthly misalignment during that year, a positive value denoting REER overvaluation.

4.5.2 Results

We first analyze the estimates of variables characterizing the macroeconomic context. The results are shown in Table [3.1](#).

Columns 1-6 report the estimation results for univariate regressions using the variables characteristic of the macroeconomic context separately, while column 7 includes all these variables jointly in the regression. Column (1) shows that years during which countries experienced high growth are associated with a higher probability of being in a debt consolidation episode. Also, having experienced high growth during at least one of the last three years is positively correlated with the probability of debt consolidation in year t . Experiencing high inflation is not associated with a higher probability of debt consolidation. This may reflect the fact that any erosion

Table 4.1: Debt Consolidation Determinants: Macroeconomic Environment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>High growth</i>	0.113*** (0.040)						0.103*** (0.039)
<i>Past high growth</i>		0.052* (0.031)					0.020 (0.031)
<i>High inflation</i>			0.029 (0.032)				0.011 (0.031)
<i>Past high inflation</i>				0.098** (0.041)			0.087** (0.038)
<i>Overvaluation</i>					-0.001 (0.022)		-0.002 (0.024)
<i>Past overvaluation</i>						-0.059** (0.028)	-0.065** (0.030)
<i>Observations</i>	922	922	922	922	922	922	922
<i>McFadden's pseudo-R²</i>	0.020	0.003	0.001	0.010	0.000	0.005	0.036

Note: The Table shows the estimates of equation (4.11). The coefficients indicate average marginal effects. Robust standard errors, shown in parentheses, are clustered at the country level. * Significant at the 10 percent level, ** significant at the 5 percent level, *** significant at the 1 percent level.

Source: Author's construction.

of the real value of domestically denominated debt during high-inflation episodes tends to be accompanied by macroeconomic imbalances, including exchange rate depreciation, which can raise the real value of foreign currency-denominated debt. However, high inflation in previous years is associated with a higher probability of public debt consolidation. One possible interpretation is that past inflationary episodes—reflecting underlying macroeconomic imbalances—are more frequently observed in contexts where countries subsequently engage in policy adjustment programs, including IMF-supported arrangements, which are themselves correlated with debt consolidation episodes. Taken together, the results for past high inflation and current high inflation are in line with this hypothesis. While the presence of REER overvaluation does not affect the probability of being in a debt consolidation episode, past overvaluation is associated with a lower probability of debt consolidation. This result is consistent with the fact that large overvaluations are often followed by exchange rate depreciation, which tends to increase the value of

foreign-currency-denominated debt.

Taken together, the results reported in Table 3.1 highlight the importance of macroeconomic stability. High growth appears as a key correlate of debt consolidation episodes, and the negative effect of exchange rate overvaluation could lie in the fact that these periods are usually associated with lower growth, an increase in future inflation, and future exchange rate depreciation. As such, it constitutes an obstacle to overall macroeconomic stability.

Table 3.2 reports the estimates of the models that include global shocks and domestic policies as correlates of debt consolidation episodes. Columns 1-11 show univariate models where potential correlates are included individually. Fig. 4.18 provides a visual representation of some of these results.

The rises in the commodity price index and oil prices are associated with a higher probability of debt consolidation (columns 1-2). Indeed, higher commodity prices are associated with improved fiscal balances in commodity-exporting countries, which may be conducive to debt reduction. Additionally, an increase in global demand is associated with a higher probability of debt consolidation (column 3): This could be explained by the positive effect of global demand on exports, and hence on economic growth in sub-Saharan African countries. Moreover, a decrease in regional bond spreads is also associated with a higher probability of debt consolidation (column 4). This can be due to the availability of cheaper financing, or because lower spreads are a consequence of lower macroeconomic imbalances, which themselves contribute to debt consolidation.

The estimates for the governance index and the structural reforms index are positive and significant (columns 5-6), underlying the role of institutions and the business climate, which allow the private sector to flourish and drive growth, associated with a higher likelihood of a debt consolidation episode. Column 7 reports the results for fiscal consolidation. Implementing fiscal consolidation is not sufficient in itself for debt consolidation: Fiscal efforts need to be sustained over time to be associated with a higher probability of debt consolidation. It is only when fiscal efforts are sustained over time that they are associated with an increased probability of experiencing debt consolidation. This result confirms the debt decomposition analysis, which shows that fiscal consolidations are one dimension of a larger context of reduced macroeconomic imbalances during debt consolidation episodes.

Debt consolidation is more likely when the country has or has had an IMF-supported arrangement (columns 8-9). This highlights the contribution of international support

Table 4.2: Debt Consolidation Determinants: Global Shocks and Policies

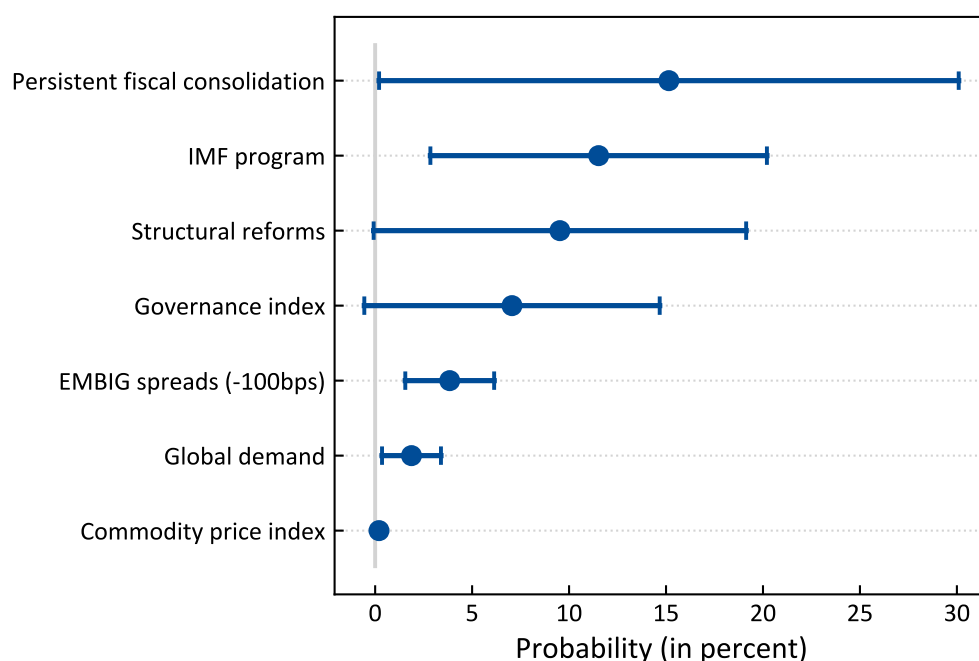
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Commodity prices</i>	0.002*** (0.001)											0.017* (0.009)
<i>Oil prices</i>		0.001* (0.001)										-0.012* (0.007)
<i>Global demand</i>			0.019** (0.008)									0.008 (0.017)
<i>Sovereign spreads</i>				-0.038*** (0.012)								0.021 (0.031)
<i>Governance</i>					0.089* (0.049)							-0.034 (0.115)
<i>Structural reforms</i>						0.779* (0.401)						0.197 (0.269)
<i>Contemporary fiscal consolidation</i>							-0.039 (0.082)					-0.148 (0.151)
<i>Past fiscal consolidation</i>							-0.048 (0.050)					-0.086 (0.079)
<i>Persistent fiscal consolidation</i>							0.151** (0.076)					0.319** (0.159)
<i>Contemporary IMF program</i>								0.115*** (0.044)				0.086 (0.055)
<i>Past IMF program</i>									0.084* (0.043)			0.022 (0.036)
<i>Past restructuring</i>										0.095** (0.043)		0.205*** (0.046)
<i>Natural disaster</i>											-0.012 (0.011)	-0.030* (0.018)
<i>Observations</i>	922	922	922	922	860	463	779	766	766	922	898	335
<i>McFadden's pseudo-R²</i>	0.013	0.007	0.007	0.018	0.004	0.014	0.007	0.020	0.010	0.011	0.001	0.0237

Note: The Table shows the estimates of equation (4.11). The coefficients indicate average marginal effects. Robust standard errors, shown in parentheses, are clustered at the country level. Year fixed effects are not included, as global shocks and common time-varying influences are explicitly controlled for through variables capturing global economic conditions, including commodity prices, global demand, and international financial conditions. * Significant at the 10 percent level, ** significant at the 5 percent level, *** significant at the 1 percent level.

Source: Author's construction.

for macroeconomic stability in the region. Column 10 shows that debt consolidation is also more likely in the three years following a debt restructuring. Finally, the occurrence of natural disasters is not associated with a significantly lower probability of debt consolidation in a univariate model (column 11).

Column 12 reports a multivariate model that includes the 11 determinants already discussed. Commodity and oil prices, lasting fiscal consolidations, past debt restructuring and the occurrence of natural disasters have a statistically significant relationship with the probability of being in a debt consolidation episode. However, the reduced sample and multicollinearity (past debt restructuring can be accompa-

Figure 4.18: Debt Consolidation Determinants: Global Shocks and Policies

Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: The figure shows some of the estimates reported in Table 2. Interpretation: The presence of a persistent fiscal consolidation is associated with a 15.1% higher probability that the country is in a debt consolidation episode.

nied or followed by IMF programs, for example) prevent any strong interpretation of these results.

To summarize, debt consolidation is associated with a stable macroeconomic environment (high growth, absence of REER overvaluation) and reduced macroeconomic imbalances (such as the disappearance of past high inflation). Both global shocks, such as commodity prices and global demand, and domestic policies, such as lasting fiscal consolidations, are associated with a higher probability of achieving debt consolidation. The results reflect the fact that, as small open economies, sub-Saharan African countries are sensitive to the external environment for their macroeconomic stability, while also highlighting that domestic policy choices and institutional frameworks are correlated with more favorable debt-consolidation outcomes.

4.6 Conclusion

This paper provides novel evidence on public debt dynamics in 39 sub-Saharan African countries during the period 2000–2023. First, it identifies debt consolidation episodes during this period, excluding occurrences of debt restructuring. Second, it performs an accounting decomposition of debt dynamics during these episodes to illustrate the role played by GDP growth, fiscal policy, inflation, exchange rate variations, effective nominal interest rates, and stock-flow adjustments. Third, it explores the domestic and external factors associated with debt consolidation episodes using a logistic regression approach.

The identification of debt consolidation episodes shows that such events have not been uncommon in sub-Saharan Africa, with 61 episodes of decline in the public debt ratio over periods of two years or more, covering more than 25 percent of all country-year observations. The decomposition of debt dynamics during these episodes highlights the importance of macroeconomic stability in periods of debt reduction. Debt consolidation episodes are typically characterized by a combination of high growth and sound public finances, contained inflation that limits excessive exchange rate depreciation and increases in interest rates, and relatively contained stock-flow adjustments. Heterogeneity analysis further indicates that strong growth is particularly important in low-income countries and those in a fragile or conflict-affected situation.

The empirical results reinforce the association between macroeconomic stability and debt consolidation, and provide evidence that persistent fiscal consolidations, structural reforms, improved governance, external support catalyzed by an IMF program, and a supportive global economy are associated with a higher likelihood of debt consolidation episodes.

The findings have implications for policy-making in the region. Fiscal adjustments tend to be associated with larger and more durable debt reduction when complemented by pro-growth structural reforms and reinforcements in institutional frameworks. This is particularly the case in low-income countries. In light of the importance of foreign currency-denominated debt in the region, inflating away public debt appears to be an ineffective strategy since higher inflation is typically accompanied by exchange rate depreciation and higher interest rates, both of which exert upward pressure on debt ratios. On the contrary, this paper evidences that debt consolidation episodes tend to occur in contexts characterized by macroeconomic stability and low imbalances, including sound public finances, robust growth, contained

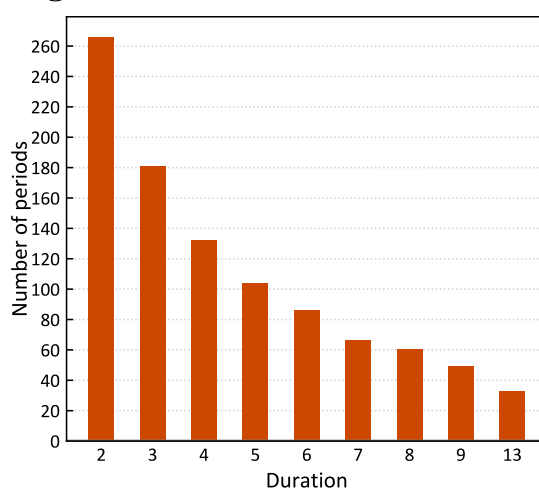
inflation, and limited exchange rate depreciation. Finally, the results for low-income countries and for countries in a fragile and conflict-affected situation suggest that support from the international community, including through concessional financing, plays an important role by allowing for more gradual fiscal adjustment that preserves growth, mitigates adverse social effects, and enables progress in fulfilling essential development needs.

Future research could further explore the drivers of debt consolidation in developing countries. Further work could also assess the economic and social outcomes of debt consolidation in the region.

D Appendix

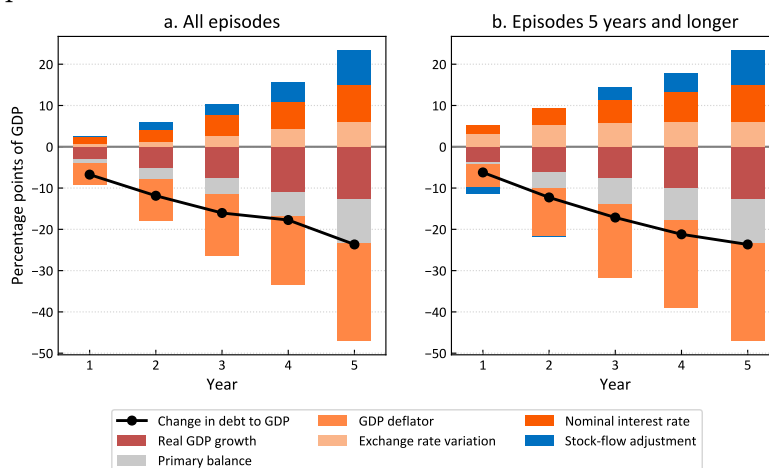
D.1 Data, Sources and Descriptive Statistics

Figure D1: Periods of Debt Increase



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Figure D2: Debt Decomposition during Public Debt Consolidation Episodes: Sample Composition



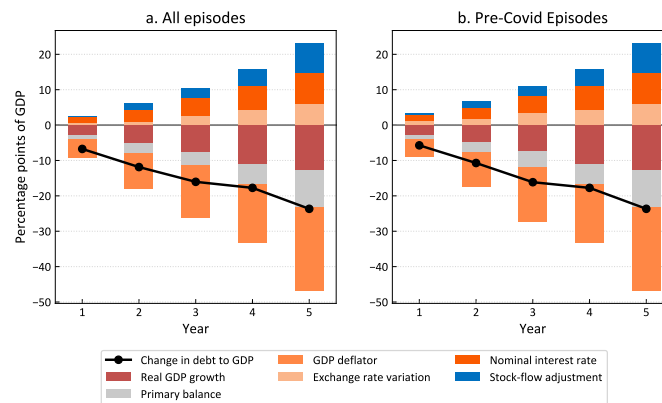
Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Each bar denotes the contributors to average debt reduction in a specific episode year. For panel (a), years 1 and 2 include all debt consolidation episodes, and years 3 to 5 include all episodes that lasted at least that number of years. For panel (b), only episodes that lasted at least five years are included.

Table D1: Data Sources

Variables	Sources
Nominal GDP	IMF, World Economic Outlook database, Oct. 2024
Real GDP	IMF, World Economic Outlook database, Oct. 2024
Exchange rate	IMF, World Economic Outlook database, Oct. 2024
General Government Interest expenditure	IMF, World Economic Outlook database, Oct. 2024
General government net lending/borrowing ratio	IMF, World Economic Outlook database, Oct. 2024
General Government gross debt	IMF, World Economic Outlook database, Oct. 2024
General government gross debt in foreign currency	IMF, World Economic Outlook database, Oct. 2024
General government revenue	IMF, World Economic Outlook database, Oct. 2024
General government total expenditure	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
GDP Deflator	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Domestic Inflation	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Nominal exchange rate	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Nominal effective interest rate	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Inflation rate	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Real GDP growth rate	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Primary balance	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Stock-flow adjustments	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
High growth	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
High inflation	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Overvaluation	Authors' construction based on data from Darvas (2012)
Commodity prices	World Bank Commodity Prices database
Oil prices	World Bank Commodity Prices database
Global demand	Authors' construction based on data from IMF, World Economic Outlook database, Oct. 2024
Sovereign spreads	Bloomberg L.P
Governance	World Bank World Development Indicators
Structural reforms	World Bank and the Fraser Institute
Fiscal consolidation	Comelli et al. (2023)
IMF program	IMF, MONA database
Debt Restructuring	Horn et al. (2022b) ; Djimeu (2018) ; Asonuma and Trebesch (2016) ; Asonuma et al. (2023)
Natural disaster	Delforge et al. (2025)

Figure D3: Debt Decomposition during Public Debt Consolidation Episodes: Excluding Post-Covid



Source: IMF, World Economic Outlook database (October 2024); calculations and elaboration by the authors.

Note: Each bar denotes the contributors to average debt reduction in a specific episode year. For panel (a), years 1 and 2 include all debt consolidation episodes, and years 3 to 5 include all episodes that lasted at least that number of years. Panel (b) does the same but excludes episodes that started after the Covid.

Table D2: Descriptive statistics

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Nom GDP LCU	922	11276.53	27089.38	0	195788.52
Nom GDP Growth	921	4.19	6.5	-50.32	110.51
Exchange rate	922	751.76	1697.52	0	22797.1
Interest Expenditure	915	170.01	516.11	0	6163.41
Net-lending GDP	915	-2.2	5.05	-18.23	31.05
Consumer Prices (period avg.)	921	11.15	42.32	-72.73	667.36
Debt Nominal	908	4727.66	11422.01	0	97150.43
Debt foreign	905	3195.81	7454.17	0	58572.89
Debt to GDP	908	53.54	36.18	0	260.96
Gen. gov. revenue	915	1761.95	3925.6	0	29226.24
Gen. gov. tot. expenditure	915	2036.97	4736.9	0	36527.71
REER Misalignment	880	0	.05	-.61	.45
WB ComPrice Index Real	922	85.7	22.86	49.01	129.1
Oil prices (crude)	922	64.65	26.03	24.49	105.1
EMBI spreads	922	3.99	1.47	1.97	8.09
WGI avg	860	-.58	.61	-2.11	.87
Structural reforms	463	.57	.1	.19	.82
Fiscal consolidation	779	.21	.41	0	1
IMF program	766	.58	.49	0	1
Debt Restructuring	922	.25	.43	0	1
Natural disaster (occurrences)	898	1.1	1.28	0	8

Source: Author's construction.

D.2 Database Construction

This Appendix clarifies the principles governing the inclusion or exclusion of debt reduction episodes during the construction of the database. First, we have removed or adjusted episodes that occurred while debt restructuring was under way and involving reductions in face value, whether they occurred under the Enhanced HIPC Initiative, the MDRI, or with the Paris Club or private creditors. In addition, we have distinguished between substantive debt restructurings and the series of symbolic or minor restructurings often recorded in the case of China. Following [Horn et al. \(2022b\)](#), these symbolic operations "involve very small amounts", and therefore do not warrant exclusion of a full debt reduction episode unless they exceed a materiality threshold. Consistent with this approach, we exclude only those years in which debt relief from China exceeds 1.5 percent of GDP, while years marked by negligible or undocumented symbolic restructurings are retained. This

Table D3: Country Grouping

Country	Sectoral Structure	Fragility status	Income level
Angola	Oil exporter	Not FCS	Lower-middle income
Burundi	Non-resource-intensive	FCS	Low-income
Benin	Non-resource-intensive	Not FCS	Lower-middle income
Botswana	Other resource-intensive	Not FCS	Upper-middle income
Central African Republic	Other resource-intensive	FCS	Low-income
Cameroon	Oil exporter	FCS	Lower-middle income
Congo, Democratic Republic of the	Other resource-intensive	FCS	Low-income
Congo, Republic of	Oil exporter	FCS	Lower-middle income
Côte d'Ivoire	Non-resource-intensive	Not FCS	Lower middle income
Comoros	Non-resource-intensive	FCS	Lower-middle income
Cabo Verde	Non-resource-intensive	Not FCS	Lower-middle income
Ethiopia	Non-resource-intensive	FCS	Low-income
Gabon	Oil exporter	Not FCS	Upper-middle income
Ghana	Other resource-intensive	Not FCS	Lower middle income
Guinea	Other resource-intensive	Not FCS	Low-income
Gambia, The	Non-resource-intensive	Not FCS	Low-income
Guinea-Bissau	Non-resource-intensive	FCS	Low income
Equatorial Guinea	Oil exporter	Not FCS	Upper-middle income
Kenya	Non-resource-intensive	Not FCS	Lower-middle income
Lesotho	Non-resource-intensive	Not FCS	Lower-middle income
Mali	Other resource-intensive	FCS	Low income
Mozambique	Non-resource-intensive	FCS	Low-income
Mauritius	Non-resource-intensive	Not FCS	Upper-middle income
Malawi	Non-resource-intensive	Not FCS	Low-income
Namibia	Other resource-intensive	Not FCS	Upper-middle income
Niger	Other resource-intensive	FCS	Low-income
Rwanda	Non-resource-intensive	Not FCS	Low-income
Senegal	Non-resource-intensive	Not FCS	Lower middle income
Sierra Leone	Other resource-intensive	Not FCS	Low-income
South Sudan	Oil exporter	FCS	Low-income
Eswatini	Non-resource-intensive	Not FCS	Lower-middle income
Seychelles	Non-resource-intensive	Not FCS	High-middle income
Chad	Oil exporter	FCS	Low-income
Togo	Non-resource-intensive	Not FCS	Low-income
Tanzania	Other resource-intensive	FCS	Lower middle income
Uganda	Non-resource-intensive	Not FCS	Low-income
South Africa	Other resource-intensive	Not FCS	Upper-middle income
Zambia	Other resource-intensive	Not FCS	Low-income
Zimbabwe	Other resource-intensive	FCS	Lower-middle income

Note: The groupings correspond to 2023. Income level category and fragility status are not constant over time. The official list are available from the World Bank in the following webpages: <https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/classification-of-fragile-andconflict-affected-situations> and <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.

Source: Author's construction.

Table D4: List of Debt Consolidation and Stabilization Episodes

Country	Start	End	Duration	Change in debt/GDP	Country	Start	End	Duration	Change in debt/GDP
Angola	2001	2006	6	-101.5	Lesotho	2004	2005	2	-11.7
Angola	2010	2012	3	-24.6	Lesotho	2008	2010	3	-15.8
Angola	2021	2022	2	-63.0	Lesotho	2016	2017	2	-4.8
Burundi	2011	2013	3	-9.1	Mozambique	2002	2004	3	-49.0
Benin	2012	2013	2	-3.4	Mozambique	2010	2011	2	-5.2
Botswana	2000	2003	4	-2.2	Mozambique	2017	2019	3	-26.5
Botswana	2005	2007	3	-4.8	Mozambique	2021	2023	3	-26.1
Botswana	2012	2017	6	-6.4	Mauritius	2004	2008	5	-18.2
Botswana	2021	2022	2	-0.6	Mauritius	2010	2012	3	-2.7
Central African Republic	2002	2003	2	-7.2	Mauritius	2016	2017	2	-1.7
Central African Republic	2015	2020	6	-17.8	Mauritius	2021	2023	3	-13.2
Cameroon	2007	2008	2	-7.2	Malawi	2009	2010	2	-4.2
Cameroon	2022	2023	2	-4.0	Namibia	2005	2009	5	-13.3
Congo, Democratic Republic of the	2011	2023	13	-15.1	Niger	2007	2011	5	-3.5
Congo, Republic of	2011	2012	2	-13.3	Rwanda	2007	2011	5	-3.8
Comoros	2000	2008	9	-31.3	Sierra Leone	2009	2013	5	-23.8
Cabo Verde	2005	2008	4	-10.4	South Sudan	2017	2019	3	-82.7
Cabo Verde	2016	2019	4	-6.2	Eswatini	2002	2009	8	-10.7
Cabo Verde	2022	2023	2	-35.0	Eswatini	2021	2023	3	-0.1
Ethiopia	2008	2009	2	-13.1	Seychelles	2002	2006	5	-64.7
Ethiopia	2019	2023	5	-19.7	Seychelles	2011	2019	9	-33.4
Gabon	2003	2010	8	-59.8	Seychelles	2021	2023	3	-20.9
Gabon	2017	2019	3	-4.4	Chad	2017	2018	2	-4.8
Gabon	2021	2022	2	-12.6	Chad	2022	2023	2	-9.7
Guinea	2016	2019	4	-5.8	Togo	2017	2019	3	-5.0
Guinea	2021	2022	2	-7.6	Uganda	2004	2005	2	-12.6
Gambia, The	2018	2023	6	-11.8	Uganda	2007	2009	3	-13.0
Equatorial Guinea	2000	2008	9	-60.0	South Africa	2002	2008	7	-14.0
Equatorial Guinea	2011	2013	3	-1.6	Zambia	2007	2010	4	-6.1
Equatorial Guinea	2021	2022	2	-19.2	Zimbabwe	2010	2013	4	-21.7
Kenya	2004	2007	4	-9.6					

Source: IMF, World Economic Outlook database (October 2024), calculations by the authors.

ensures a uniform treatment of restructuring events across creditors and prevents the disproportionate removal of episodes based solely on debt cancellations of limited macroeconomic importance.

D.3 Episodes excluded from the sample due to a debt restructuring

Burundi, 2005–2009

Bilateral and multilateral debt restructurings occurred during the period, all of them including a reduction in face value. The country benefited from debt relief under the enhanced HIPC initiative between the decision point in 2005 and the completion point in 2009, and from the MDRI in 2009. Debt relief from the Paris Club was provided under the enhanced HIPC initiative in 2005 and 2009. A symbolic restructuring with China also took place in 2007, including a reduction in face value.

Benin, 2000–2006

Bilateral and multilateral debt restructurings under the HIPC and the MDRI occurred during the period of the episode. The country benefited from bilateral and multilateral debt restructurings between the decision point of the enhanced HIPC in 2000 and the completion point in 2003, and from the MDRI in 2006. Other minor restructurings occurred, including a debt restructuring with China in 2004 (without a reduction in face value) and a symbolic debt restructuring with China in 2002 (including a reduction in face value).

Central African Republic, 2006–2011

Bilateral and multilateral debt restructurings under the enhanced HIPC and the MDRI occurred during the period of the episode. Bilateral and multilateral debt restructurings under the enhanced HIPC and the Paris Club between 2007 and 2009, before the MDRI in 2009. A minor restructuring took place in 2007 with China (including a reduction of face value).

Cote d'Ivoire, 2000–2013

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, the Paris Club, and Private Creditors, all with a reduction of face value. The Paris Club provided debt restructuring in 2002, 2009, 2011, and 2012. In addition, debt restructuring occurred under the enhanced HIPC between the decision point in 2009 and the completion point in 2012, and under the MDRI in 2012. Private creditors restructuring also occurred over the periods 2000-2010 and 2011-2012. Minor symbolic debt restructurings with China took place in 2002, 2007, and 2011.

Democratic Republic of the Congo, 2002–2003

The country benefited from bilateral debt restructuring with the Paris Club in 2002. This debt relief included a reduction in face value. The country also benefited

from symbolic debt restructurings with China in 2002 and 2003 (also leading to a reduction in face value).

Democratic Republic of the Congo, 2005–2008

Bilateral and multilateral debt restructurings occurred during the episode, all including a reduction in face value. The decision point of the enhanced HIPC was in 2003, with a completion point in 2010. In 2010, the MDRI and another debt relief with the Paris Club also occurred. A symbolic debt restructuring with China occurred in 2007.

Republic of the Congo, 2004–2008

Bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, and the Paris Club occurred during the episode. Three debt restructuring episodes with the Paris Club occurred in 2004, 2006, and 2008. The decision point of the enhanced HIPC was in 2006 while its completion point was in 2010. A symbolic debt restructuring with China took place in 2007. All these episodes involved a reduction in face value.

Republic of the Congo, 2021–2022

A restructuring with private creditors occurred over the period 2018–2021. This restructuring with private creditors represents the main debt relief during the period of the episode, including a reduction in face value. A symbolic debt restructuring with China happened in 2021.

Ghana, 2001–2006

The country benefited from bilateral and multilateral debt restructurings with the Paris Club, the enhanced HIPC, and the MDRI. Three restructurings from the Paris Club occurred in 2001, 2002, and 2004 (including a reduction in face value). The decision point of the enhanced HIPC was in 2002 and its completion point was in 2004, while the MDRI was approved in 2006. A symbolic debt restructuring with China was reached in 2002 (including a reduction in face value).

Guinea, 2000–2003

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC and the Paris Club. The country benefited from the enhanced HIPC from the decision point in 2000 to the completion point in 2010. A debt restructuring

with the Paris Club happened in 2001, and a symbolic debt restructuring with China was also reached in the same year (all including a reduction in face value).

Guinea, 2006–2008

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC and the Paris Club. The enhanced HIPC was granted between 2000 and 2010. A debt restructuring with the Paris Club happened in 2008, and symbolic debt restructurings with China occurred in 2005 and 2007 (all including a reduction in face value).

Guinea, 2011–2012

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, and the Paris Club. While the enhanced HIPC was granted between 2000 and 2010, the MDRI was approved in 2012. Moreover, a debt restructuring with the Paris Club happened in 2012 (including a reduction in face value).

The Gambia, 2003–2004

The country benefited from bilateral and multilateral debt restructurings with the Paris Club, the enhanced HIPC, and the MDRI. The enhanced HIPC was granted between 2000 and 2007. There was also a debt restructuring with the Paris Club in 2003 (including a reduction in face value).

The Gambia, 2007–2009

The country benefited from bilateral and multilateral debt restructurings with the completion point of the enhanced HIPC, the MDRI, and the Paris Club. The completion point of the enhanced HIPC was in 2007, and the MDRI was also approved in the same year. In addition, two debt restructurings with the Paris Club happened in 2007 and 2008 (the latter with a reduction in face value).

Guinea-Bissau, 2001–2003

Bilateral and multilateral debt restructurings occurred with the decision point of the enhanced HIPC and the Paris Club. The decision point of the enhanced HIPC was in 2001. Moreover, a debt restructuring with the Paris Club happened in 2001, with a symbolic debt restructuring with China in the same year (all including a reduction in face value).

Guinea-Bissau, 2006–2011

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, and the Paris Club. Initiated in 2000, the completion point of the enhanced HIPC was reached in 2010. After that, the MDRI was approved in 2010. Two other debt restructurings also occurred with the Paris Club in 2010 and 2011 (all including a reduction in face value).

Mali, 2001–2006

The country benefited from bilateral and multilateral debt restructurings during the period of the episode, all including a reduction in face value. Debt restructuring occurred under the enhanced HIPC between the decision point in 2000 and the completion point in 2003, and under the MDRI in 2006. Two debt restructurings were also reached with the Paris Club in 2000 and 2003, with additional symbolic debt restructurings with China in 2001 and 2007.

Mozambique, 2006–2007

The country benefited from bilateral and multilateral debt restructurings with the MDRI and private creditors over the period. The MDRI was approved in 2006 and a debt restructuring with private creditors ended in 2007 (including a reduction in face value). A symbolic debt restructuring with China was also reached in 2007 (including a reduction in face value).

Senegal, 2001–2006

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, and the Paris Club. Bilateral and multilateral debt restructurings occurred under the enhanced HIPC and with the Paris Club between 2000 and 2004, before the MDRI in 2006. A symbolic debt restructuring with China also occurred in 2006 (including a reduction in face value).

Sierra Leone, 2002–2007

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, and the Paris Club. The completion point of the enhanced HIPC was in 2002 and its completion point was in 2006. In 2006, the MDRI was also approved. Three debt restructuring episodes with the Paris Club occurred in 2001, 2002, and 2007. A symbolic debt restructuring with China took place in 2007. All these episodes involved a reduction in face value.

Chad, 2000–2008

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC and the Paris Club. The country obtained debt relief under the enhanced HIPC between the decision point in 2001 and the completion point in 2015. A debt restructuring with the Paris Club happened in 2001, and a symbolic debt restructuring with China was reached in 2007 (all including a reduction in face value).

Chad, 2017–2018

Private creditor restructuring occurred over the period 2017-2018. This private creditor restructuring represents the main debt relief during the period of the episode initially identified but does not include a reduction in face value. A symbolic debt restructuring with China happened in 2017.

Togo, 2008–2010

The country benefited from bilateral and multilateral debt restructurings with the enhanced HIPC, the MDRI, and the Paris Club. The Paris Club provided debt relief in 2008, 2009, and 2010. In addition, debt restructuring occurred under the enhanced HIPC between the decision point in 2008 and the completion point in 2010, and under the MDRI in 2010. A minor debt restructuring with China took place in 2007.

Tanzania, 2002–2008

Bilateral and multilateral debt restructurings from the MDRI and private creditors occurred over the period. The MDRI was approved in 2006 and a debt restructuring with private creditors occurred over the period 1984-2004 (including a reduction in face value). The Paris Club also provided debt relief in 2002, and a symbolic debt restructuring with China happened in 2007 (including a reduction in face value).

Zambia, 2021–2022

The period of debt reduction occurred during debt restructuring negotiations. Zambia requested a debt restructuring under the Common Framework for Debt Treatment in early 2021.

D.4 Episodes excluded due to major symbolic debt restructurings with China (above 1.5 percent of GDP)

Guinea-Bissau, 2015–2017

A symbolic debt restructuring with China occurred in 2016, representing 2.4 percent of GDP. Since the symbolic debt restructuring provided a debt relief greater than 1.5 percent of the recipient country's GDP, this episode is excluded from the sample.

D.5 Episodes shortened due to debt restructuring

Cameroon, 2007–2008

The period of debt reduction from 2001 to 2007 is identified as an episode from 2007 to 2008. The country benefited from debt restructuring under the enhanced HIPC between the decision point in 2000 and the completion point in 2006, and the MDRI in 2006. Debt restructurings were also reached with the Paris Club in 2001 and 2006, and restructuring with private creditors occurred over the period 1985–2003 (all including a reduction in face value). A symbolic debt restructuring with China occurred in 2007, but the reduction of the face value was lower (equal to 0.11 percent of GDP, lower than the retained threshold of 1.5 percent). The year 2007 is therefore not excluded from the episode.

Democratic Republic of the Congo, 2011–2023

The period of debt reduction from 2010 to 2023 is identified as an episode from 2011 to 2023. The completion point of the enhanced HIPC was in 2010 and the MDRI was granted during the same year. In addition, a debt restructuring with the Paris Club was reached in 2010. A symbolic debt restructuring with China occurred in 2021 but the reduction in face value was low (0.05 percent of GDP). Therefore, the year 2021 is not excluded from the episode.

Republic of the Congo, 2011–2012

The year 2010 is excluded from an episode, which lasts from 2011 to 2012. The completion point of the enhanced HIPC was in 2010, and the MDRI was approved also in 2010. A debt restructuring with the Paris Club was also obtained 2010.

Comoros, 2000–2008

The period of debt reduction from 2000 to 2013 is identified as an episode from 2000 to 2008. The country benefited from debt relief under the enhanced HIPC between 2010 and 2012, and from the MDRI in 2012. Debt restructurings with the Paris Club occurred in 2009, 2010, and 2013 (including a reduction in face value). Two symbolic debt restructurings with China occurred in 2001 and 2005 but the reductions in face value were low (1.34 percent of GDP in 2001 and 0.46 percent of GDP in 2005, all lower than 1.5 percent). Hence, the years 2001 and 2005 are not excluded from the episode.

Ethiopia, 2008–2009

The period of debt reduction from 2003 to 2009 is identified as an episode from 2008 to 2009. The completion point of the enhanced HIPC was in 2004 and the MDRI was granted in 2006. A restructuring with the Paris Club also occurred in 2004, including a reduction in face value, and a symbolic debt restructuring with China happened in 2007 (including a reduction in face value, but no information on the amount was available).

Malawi, 2009–2010

The period of debt reduction from 2003 to 2010 is identified as an episode from 2009 to 2010. Debt restructuring occurred under the enhanced HIPC between 2000 and 2006, and under the MDRI in 2006. Another debt restructuring with the Paris Club was reached in 2006. An increase in debt ratio in 2007 and 2008 finally leads to a start of this episode in 2009.

Niger, 2007–2011

The period of debt reduction from 2001 to 2011 is identified as an episode from 2007 to 2011. The country benefited from debt relief under the enhanced HIPC between 2000 and 2003, and from the MDRI in 2006. Debt restructurings with the Paris Club has been reached in 2001 and 2004 and a symbolic debt restructuring with China was reached in 2001 (all including a reduction in face value). Another symbolic debt restructuring with China was reached in 2007 (including a reduction in face value, but the monetary value of the cancellation is unknown).

Rwanda, 2007–2011

The period of debt reduction from 2003 to 2011 is identified as an episode from 2007 to 2011. Debt restructuring occurred under the enhanced HIPC between

2000 and 2004, and under the MDRI in 2006. The Paris Club also provided debt restructurings in 2002 and 2005 (including a reduction in face value). A symbolic debt restructuring with China occurred in 2007 (including a reduction in face value, but no information on the amount was available).

Seychelles, 2011–2019

The period of debt reduction from 2009 to 2019 is identified as an episode from 2011 to 2019. The country benefited from a restructuring with the Paris Club in 2009 and with private creditors over the period 2008–2010. A debt restructuring with China was reached in 2011, but without a reduction in face value, and a symbolic debt restructuring with China occurred in 2018 with a low reduction in face value (0.28 percent of GDP). Hence, the years 2011 and 2018 are not excluded from the episode.

Uganda, 2007–2009

The period of debt reduction from 2004 to 2009 is identified as two episodes from 2004 to 2005 and from 2007 to 2009. The country benefited from debt relief under the MDRI in 2006. A symbolic Chinese debt restructuring occurred in 2007 but the reduction in face value was low (0.09 percent of GDP). Therefore, the year 2007 is not excluded from the episode.

Zambia, 2007–2010

The period of debt reduction from 2001 to 2010 is identified as an episode from 2007 to 2010. The completion point of the enhanced HIPC was in 2005 and the MDRI was granted in 2006. Restructurings with the Paris Club also occurred in 2002 and 2005 (including a reduction in face value in 2005), and a symbolic debt restructuring with China happened in 2001, 2006, and 2007 (no information on the amount was available for the restructuring in 2007, so this year is not excluded from the episode).

D.6 Episodes excluded due to data availability constraints

As indicated in Section 4.2, some countries are not included in the sample due to data constraints. Consequently, episodes of debt reduction in these countries have been excluded. These are: Burkina Faso (2003–2006), Eritrea (2009–2011 and 2018–2019), Liberia (2001–2002 and 2004–2012), Madagascar (2010–2011 and 2016–2019), Nigeria (2000–2008), and São Tomé and Príncipe (2005–2008, 2013–2014, and

2016–2023).

Lesotho, 2004–2005

The period of debt reduction from 2002 to 2005 is included as an episode from 2004 to 2005. This is because of data restriction for debt decomposition: the stock of debt in foreign currency is only available after 2003.

D.7 Episodes included in the presence of minor debt restructurings

Central African Republic, 2015–2020

The country benefited from two minor symbolic debt restructurings with China during the episode. The first debt relief in 2017 represented 1.44 percent of GDP and the second reached in 2019 amounted to 0.12 percent of GDP. These two restructurings were lower than the threshold of 1.5 percent of GDP and hence these years are not excluded from the episode.

Cameroon, 2007–2008

A minor symbolic debt restructuring with China occurred in 2007, representing 0.11 percent of GDP. Therefore 2007 is retained as the beginning of the episode.

Democratic Republic of the Congo, 2011–2023

A minor symbolic debt restructuring with China occurred in 2021, equivalent to 0.11 percent of GDP. Therefore, the year is not excluded and the episode extends to 2023.

Comoros, 2000–2008

Two symbolic debt restructurings with China occurred in 2001 and 2005, but the reductions in face value were low. These restructurings represented 1.34 percent of GDP and 0.46 percent of GDP, respectively. Hence, the years 2001 and 2005 are not excluded from the episode.

Cabo Verde, 2005–2009

A symbolic debt restructuring with China occurred in 2007, but no information on the amount was available. As the monetary value of the cancellation is unknown,

we follow [Horn et al. \(2022b\)](#) and consider that this debt relief involves very small amounts, therefore not sufficient to exclude this year from the episode.

Cabo Verde, 2016–2019

A minor symbolic debt restructuring with China occurred in 2016, representing 0.08 percent of GDP. 2016 is therefore set as the beginning of the episode.

Equatorial Guinea, 2000–2008

Two symbolic debt restructurings with China occurred in 2001 and 2006, but the amount of the restructuring is unknown. Hence, these years are not excluded from the episode.

Mozambique, 2017–2019

A minor symbolic debt restructuring with China was reached in 2017, equivalent to 0.25 percent of GDP. 2017 is therefore not excluded from the episode.

Mozambique, 2021–2023

A minor symbolic debt restructuring with China occurred in 2016, representing 0.23 percent of GDP. The year 2021 is therefore retained as the beginning of the episode.

Mauritius, 2016–2017

The symbolic debt restructuring reached with China in 2016 was low, representing only 0.08 percent of GDP. 2016 is therefore retained as the beginning of the episode.

Niger, 2007–2011

A symbolic debt restructuring with China occurred in 2007, but the monetary value of the cancellation is unknown. In this case, for the reason explained above, 2007 is not excluded from the episode.

Rwanda, 2007–2011

A symbolic debt restructuring with China occurred in 2007, but no information on the amount is available. 2007 is therefore considered as the beginning of the episode.

Seychelles, 2002–2006

Three debt restructurings with China occurred in 2003, 2004, and 2006, but without a reduction in face value. These debt restructurings consisted of debt rescheduling only.

Seychelles, 2011–2019

A minor symbolic debt restructuring with China occurred in 2018, representing 0.29 percent of GDP. 2018 is therefore not excluded from the episode. Moreover, a debt restructuring with China occurred in 2011, but without a reduction in face value.

Chad, 2017–2018

The country reached a symbolic debt restructuring with China in 2017 and with private creditors over the period 2017-2018, all without a reduction in face value. As these restructuring did not lead to a reduction in face value, we did not exclude these years from the episode.

Uganda, 2007–2009

A minor symbolic debt restructuring with China occurred in 2007, representing 0.1 percent of GDP. The year 2007 is retained as the beginning of the episode.

Zambia, 2007–2010

A symbolic debt restructuring with China occurred in 2007, but no information on the amount is available. 2007 is therefore considered as the beginning of the episode.

Zimbabwe, 2010–2013

The country reached a debt restructuring with China in 2010 and 2012 without a reduction in face value. As these restructuring did not lead to a reduction in face value, these years are not excluded from the episode.

CHAPTER 0

General Conclusion

Over the past few decades, developing countries have faced—and continue to face—a persistent challenge. Indeed, they have to find strategies to finance development in the presence of large spending needs while preserving macroeconomic stability and debt sustainability. Despite the potential benefits of natural resource endowments, the literature has found that many developing countries with abundant natural resources have experienced low revenue mobilization, weak growth performance, fiscal fragility, and recurrent episodes of debt accumulation. This paradox has favored an extensive literature on the resource curse, with a large part of this literature focusing on the analysis of its determinants. This research has pointed out governance and institutional quality as one of the main determinants of the resource curse.

Due to its importance as highlighted in the literature, this thesis positions itself within the strand of the literature that emphasizes the role of governance and institutional quality. Then, the thesis contributes to the literature by examining how improving governance in natural resource management influences development financing and public debt dynamics in developing countries. The thesis adopts an integrated macro-fiscal perspective, combining policy-specific evaluation with broader macroeconomic analysis.

The first three chapters of the thesis focus on the Extractive Industries Transparency Initiative (EITI) as a prominent governance reform to empirically investigate how transparency-oriented governance reforms influence resource revenue mobilization, economic growth, and public debt dynamics.

In [Chapter 1](#), we evaluate the effects of implementing the EITI on resource revenue in developing countries, applying the dynamic heterogeneity-robust DID estimator proposed by [De Chaisemartin and d'Haultfoeuille \(2020; 2024\)](#) to account for heterogeneous and dynamic treatment effects. The study conducted on a sample of 83

developing countries over the period 1995 to 2019 shows that EITI implementation increases resource revenue, with statistically and economically significant effects. Additionally, we find that the annual effects remain significant over time, up to 10 years after EITI membership. Finally, the transmission channel analysis suggests that improvements in the investment climate and increases in foreign direct investments and extractive resource exports could be considered as the main channels through which EITI implementation increases resource revenue.

[Chapter 2](#) examines how implementing the EITI affects economic growth in developing countries. The analysis considers 99 developing countries over the period 1995-2019 and applies the heterogeneity-robust difference-in-differences estimator. The main finding shows that implementing the EITI promotes economic growth. Most interestingly, the analysis of EITI's dynamic effects provides evidence that these effects occur only in the short and medium terms, while the effects remain non statistically significant in the long term. Furthermore, the analysis of the transmission channels suggests that the increase in foreign direct investment and the rise in resource revenue represent the main transmission channels. Lastly, we investigate four possible explanations behind the EITI's mixed results on long-term growth: the lack of evidence of a negative relationship between natural resource abundance and long-term economic growth, a possible increasing reliance on non-resource taxes, a possible signaling effect targeted by member countries, and the lack of effect of EITI implementation on reducing corruption.

In [Chapter 3](#), we analyze the relationship between EITI implementation and debt-to-GDP ratios. The analysis uses a panel of 69 natural resource-dependent developing countries over the period 1995 to 2021 and applies the dynamic heterogeneity-robust difference-in-differences estimator. We find that implementing the EITI reduces government debt-to-GDP ratios, with statistically and economically significant effects. Finally, by empirically analyzing some underlying mechanisms, we provide evidence that the improvement in the investment climate, the rise in government resources and total revenues, and increases in foreign direct investment and domestic private investment (by providing diversified sources of financing and fostering robust economic growth) may represent valid transmission channels through which EITI implementation reduces debt-to-GDP ratios.

The last chapter of the thesis explores the conditions under which debt stabilization and consolidation episodes have been achieved in Africa over the last two decades. Indeed, [Chapter 4](#) explores the evolution of public debt in Africa between 2000 and 2023. Analysis of quantitative and historical data from 39 countries shows that debt consolidation in the region has been much more prevalent than is usually thought,

even outside debt restructuring episodes. Furthermore, applying the accounting approach of the International Monetary Fund to decompose public debt dynamics into six contributors, the results suggest that macroeconomic stability is important for debt consolidation, characterized by high growth, sound public finances, a relatively stable and well-aligned exchange rate, and limited stock-flow adjustments. Finally, we use a logistic regression framework to explore the potential correlates of debt stabilization and consolidation episodes in the region, and the results suggest that both a supportive external environment and domestic public policies seem to contribute to the occurrence of debt consolidation.

This thesis makes several contributions to the literature. First, the thesis provides evidence that governance reforms in extractive industries (like the EITI) strengthen fiscal capacity by improving resource revenue mobilization and reducing opportunities for revenue misappropriation ([Chapter 1](#)). This paper offers valuable insights into the literature on development finance by highlighting the central role that good governance in the extractive sector can play. Second, the thesis shows that improvements in natural resource governance are associated with stronger economic growth over the medium term ([Chapter 2](#)). These findings highlight the importance of governance as a central conditioning factor in the resource-growth literature. Third, the thesis makes a novel contribution to the study of public debt in natural resource-dependent economies. Indeed, it shows that governance reforms in extractive industries influence public debt, extending existing work that focuses primarily on commodity price shocks ([Chapter 3](#)). Fourth, the thesis provides a methodological contribution to the literature on the EITI's impact evaluation. By consistently applying estimation strategies that account for heterogeneous and dynamic treatment effects, the thesis demonstrates that the impacts of transparency-based reforms evolve over time ([Chapters 1, 2, and 3](#)). This approach addresses key limitations in earlier empirical studies and provides a framework that can be applied to the evaluation of other institutional and governance reforms. Finally, the exploration of debt stabilization and consolidation episodes further clarifies the macroeconomic conditions under which such reforms can support sustained debt reduction ([Chapter 4](#)). Taken together, these contributions show that natural resources are neither a curse nor a guarantee of development financing. Importantly, outcomes depend on governance structures, macro-fiscal conditions, and the responsible use of resource revenue.

This thesis has several implications for policymakers. First, improving governance in natural resource management can play an important role in fostering public finances

and growth in developing countries while helping to better manage public debt dynamics in natural resource-dependent developing countries. Indeed, governance reforms aimed at improving transparency in the extractive sector, such as those promoted under the Extractive Industries Transparency Initiative (EITI), appear to be an effective instrument for improving resource revenue mobilization by reducing rent misappropriation and strengthening accountability. Furthermore, a reform like the EITI helps improve resource revenue forecasting. In other words, for countries facing persistent financing constraints, reforms aimed at improving governance in the extractive sector should be considered as an essential complement to broader strategies for Domestic Revenue Mobilization, rather than as isolated transparency initiatives. Second, implementing the EITI significantly helps to limit rent-seeking by increasing detour and extraction revenue capture costs, promoting higher resource exports. Additionally, by improving transparency and accountability, initiatives such as the EITI send credible signals to international investors, contributing to improved investment attractiveness beyond the extractive sector itself. Third, transparency reforms, such as the EITI, help to promote economic growth. However, these effects appear to occur in the short and medium term rather than in the long term. This highlights the fact that implementing the EITI alone is not sufficient to mitigate the negative effects of the resource curse; rather, it is necessary to ensure effective implementation even after compliance is achieved, to have a concrete objective of improving governance, and to ensure that revenues derived from natural resources are used responsibly to finance productive expenditures. Fourth, the thesis findings suggest that improving governance in the extractive sector can help mitigate excessive borrowing during commodity booms and contribute to more favorable debt trajectories. This highlights the necessity to integrate governance reforms into a broader debt-management framework in resource-dependent countries. Of course, governance reform like the EITI implementation alone cannot guarantee debt sustainability. Its contribution depends on macro-fiscal conditions, such as prudent borrowing strategies, realistic revenue expectations, and the capacity to implement counter-cyclical fiscal policy during commodity price volatility. Fifth, the analysis of debt consolidation episodes highlights that successful and durable debt reductions are more likely in contexts characterized by robust growth, sound fiscal adjustment, contained inflation, and limited exchange-rate depreciation. These results suggest that, in countries with high levels of foreign-currency-denominated debt, inflation-based strategies to reduce debt appear particularly ineffective, as they tend to worsen debt ratios through exchange-rate and interest-rate channels. Moreover, for low-income and fragile states, the findings also underline the importance of

international support through concessional financing.

This thesis also provides policy implications for the EITI Board. Indeed, the results indicate that the effectiveness of the EITI depends on the quality and rigor of implementation. It is essential to strengthen disclosure requirements related to revenue allocation and use (including transfers to national budgets, sub-national governments, and state-owned enterprises) because it would enhance the EITI's contribution to development financing. Moreover, as global demand for critical minerals is expected to increase in the context of the energy transition, improving governance in the management of these resources is essential to avoid the emergence of a "new curse of critical minerals". In this regard, the EITI can definitely play an important role.

While this thesis provides new evidence on the role of governance in natural resource management (through the analysis of the EITI implementation) for development financing and public debt dynamics, several limitations should be acknowledged. These limitations do not undermine the validity of the thesis results, but they reflect the inherent constraints of empirical research on governance reforms and macro-fiscal indicators in developing countries. An essential implication is the scope of governance reforms considered in the analysis. Indeed, the thesis focuses on the Extractive Industries Transparency Initiative (EITI). While the EITI is the most widely implemented global standard in improving governance in the extractive sector, it captures only one dimension of a broader and multidimensional concept of governance. Then, the findings should be interpreted as evidence on the effects of transparency-based governance reforms. A central limitation relates to the identification challenges inherent to the evaluation of public policy. EITI adoption is voluntary, and there is heterogeneity in the implementation across countries. The implementation process remains complex as countries differ in terms of political commitment, civil society participation, and implementation quality. Although the thesis uses econometric strategies designed to address staggered adoption and treatment heterogeneity, causal inference in this context remains a challenge. In particular, distinguishing the effects of EITI implementation from other policies remains difficult. The results should therefore be interpreted as indicative of causal relationships rather than as definitive evidence of the effects of the reform isolated. Another limitation is related to data constraints, particularly in the context of developing countries and resource-dependent countries. Data on resource revenue and public debt, which are used as dependent variables in the analysis, and other macroeconomic variables are often subject to measurement error, reporting delays,

and revisions. These data limitations may bias estimates. Moreover, the analysis carried out in this thesis is done at the country-level, and this masks important sub-national dynamics. Resource exploitation, revenue allocation, public investment, and political accountability can all differ substantially across regions within countries. In some countries, sub-national governments, local communities, and state-owned enterprises play essential roles in fostering development outcomes, particularly in federal or decentralized systems. By relying on national-level aggregates, the analysis cannot capture how extractive-sector governance reforms affect regional inequalities, local public finance, or conflict dynamics at the local level. This limitation is closely related to data availability and comparability constraints. For now, while the information disclosed through EITI reports represents a rich source of data covering many extractive activity areas (such as production, value added, and employment), it remains difficult to use these data for cross-country and sub-national empirical analysis. As shown by [Bouterige and Pafadnam \(2024\)](#), EITI member countries do not follow harmonized reporting standards as they rely on different calculation methodologies, apply varying definitions of the extractive sector (including or excluding mining, oil, gas, agriculture, fisheries, or forestry), and face difficulties in distinguishing consistently between industrial and artisanal activities. This lack of harmonization and comparability in EITI-reported data considerably limits the construction of consistent sub-national or sector-disaggregated datasets across countries. Finally, another limitation concerns the analysis of public debt dynamics and debt consolidation realized in [Chapter 4](#) and which comes from the complexity of debt processes in African countries. Indeed, this chapter identifies stylized facts and correlates of debt consolidation episodes in Sub-Saharan Africa, but does not claim strong causal identification of consolidation drivers. Some factors, such as the global financial environment, geopolitical shocks, and conditions attached to international financial assistance, are difficult to model explicitly and may influence debt trends in ways that are only partially accounted for. Consequently, the results of this chapter should be interpreted as indicative patterns rather than causal determinants.

The thesis suggests several avenues for future research. First, while this thesis focuses on macro-fiscal outcomes, future work could examine whether improvements in transparency and accountability in natural resource management translate into reductions in poverty, inequality, and vulnerability, particularly through enhanced public service delivery and social spending. Linking EITI implementation to household-level poverty indicators would provide a more comprehensive assessment of its development effects. Second, as global demand for natural resources evolves

in the context of the energy transition, future research could explore the role of governance reforms in orienting the management of critical minerals. Given the expected increase in demand for minerals essential to renewable technologies and clean energy systems, an important research agenda concerns whether initiatives promoting transparency can help resource-dependent developing countries to avoid the emergence of a "new curse" associated with critical minerals. Third, regarding public debt dynamics, future research could further analyze the factors associated with debt stabilization and consolidation episodes in developing countries, extending the descriptive and correlational analysis conducted in this thesis. In particular, distinguishing between the roles of domestic policies, external conditions, and international financial support in sustaining debt consolidation over time remains an open question. Finally, further research could evaluate the economic and social outcomes of debt stabilization and consolidation episodes in developing countries. While debt consolidation can support macroeconomic stability, its implications for growth, poverty, infrastructure financing, and access to public services deserve closer examination.

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