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Development Financing: Four Essays On External Financing And Domestic Revenue Mobilization In Developing Countries

Abdramane Camara

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**FINANCEMENT DU DEVELOPPEMENT : QUATRE ESSAIS SUR LE
FINANCEMENT EXTERNE ET LA MOBILISATION DES RECETTES INTERNES
DANS LES PAYS EN DEVELOPPEMENT**

**DEVELOPMENT FINANCING: FOUR ESSAYS ON EXTERNAL
FINANCING AND DOMESTIC REVENUE MOBILIZATION IN
DEVELOPING COUNTRIES**

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pour l'obtention du titre de Docteur en Sciences Economiques

par

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Sous la direction de Professeure Mary-Françoise Renard

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À ma mère feu KEITA SITAN

À mon épouse DOUA AKOUA KODIA

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SUMMARY

The achievement of the 17 goals of the 2030 Agenda by developing countries (DCs) is threatened by a considerable financing gap faced by these countries. Thus, domestic resource mobilisation and external financial flows are essential for financing these development goals. Hence, the financing of development in developing countries is at the heart of this thesis. Accordingly, we have divided the thesis into two parts. The first part, consisting of Chapters 1 and 2, is devoted to the mobilisation of domestic tax revenues, while the second part, consisting of Chapters 3 and 4, addresses the issue of incentives to attract foreign direct investment, which represents a significant source of external finance for developing countries.

Chapter 1 analyses the relationship between financial development and non-resource tax revenues in developing countries. Three significant findings emerge from this chapter. First, financial development has a non-linear impact on non-resource tax revenue mobilisation in developing countries in both the long and short run. However, the development of financial institutions affects non-resource tax revenues only in the long run. Furthermore, our results indicate that institutional characteristics are significant for the relationship

between tax revenue and financial development. These findings suggest that a wide range of policies that focus on financial development as a channel for tax revenues may be useless if there is no attention and goodwill for the rule of law and anti-corruption actions. Finally, the government could encourage direct taxation with financial tools.

Chapter 2 looks at the impact of South-South cooperation on non-resource tax revenues in Africa, focusing on Chinese aid to Africa. Our estimation results indicate that Chinese aid encourages non-resource tax revenue mobilisation in Africa. In terms of policy implications, these results help to inform policymakers that South-South cooperation is essential for increasing economic infrastructure and thus improving tax compliance to boost non-resource tax revenue mobilisation in Africa.

Chapter 3 examines the impact of foreign direct investment (FDI) on tax revenue mobilisation empirically in developing countries. Two significant findings emerge from this chapter. First, foreign direct investment positively impacts tax revenue mobilisation in developing countries. However, our results indicate that FDI does not statistically influence tax revenue mobilisation in resource-exporting economies. In terms of

policy, this work shows that the promotion of FDI through tax incentives should consider the role of tax evasion. The results also suggest that it is necessary to substitute or combine these policies with non-tax measures such as subsidies to foreign investors, improvement of the institutional environment, and infrastructure development to attract FDI without a significant loss of tax revenue. In addition, countries should also consider the crucial role of natural resources, agriculture and trade openness in mobilising tax revenues.

Finally, Chapter 4 analyses the effectiveness of corporate income tax rate reductions in attracting net foreign direct investment (FDI) inflows from gold and silver in Africa. Unlike previous studies on the determinants of FDI in Africa, we consider the spillover effects of FDI between countries, as Blonigen et al. (2007) suggested. These results indicate that reductions in corporate income tax rates applied to mining companies will not necessarily attract FDI to gold and silver projects. Furthermore, we find a strategic complementarity in gold and silver FDI flows between countries, suggesting that an increase in host country gold and silver FDI flows can stimulate FDI to gold and silver projects in neighbouring countries.

Furthermore, the results show that infrastructure, government stability, and gold and silver reserves positively impact FDI inflows into the gold and silver sector.

The main lesson from this thesis suggests the need for developing countries, particularly African countries, to intensify their efforts in improving the economic landscape in which taxes are collected by addressing financial development and South-South cooperation, enhancing the quality of institutions and the economic infrastructure of their economies for better mobilisation of non-resource tax revenues. These efforts must be complemented by better management of natural resource revenues for productive investment to support economic growth and streamlining tax incentives to attract foreign investors in the mining sector to limit net tax revenue losses.

Keywords: Non-resource tax revenues, Financial Development, Chinese aid, institutional quality, Foreign Direct Investment, Developing countries.

RÉSUMÉ

La réalisation des 17 objectifs de l'agenda 2030 par les pays en développement (PED) est menacée par un énorme déficit de financement auquel font face ces différents pays. Ainsi la mobilisation des ressources internes et les flux financiers extérieurs deviennent essentiels pour le financement de ces objectifs de développement. Le financement du développement dans les pays en développement est au cœur de cette thèse. Nous avons subdivisé la thèse en deux parties. La première partie, composée des chapitres 1 et 2, est consacrée à la mobilisation des recettes fiscales intérieures, tandis que la seconde partie, composée des chapitres 3 et 4, aborde la question des incitations à attirer des investissements directs étrangers, qui représentent une source de financement extérieure non négligeable pour les pays en développement.

Le chapitre 1 analyse la relation entre le développement financier et les recettes fiscales hors ressources dans les pays en développement. Trois importants résultats ressortent de ce chapitre. Le développement financier exerce un impact non linéaire sur la mobilisation des recettes fiscales hors ressources dans les pays en développement à long et court terme.

Cependant, le développement des institutions financières n'affecte les recettes fiscales hors ressources qu'à long terme. En outre, nos résultats indiquent que les caractéristiques institutionnelles sont significatives pour la relation entre les recettes fiscales et le développement financier. Ces conclusions suggèrent qu'un large éventail de politiques axées sur le développement financier en tant que canal pour les recettes fiscales peut s'avérer inutile si l'État de droit et les actions de lutte contre la corruption ne bénéficient pas d'une attention et d'une bonne volonté. Enfin, le gouvernement pourrait encourager la taxation directe avec des outils financiers.

Le chapitre 2 s'intéresse à l'impact des coopérations sud-sud sur les recettes fiscales hors ressources en Afrique, en se focalisant sur les aides chinoises en Afrique. Les résultats des estimations indiquent que les aides chinoises encouragent la mobilisation des recettes fiscales hors ressources en Afrique. En termes d'implication politique, ces résultats aident à informer les décideurs politiques que la coopération sud-sud constitue un levier important pour accroître les infrastructures économiques et donc améliorer le civisme fiscal afin de booster la mobilisation des recettes fiscales hors ressources en Afrique.

Le chapitre 3 examine l'impact des investissements directs étrangers (IDE) sur la mobilisation des recettes fiscales de manière empirique dans les pays en développement. Deux importants résultats ressortent de ce chapitre. Les investissements directs étrangers exercent un impact positif sur la mobilisation des recettes fiscales dans les pays en développement. Toutefois, dans les économies exportatrices de ressources naturelles, nos résultats indiquent que les IDE n'influencent pas statistiquement la mobilisation des recettes fiscales. En termes de politique, ces travaux montrent que la promotion des IDE par le biais d'incitations fiscales devrait prendre en compte le rôle de l'évasion fiscale. Les résultats suggèrent également qu'il est nécessaire de substituer ou de combiner ces politiques avec des mesures non fiscales telles que des subventions aux investisseurs étrangers, l'amélioration de l'environnement institutionnel et le développement des infrastructures, afin d'attirer les IDE sans grande perte de recettes fiscales. En outre, les pays doivent également tenir compte du rôle crucial des ressources naturelles, de l'agriculture et de l'ouverture commerciale dans la mobilisation des recettes fiscales.

Enfin, le chapitre 4, analyse l'efficacité des réductions du taux miniers d'imposition des revenus des sociétés pour attirer des entrées d'Investissement Directs Étrangers (IDE) dans les secteurs de l'or et de l'argent en Afrique. Contrairement aux études antérieures sur les déterminants des IDE en Afrique, nous prenons en compte les effets de débordement des IDE entre les pays, comme l'ont suggéré Blonigen et al (2007). Ces résultats indiquent que les réductions des taux d'impôt sur les sociétés appliquées aux sociétés minières n'attireront pas nécessairement les IDE vers les projets d'or et d'argent. De plus, nous trouvons une complémentarité stratégique dans les flux d'IDE d'or et d'argent entre les pays, ce qui suggère qu'une augmentation des flux d'IDE d'or et d'argent du pays hôte peut stimuler les IDE vers les projets d'or et d'argent dans les pays voisins. En outre, les résultats montrent que les infrastructures, la stabilité du gouvernement et les réserves des mines d'or et d'argent ont une incidence positive sur les entrées d'IDE dans ces secteurs.

Le message central qui pourrait être tiré de cette thèse est que les pays en développement, en particulier ceux d'Afrique devraient redoubler d'efforts pour améliorer l'environnement

économique dans lequel les impôts sont collectés en faisant la promotion du développement financier et de la coopération sud-sud, en améliorant la qualité des institutions et des infrastructures économiques de leurs économies pour une meilleure mobilisation des recettes fiscales hors ressources naturelles. Ces efforts doivent être complétés d'une part, par une meilleure gestion des recettes tirées des ressources naturelles orientées vers des investissements productifs pour soutenir la croissance économique et d'autre part par une rationalisation des incitations fiscales visant à attirer les investisseurs étrangers dans le secteur minier, afin de limiter les pertes nettes de recettes fiscales.

Mots clés : Recettes fiscales hors ressources, Développement Financier, Aide chinoise, qualité des institutions, Investissements directs étrangers, Pays en développement.

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GENERAL INTRODUCTION

Since adopting the Addis Ababa Agenda Action Plan at the Third International Conference on Financing for Development in 2015, developing countries have placed increasing emphasis on domestic revenue mobilisation, highlighting the role of tax revenues in financing basic infrastructure and public goods and services. Indeed, the 2008 financial crisis has highlighted the vulnerability of developing countries to exogenous shocks and the volatility of external sources of development finance, including export earnings, foreign direct investment, official development assistance and migrant remittances, and the uncertainties surrounding them.

Thus, fighting poverty, improving people's living conditions, creating jobs, and providing adequate infrastructure, health and education services in developing countries requires sufficient, stable and predictable financial resources. For this purpose, relying solely on official development assistance is risky, unstable flows and lack continuity.

The issue of domestic public resource mobilisation has not received the attention it deserves about other sources of finance, but increasing domestic public revenues has emerged as a

necessary step for developing country governments to reduce dependence on external aid and to finance the public expenditure needed to deliver essential services and reduce poverty on a more regular and sustainable basis. In this context, governments, international development institutions and researchers underline the importance of increasing domestic tax revenues to ensure sustainable financing of the development process in developing countries. In practice, some key factors could explain the increasing attention given to domestic tax revenue mobilisation in the policy dialogue in developing countries.

Firstly, the financial and economic crisis of 2008 and the coronavirus crisis (COVID19) in 2019 have demonstrated that external sources of finance, such as aid, are volatile, sometimes subject to shocks in donor countries, and that developing countries cannot, therefore, rely on this source to finance their development sustainably. An economic shock in donor countries could significantly affect development financing through official development assistance (ODA) in recipient countries. ODA is unstable and unpredictable and depends mainly on the economic situation of donor countries, which suggests that a

shock to donor countries could significantly affect development financing in developing countries that rely on ODA. For example, aid flows to developing countries decreased after the 2008 crisis. In contrast, the coronavirus (COVID19) crisis led to an unprecedented increase in ODA. This indicates that domestic resource mobilisation is imperative as developing countries cannot rely on international aid to finance their development. In this regard, developing country governments will have to reduce the share of their budgets founded by ODA to prevent fiscal problems in times of recession in donor countries.

Secondly, developing countries, especially those with low-income levels, using official aid to finance an increasing share of their public expenditure, have to take into account specific considerations: aid-funded projects entail, for example, additional operation and maintenance costs that have to be financed partly or entirely from domestic resources. Therefore, developing countries need to generate enough revenue to finance these costs adequately and thus not compromise the productivity of aid-financed projects. Secondly, as some low-income countries become emerging economies, they will need to

strengthen their revenue collection systems accordingly to finance priorities and pursue an expenditure policy consistent with their strategic priorities as aid declines.

Thirdly, expanding domestic resources could help developing countries meet the challenges of globalisation. Indeed, increased trade liberalisation would lead to a sharp decline in government revenues since, according to Gupta and Tareq (2008), about one-third of non-resource tax revenues come from trade taxes in revenue-rich countries. This suggests that further trade liberalisation would lead to a sharp decline in government revenues. Thus, to mitigate the risk of a decline in resources due to trade liberalisation, governments in developing countries need to mobilise other sources of revenue, notably from domestic sources.

Fourth, developing countries' current financial needs, particularly in Africa, are enormous and urgent. The 2030 Agenda for Sustainable Development and the African Union's Agenda 2063 set out the ambition of African countries to achieve concrete and significant development results for poverty reduction and inclusive prosperity in the coming decades. Based on the poverty and inequality reduction targets

and assumptions made about savings rates, FDI, ODA and remittances, the Economic Commission for Africa (ECA) estimates that the additional financial resources required to achieve the 2030 Sustainable Development Goals range from \$6.5 billion to \$246 billion per year from 2015 to 2030 (UNECA, 2017). In the recent African Economic Outlook 2018, the African Development Bank revealed that Africa's infrastructure needs are estimated at \$130-170 billion per year, leaving a financing gap ranging from \$68-108 billion (AfDB, 2018). Therefore, the continent will need unprecedented domestic revenues to finance the achievement of the Sustainable Development goals within the timeframe of Goal 17.1 "domestic resource mobilisation needs strengthening, including through international support, to improve countries' capacity to raise taxes and other revenues". Besides the economic benefits, taxation increases the incentive for public participation in the political process and enhances the accountability and effectiveness of public spending. Indeed, tax systems are a vehicle for improving the relationship between the government and society and strengthening accountability to citizens. In

other words, determining how to raise taxes is as important as knowing how much they yield.

Moreover, reforms in tax administration to increase revenue mobilisation efforts sometimes inspire reforms in other areas of the public sector. This is essential for developing countries wishing to start their reform process. While developing countries such as those in sub-Saharan Africa cannot have the same tax burden as an industrialised country, they could increase their government revenues by making a more significant effort to mobilise government revenues, promoting their development. The theoretical and empirical literature has identified several factors that influence the fiscal capacity of developing countries. These factors explain the differences in revenue levels and low tax revenue mobilisation in developing countries. We will review brief literature on some of these main factors and the channels that may affect tax revenues in developing countries.

The level of income and imports are two significant factors in tax revenue mobilisation in developing countries. On the one hand, the importance of income level resides in its direct relationship with taxes. As economic development proceeds, tax

instruments diversify, leading to a broadening of the tax base. Moreover, the correlation between this variable and most of the structural and institutional determinants of levy taxes is substantial: for example, administrative capacity increases with economic development. On the other hand, imports are similarly the tax base for several taxes. In the particular case of developing countries, revenues from international trade still account for a large share of tax revenues. Moreover, according to Ebrill et al. (2001), who studied 22 developing countries, more than half of VAT revenues are collected at the import stage. Moreover, collecting tax revenues at the import stage is relatively straightforward and requires less administrative capacity.

The non-tax revenues represent heterogeneous revenues and vary considerably between regions. In addition to income from government property, they include sharing contracts and government aid. As a result, these revenues are subject to considerable volatility and are characterised by high instabilities. This characteristic complicates public policy planning in countries where they are essential. In addition, these revenues can crowd out tax revenues.

Indeed, foreign aid flows can be significant in some developing countries with low tax revenue levels. It can develop aid dependency and even develop the so-called Samaritan dilemma. The crowding-out effect of official aid on fiscal reserves may reflect policymakers' high credibility to international aid promises. It should also be noted that compared to tax revenues, official aid is accompanied by less accountability to the governed. The empirical literature does not agree on the effects of aid on tax revenues. The results vary according to the type of aid. (loans or grants); or conditionality terms.

Revenues from the resource sector can also crowd out tax revenues. A large body of empirical literature establishes a negative relationship between tax revenues and revenues from natural resource extraction (Bornhorst et al., 2009; Crivelli and Gupta, 2014; James, 2015; Jensen, 2011). Jensen (2011), in particular, finds that a 1% increase in the share of resource rents in total government revenue is associated with a 1.4% decrease in the share of tax revenue as a percentage of GDP. For James (2015), this crowding-out effect results from a benevolent government response: An increase in resource revenues implies a decrease in income taxes since the tax rate

equals the marginal utility in private and public consumption. However, Collier (2006) argues that governments tax less and are not scrutinised in resource-rich countries. As a result, policymakers are less accountable to the population for using natural resource revenues. This reduced accountability can manifest itself through inefficient use of public expenditure, distribution for patronage purposes or allocation of benefit to a specific advantage (Robinson et al., 2006; Robinson and Torvik, 2005).

The effectiveness and efficiency of tax collection are determined by the institutions' quality, particularly the tax administration. The implementation of the tax process can be categorised into four distinct phases: Drafting and promulgating tax regulations; Identifying taxpayers and collecting information on them; Assessing liabilities, tax disputes and enforcement; and Collection. Weak tax administration capacity may exist at each stage, resulting in a hampered process.

Creating a culture of tax compliance can be critical to increasing revenue. This culture of tax compliance is analysed in the literature by the "moral tax". The moral tax represents voluntary compliance with tax rules and creating a social norm

of compliance. Of course, enforcement is the primary driver of tax compliance. However, moral tax significantly improves tax compliance. Luttmer and Singhal (2014) review five main channels through which tax morality operates: Intrinsic motivation, reciprocity, peer and social influence effects, long-term cultural factors, and limits to rationality. The importance of fiscal rectitude depends on the enforcement environment as the two interact. His analysis shows that tax ethics play an important role in tax compliance in developed countries. However, there is little consensus on tax morale's effects and empirical significance (Besley and Persson, 2014). Another limitation of the analysis of this factor is that the estimates vary across countries, and the results are not very generalisable in addition. Recent initiatives designed to improve tax morale have had mixed results. However, the importance of tax morale in understanding differences in tax revenue levels should be noticed.

The tax system and revenue collection design depend on the economy's structure in developing countries. In low-income countries, the informal sectors are large and inherently difficult to tax. This reflects the size of these sectors and the

organisation of traditional activities. The most obvious example is the primary sector. Many developing countries still derive a large share of their production from this sector. In addition to being difficult to tax, many businesses in this sector often benefit from exemptions. As a result, this can reduce the indirect tax base.

The relationship between taxation and informality is twofold. On the one hand, the tax system can lead to informality: avoiding taxes is an essential motive for informality (La Porta and Shleifer, 2014). On the other hand, informal activity undermines verification mechanisms and reduces tax revenues. For instance, everyday practices obstruct the implementation of deduction at source mechanisms, which facilitate the cross-checking of tax returns between individuals and businesses. In addition, a large informal sector may indicate that the elasticity of taxable income concerning the level of taxes is very high (Besley and Persson, 2014). The authors explain that if the government tries to increase taxes in such a configuration, the taxable income reported to the government may fall considerably.

However, financial development, also a determinant of tax collection, could offset the adverse effects of informality on tax collectors. Financial development associated with access to credit allows economic agents to pursue profitable projects and improve information systems on economic activities (Gordon and Li, 2009). Furthermore, financial development combined with a reduction in informality reduces the investment cost of reforms to improve the tax system.

To attract capital, several countries engage in horizontal tax competition, which results in a reduction of tax revenues (Crivelli et al., 2015). The incentive of attracting capital may also explain some incoherence in tax regimes in developing countries, particularly some of the various tax incentives. For example, many sub-Saharan African countries have reduced rates or tax exemptions. These practices lead to regressivity in the tax system as they disproportionately benefit the more profitable and larger companies.

Tax havens also prevent taxes that would otherwise have to be paid by allowing taxpayers to reallocate taxable income to the low-tax jurisdiction. Price shifting or investment from borrowing in low-tax jurisdictions can be one way of doing this.

(Dharmapala, 2014; Dharmapala and Hines, 2006). Crivelli et al. 2015 estimated a revenue loss to governments of around \$200 billion for non-OECD countries.

This thesis aims to contribute to the literature on domestic tax revenue mobilisation, the role of FDI and its attractiveness in the prospect of financing development in developing countries. Furthermore, it assesses the new way in which domestic tax mobilisation could be improved. It also pays attention to the relationship between Foreign Direct Investment (FDI) and taxation, particularly the natural resources sectors.

The thesis consists of two-part. Each part consists of two chapters. In the first part of this thesis, we empirically analyse some factors and channels that could influence tax revenue mobilisation. We examine the role of financial development and cooperation south-south in tax revenue mobilisation. More specifically, we are interested in the relationship between financial development and non-resource tax revenue mobilisation in developing countries and between Chinese aid and non-resource tax revenue in Africa. As a result, the first chapter of this part (chapter1) investigates the impact of financial development on non-resource tax mobilisation in

developing countries. We explore further whether the effects of financial development on non-resource tax revenues depend on the quality of institutions. Besides, we analyse the non-linearity of this relationship. The second chapter (chapter 2) examines if cooperation south-south could crowd out non-resource tax revenue in Africa. Finally, we focus on the impact of Chinese aid on non-resource tax revenue mobilisation.

The second part of this study focuses on external sources of development finance. While underlining the importance for developing countries to increase domestic tax revenue mobilisation, it is necessary to note that the issue of external sources of finance also requires reflection. These countries could continue to finance part of their development through external financial flows such as FDI. Concerning FDI, experience on the ground shows that African countries offer too many fiscal incentives to attract investors in the natural resource sector. As each country provides tax incentives to attract FDI, these incentives could lead to tax revenue losses for these countries through tax evasion. Therefore, the first chapter of this part (chapter 3) analyses the impact of FDI on tax revenue mobilisation empirically in developing countries. It also

examines this relationship by considering the resource exporters' countries and discussing the implication of FDI in direct and indirect tax. The second chapter of this part (chapter 4) analyses the effectiveness of cuts in the corporate income tax (CIT) rate in the mining sector in attracting gold and silver FDI in Africa.

Part 1: Financial Development,
Quality of Institutions, Official
Finance of China and Non-
resource Tax Revenue
Mobilization in Developing
Countries.

Chapter 1: Does financial development matter for tax revenue? Investigating for institutional quality in developing countries

Abstract

This chapter investigates the revenue effects of financial development in developing countries. Using an error correction model approach for cointegration, we find that financial development increases tax revenue in the short run. Furthermore, we find an inverse U-shaped relation between tax revenue and revenue to financial development. However, institutional quality help drain financial development's tax revenue effect in the long run. In addition, appropriate rules of laws and fighting against corruption help increase revenue through a U-shaped relation. Finally, our results also suggest that direct and indirect taxes are most beneficial from financial development. We conclude the study by highlighting that financial development could be an essential intermediate tool for favouring income taxes-oriented tax transition in developing countries.

Keywords: Financial development, Tax revenue, Institutions,
Developing countries.

1. Introduction

A growing literature demonstrates meaningful connections between financial development (FD) and growth, a link that has spurred a further exploration into various aspects of financial development (Beck et al., 2000; Beck and Levine, 2004; De Gregorio and Guidotti, 1995; Demetriades and Hussein, 1996; Khan, 2001; King and Levine, 1993; Levine, 1999; Levine et al., 2000). As a result, financial development has been regarded as an essential factor in conducting economic forwardness. Accordingly, extensive research has been carried out to provide evidence and conditions on the impact of financial development on economic growth. However, little research has been done to identify its effect on tax revenue.

A fundamental constraint for taxation is that tax administration needs to observe transactions to impose a tax on them. Therefore, a growing literature argues that understanding information flows centrally for effective taxation (Besley and Persson, 2014; Bird and Zolt, 2008; Hondroyannis and Papaoikonomou, 2017; Kleven et al., 2016; Kosonen and Ropponen, 2015; Pomeranz, 2015). The challenge of enforcing

taxation is particularly severe in developing countries, where many transactions in the economy are not readily observable by tax authorities, and it is argued that these limited sources of information can explain some of the key differences in tax revenue between countries (Besley and Persson, 2013; Gordon and Li, 2009).

From a standpoint, the ability of the financial sector to reveal and signal revenues reduces information frictions on taxpayers' income and purchases through financial institutions and financial markets (Ellul et al., 2016). Improvements through better information reduce the firm's incentives to operate underground (Gilbert and Ilievski, 2016). As highlighted by Beck et al. (2014), FD reduces the degree of a firm's tax evasion, as accessing finance is expensive for firms with more excellent tax avoidance practices (Hasan et al., 2014). The development of the financial sector plays an essential role in acquiring information, enforcing contracts and making transactions (Levine, 2005). In conjunction with legal, regulatory tax systems, it facilitates tax enforcement and collection of taxes since it may crowd out shadow economy (Bose et al., 2012; Capasso and Jappelli, 2013). As financial

institutions develop, more efficient financial instruments enter the market, replacing cash payments that are unobservable by the government (Gilbert and Ilievski, 2016).

Nonetheless, other studies handle the positive financial development on corporate tax avoidance because innovative financial instruments such as derivatives encourage the development of tax planning strategies (Donohoe, 2015; McDonald, 2004; Warren Jr, 2004). A similar issue is discussed by (Desai and Dharmapala, 2006, 2009), highlighting the positive between tax avoidance and a firm's stock value. The literature on the effect of financial development on tax revenue is mixed. As Taha et al. (2013) outlined, the relationship must be closely investigated. The apparent negative effect of financial development on tax revenue should raise additional questions on the occurrence of this relationship. The FD-growth literature suggests that the impact of financial development depends on institutions (Asongu and De Moor, 2017; Claessens and Laeven, 2003; Fernández and Tamayo, 2017; Herwartz and Walle, 2014; Law et al., 2013). Existing studies on the tax revenue nexus of financial development have not uncovered such conditions to the best of our knowledge.

This chapter aims to fill the gap by examining the short and long-run linkages between financial development and tax revenue. It exploits a panel of 95 developing countries spanning 1990–2015 and tests whether the institutional framework matters for the long-run tax response of financial development.

Therefore, the study contributes to the literature through three specific objectives: First, we examine the effect of financial development on aggregate and disaggregated tax revenues. Second, we analyse the possibility of a threshold beyond which the financial development effect on tax revenues could change significantly. Third, we examine the extent to which the rule of law or control of corruption could individually influence the above linkage.

The rest of the chapter is divided as follows: Section 2 emphasises the literature review and handles the institutional conditioning factors. In section 3, we present our data followed by some stylised facts. Section 4 focuses on the empirical framework, followed by section 5. Then we deal in section 6 with robustness checks and conclude the chapter in its last part.

2. Literature review

Financial development (FD) can affect tax revenue both directly and indirectly. As a direct channel, FD can increase tax revenue by taxing financial services and facilitating the collection of taxes. In contrast, indirectly, it can increase the transparency of information flows for the tax authority.

The direct effects of financial development include three components of tax revenues: those recovered through the reduction in tax evasion, those, under ordinary law, collected on the financial services through trading of mobile money and new revenues linked to specific taxes on some financial assistance. The reduction of tax evasion results from the visibility of financial flows from standard production units through the acceptance of financial institutions. The most trivial direct effect could come from improving the VAT recovery rate. Indeed, the VAT levied on transactions paid to formal businesses will be better controlled. However, this would require the trader to automatically transmit to the authorities the value of the payments to mitigate the positive effect of the financial service on recovery. In addition, some financial

services can (mobile money) potentially identify a payment but without information on the product components within the payment, which could be subject to different VAT rates.

The second source of direct effects concerns the tax revenues inherent in financial services marketing. Indeed, like most economic activities, the turnover generated by financial services marketing is subject to VAT, as is the profit and the remuneration of the jobs created. However, some financial services, such as (mobile-money services) do not result from the conduit of existing economic activities, except for microfinance institutions' international transfers and financial services. Consequently, the commercialisation of mobile-money services provides the country with additional fiscal resources through VAT and income taxes levied on mobile-money operators.

The third source of direct effects is the taxation of transfers between informal enterprises. In economies dominated by the informal sector, these transfers could reflect informal trade outside the tax base and include "informal" payments that would have been subject to taxation (VAT or income tax). However, informal payments are not identifiable in the mass of

transfer flows between informal enterprises. This identification problem requires all transfer transactions between informal enterprises to be considered part of the tax base. Some countries have tried taxing this base directly through excise duty on the volume or value of transfers or through a specific VAT on top of the rate established by general law. Excise duty on the value of transfers was introduced in Tanzania without success (Fehling, 2019; Mhella, 2019). The option of introducing a specific VAT on transfers seems to be more favoured by the government. It is currently implemented in Kenya, Uganda and Ghana. However, its effects on the adoption and use of mobile money are still unknown. In theory, the effect of introducing this tax would be threefold. First, the higher cost of access to mobile-money services could risk excluding the poorest, typically the least banked. Secondly, the specific VAT risks reduce usage unless there is a threshold effect depending on the sensitivity of different user profiles to price. Finally, specific VAT may discourage introducing more innovative services such as savings credit and insurance on mobile phones.

Emerging literature highlights financial development's role on tax nexus, as financial development is a source of information

flows for tax authorities. One aspect of the phenomenon outlined by Hondroyiannis and Papaoikonomou (2017) can be viewed as the payments dematerialising effects of FD. As cash transactions facilitate tax evasion, efficient financial tools such as checks and cards are likely to increase the probability of detection, leading to greater tax compliance. The new agenda for tax reform in developing countries prescribes a broad tax base, with increased reliance on income taxes. Thus, the government must sufficiently monitor receipt of income, a complex puzzle in a country with opaque financial systems. Efficient income tax collection is impossible if income is received and spent like cash. If, instead, a country has a robust, transparent, and widely used banking system, the government has a great facility to tax either income or purchases (Gilbert and Ilievski, 2016). Why are companies doing less tax evasion? In explaining part of such an issue, Beck et al. (2014) emphasise the role of financial sector dissemination. They put forward the argument that higher bank branch penetration leads to better credit information sharing among lenders and reduce information asymmetries and agency conflicts, thus increasing the opportunity costs of tax evasion. Literature suggests that

better information sharing is associated with lower transaction costs (Majnoni et al., 2004), explaining the increases in opportunity costs of tax evasion (Beck et al., 2014). More transparent firms enjoy better access to finance (Ellul et al., 2015). This medium means that firms are more likely to under-report sales in economies with underdeveloped credit markets because they gain little from being formal (Johnson et al., 2000). In addition, information related to corporate misconduct is easily observed in a well-developed financial system and shared among all potential lenders, which will make it more difficult to evade taxes (Jappelli and Pagano, 2002). Besides, Hasan et al. (2014) show that firms with more significant taxes avoidance incur higher spreads when obtaining bank loans.

Furthermore, Capasso and Jappelli (2013) provide a theoretical assessment of the relationship between financial development and tax revenue through the effect of FD on the size of the underground economy. In their theoretical framework, agents allocate investment between a low-return technology that can be operated with internal funds and a high-return technology which requires external finance. Firms can reduce the cost of funding by disclosing more assets and pledging them as

collateral. They show that financial development, viewed as a reduction in the cost of external finance, increases the likelihood of firms to signal their assets and comply with tax obligations when they become more high-tech projects-dependent. Thus, as financial institutions develop, it increases the opportunity cost of firms to operate underground. A similar conclusion about the ousting effect of the shadow economy by the financial sector development is provided by (Blackburn et al., 2012; Bose et al., 2012).

Still, financial development is also concerned about stock market development. Balima et al. (2016) focused on the effect of bond markets initiation on tax revenue in developing countries. They highlight that bond market development can directly impact government tax revenues from one standpoint. They can generate other taxes, such as profits and capital gains taxes. The need to attract new bond markets investors encourages governments to increase fiscal and tax performance by reforming the tax system to fight against tax evasion and corruption. From another standpoint, they show that the presence of a bond market could exert an adverse effect on tax revenue mobilisation. Raising funds from bond issues could lead

governments to substitute domestic tax revenues with market resources.

Other studies focus on tax planning strategies that suggest innovative financial instruments such as derivatives. Donohoe (2015) documents a derivatives-based tax avoidance by firms that use financial derivatives. His study points out that financial derivatives are a leading source of corporate tax non-compliance. The basic underlined idea is that, even if derivatives help firms manage risks, as a notoriously complex and ambiguous area of tax law, they also help promote tax avoidance. According to Donohoe (2015), there are two types of tax avoidance. First, a benign by-product of risk management, as theory suggests that risk hedging can reduce taxes by reducing the volatility of taxable income. The second kind is the result of companies aggressively navigating the widespread ambiguity of derivatives taxation (Schizer, 1999). The fiscal code adopts a category-based approach to taxing derivatives by stipulating regulations for only a few types of instruments. Nevertheless, as derivatives can duplicate any underlying asset's economic profile and generate innovative economic profiles, such sophisticated instruments do not fit

neatly into a categorical tax system. Many are perfectly legal, while others aggressively push the boundaries of tax law (Donohoe, 2015). Similar conclusions are derived from (McDonald, 2004; Warren Jr, 2004); and from (Desai and Dharmapala, 2006, 2009), the latter highlighting the positive between tax avoidance and a firm's stock value.

Very few empirical studies have been conducted about the tax revenue effects of financial development. Gilbert and Ilievski (2016) empirically assess the effect of banking sector outreach on tax revenue in developing countries and find that the more significant banking sector is associated with more tax revenue. They explain their results by a theoretical framework in which government can raise more revenue by making the banking sector more attractive through an infrastructure that raises deposit velocity. According to their explanations, the increase in bank deposits or banks as a basis for economic transactions acts as a source of government information. Therefore, governments in developing countries should consider the benefits of increasing deposit velocity via laws and infrastructure that support checks and electronic forms of banking. Besides, they must try to ease deposits by lowering

the marginal tax rate (Gilbert and Ilievski, 2016). Balima et al. (2016) use propensity score estimates to evaluate the effect of introducing a bond market on tax revenue in developing countries and find out that a bond market significantly fosters tax revenue in these countries. They argue that bond markets provide valuable information on the government's solvency for bond markets participants and oblige them to increase their tax performance to attract new bond investors. Taha et al. (2013) investigate the relationship between direct tax revenue and banking and non-banking sector activities in Malaysia using the ARDL bounds approach of cointegration on monthly data covering the period 1997-2008 and find out a short and long-run linkage between stock market activities and direct tax revenue in this country. However, an essential point of their results is that the impact of the financial sector on tax revenue is more profound in the short run than its effects in the long run.

3. Data and stylised facts.

Financial development: Several indicators have been used in the economic literature to measure financial development. The two

most widely used indicators, as they are available for many developing countries over a long period, are liquid assets relative to GDP and credit extended by financial intermediaries (excluding central banks and government agencies) to the private sector relative to GDP. These two indicators do not have the same meaning. The former has the advantage of its generality and considers the effect on the development of the monetarisation of the economy. Because it excludes credit to the public sector, the latter represents more precisely the role of financial intermediaries in financing the productive sector. However, this indicator is partial since it does not consider financing by the financial market, which is essential in some developing countries. We take advantage of a new composite index introduced by the IMF Strategy Policy and Review Department constructed from various indicators of financial systems using the principal component analysis (PCA). About Svirydzenka (2016), the index accounts for financial development multidimensionally, involving banking and non-banking institutions and stock markets development. Three dimensions of these systems are considered in computing the index: their depth, access and efficiency.

Banking sector depth is restricted to private sector credit to GDP, and non-banking institutions depth involves pension and mutual fund assets to GDP and life and non-life insurance premiums to GDP. Financial institution's access and efficiency sub-index are more bank-specific, given the lack of data on other financial institutions and involve the number of bank branches and ATMs per 100000 population, the number of bank accounts per 1000 adults, per cent of firms with a line of credit, and usage of mobile phones to send and receive money, concerning access. Financial institution's efficiency relies on three aspects of bank efficiency: (i) efficiency in intermediating savings to investment (net interest margin; lending-deposit spread), (ii) operational efficiency measures (non-interest income to total income; overhead costs to total assets), (iii) profitability measures (return on assets and return on equity). Data used in computing financial institutions sub-index come from the World Bank FinStats (2015) except ATMs from the IMF's Financial Access Survey (2015).

The financial markets sub-index focuses on stock markets development. The depth sub-index includes stock market capitalisation, stocks traded to GDP, and the debt securities of

sovereigns and corporations. The percentage of market capitalisation outside of the top 10 largest companies and the total number of issuers of debt in a given year per 100000 population accounted for markets access. Financial market efficiency relies on the stock market turnover ratio and the tightness of the bid-ask spread, but the latter did not enter the index given poor coverage of data (Svirydzenka, 2016). While data on stock markets development come from the World Bank Fin- Stats (2015), debt data come from the Bank for International Settlements (2015) for sovereigns, and Dialogic corporate debt database (2015), for debt securities of corporations.

Following the standard three-step approach in the literature on reducing multidimensional data into one summary index (normalisation of variables; aggregation of normalised variables into sub-indices; aggregation of sub-indices into a final index), the final FD-index is a continuous variable that lies between [0-1] with the most significant value implying more developed financial systems.

Revenue data: Revenue data comes primarily from the International Center for Tax and Development (ICTD, 2018), which presents a complete view of government revenue and tax trends over time. The dataset combines data from several major international databases and draws on data compiled from all available International Monetary Fund (IMF) Article IV reports. It achieves marked improvements in data coverage and accuracy, including a standardised approach to revenue from natural resources. In line with Brun and Diakite (2016) studies, we focus on non-resource tax revenue to purge the effect of resource endowment on a country's tax revenue.

Governance quality indexes are taken from the world governance indicators (WGI) database (Kraay et al., 2010). The index is based on six governance indicators: voice and accountability, political stability and absence of violence, government effectiveness, government regulatory quality, the rule of law, and control of corruption. Unlike the study of Le et al. (2016), which use the arithmetic mean of the indicators to proxy governance quality, we used separately three dimensions of governance quality, namely: government effectiveness, the rule of law, and control of corruption to account for the ability

of governments to formulate and implement policies including sound financial policies effectively, and the respect of citizens and State for the institutions that govern their financial and social interactions. Each indicator is ranged between [-2.5; 2.5] with more excellent value implying more quality of governance. The advantage of this database is that it goes with a percentile rank, where we can observe countries' percentile ranges according to the quality of the interested institutional variable.

Macroeconomic variables such as GDP per capita, trade openness, agriculture value-added in the percentage of GDP that primarily explains a country's tax potential are sourced from the World Development Indicator (WDI, 2018).

Since this chapter aims to visit the tax revenue effects of financial development, we wish to provide some stylised facts by depicting the Map of Financial Development and confronting tax revenue features in developing countries.

Figure 1 shows that most African countries have the lowest tax revenue level in underdeveloped financial systems areas, and well-developed financial systems areas (Europe and North America) have an adequate level of tax revenue response.

However, the scatter plot also reveals a non-linear relationship between financial development and tax revenue, emphasising the need to investigate the relationship in developing countries.

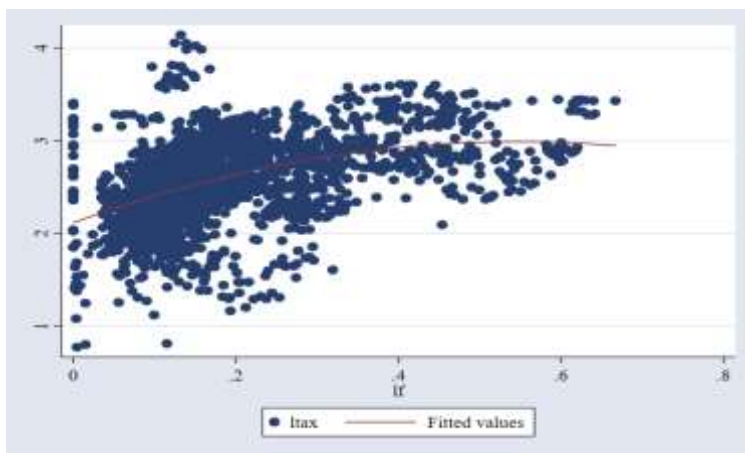
Figure 1: World map of financial development 2013



Figure 2: Tax Revenue 2013



Figure 3: Scatter plot between FD and tax revenue



4. Financial development and tax revenue: Empirical framework

To examine the link between financial development and tax revenue, we use a panel dataset covering 95 developing countries for which we have data spanning the period 1990-2015. Our main objective is to investigate short and long-run linkages between these two variables, exploiting the cointegration properties of our data. Specifically, we run panel unit root tests to investigate for stationarity, then apply an

error correction model to examine the relationship in case of cointegration.

4.1 Initial analysis.

4.1.1 Panel unit root tests.

Several panel units roots tests are developed in the time series literature. The called first-generation panel unit root tests, suggested by Choi (2001), Im et al. (2003), Levin et al. (2002), and Maddala and Wu (1999), focused on panel data where the errors are cross-sectionally uncorrelated. The second-generation panel unit root tests focused on the case where the errors can be cross-sectionally correlated (Pesaran, 2007; Pesaran et al., 2013). Cross-section dependence can be defined as a contemporaneous correlation among individuals after conditioning individual characteristics. Such dependence may arise from unobserved common factors, global shocks, local interactions, or a simple idiosyncratic correlation (Moscone and Tosetti, 2009). The presence of cross-section dependence affects the validity of commonly used panel unit root tests, and stationary tests that assume independence have substantial size bias when this assumption does not hold (Moscone and Tosetti, 2009). Recently, Chudik et al. (2011) introduced weak and

strong cross-section dependence in panel data. They show that if the dependence is relatively weak, it does not need to be considered in the data because its effect is negligible. All tests (first and second generation) are testing the null hypothesis of non-stationary against the alternative of stationary. The test developed by Levin et al. (2002) assumes homogeneity in the autoregressive unit root term across individuals, while Im et al. (2003), Maddala and Wu (1999), and Choi (2001) relax this hypothesis by assuming heterogeneity. Unlike the tests of Levin et al. (2002); and Im et al. (2003) that are based on Dickey-Fuller regressions, the ones of Maddala and Wu (1999); and Choi (2001) are Fisher tests. They perform Dickey-Fuller tests and Phillips-Perron tests individually. They then combine the P-value of individual tests for the final statistics. In this chapter, we primarily perform unit root tests of Im et al. (2003), Maddala and Wu (1999), and Choi (2001), and secondly, test the dependence assumption with tests proposed by (Pesaran, 2004, 2015). In the case of cross-section dependence, we run second-generation unit root tests thanks to (Pesaran 2007; Pesaran et al., 2013).

4.1.2 Panel cointegration tests.

The use of panel cointegration tests to test for the long-run relationship among integrated variables has received much attention in the empirical literature. Indeed, many studies fail to reject the null (no-cointegration) hypothesis even in cases where theory suggests cointegration. The explanation for this feature is that most residual-based cointegration tests require the hypothesis that long-run parameters for the variables in levels are equal to the short-run parameters for the variables in their differences. This common restriction assumption can cause a significant loss of power for residuals-based cointegration tests (Pesaran and Westerlund, 2008). Therefore, the authors developed panel cointegration tests based on structural dynamics rather than residual dynamics and do not impose common parameters restrictions. The underlined idea is to test whether the error correction term is significantly different from 0. The test is normally distributed and accommodates bootstrap methods' slope heterogeneities and cross-section dependence.

Nevertheless, Pesaran (2006) suggests a panel cointegration technique that deals with cross-section dependence in another

way. It consists of estimating an error correction model and filtering individual-specific regressors through cross-section averages such that asymptotically, as the cross-section dimension N tends to infinity, the differential effects of unobserved common factors are eliminated. A range of estimators called "common correlated effect estimators" (CCE estimators) are put forward and suggested by Pesaran (2006), Chudik and Pesaran (2015), and Banerjee and Carrion-i-Silvestre (2017). To prove the existing cointegration relationships, we run an error correction model and test the significance of the *error correction term*.

4.2 Econometric specification and estimation technique.

The basic equation of interest in our analysis is:

$$Y_{it} = \theta_i + \beta_i X_{it} + \varepsilon_{it} \quad (1)$$

Where Y is tax revenue to GDP, and the matrix of X contains financial development and covariates. All variables are taken in logarithm terms¹ as we are interested in elasticities. The

¹ As the variable 'FD' contains yet positive values, but also many zeros, the natural logarithm would not

parameter β_i allow for heterogeneities across units. We include the unobservable country-specific heterogeneities time-invariant θ_i in the model. In the case of cross-section dependence due to common correlated factors across individuals, the error term involves a specification:

$$\varepsilon_{it} = \lambda_i F_t + \mu_{it} \quad (2)$$

where F_t is a set of unobservable common factors with factor loading λ_i that drive output Y . The data generating process of the error correction model:

$$\Delta Y_{it} = \theta_i + \alpha_i (Y_{it-1} - \beta_i X_{it-1} - \lambda_i F_{t-1}) + \Sigma \gamma_i \Delta X_{it} + \lambda_i \Delta F_t + \mu_{it} \quad (3)$$

The parameter α_i determines the speed of convergence to the equilibrium relationship. If $\alpha_i < 0$, and significant, there is a cointegration relationship among variables and long-run relationships can be interpreted and represented by the

be appropriate for its transformation into Logarithm. Therefore, we use the Logarithm transformation method suggested by Yeyati, Panizza, and Stein (2007), which goes as follows: $Y = \text{sign}(X) * \log(1 + |X|)$

parameter β . The parameter γ represents short-run coefficients.

The model can be rewritten as follow:

$$\Delta Y_{it} = \pi_{0i} + \pi_{1i}Y_{it-1} + \pi_{2i}X_{it-1} + \pi_{3i}F_{t-1} + \sum \pi_{4i}\Delta X_{it} + \pi_{5i}\Delta F_t + \mu_{it} \quad (4)$$

The basic idea is to filter the individual-specific regressors using cross-section averages such that asymptotically if N is large, the differential effects of unobserved common factors are eliminated (Pesaran, 2006; Banerjee and Carrion-i Silvestre, 2017). It permits to replacement of unobservable common factors by the cross-section averages of variables and deals with omitted variables bias that helps reduce endogeneity problems in the model. The model can be rewritten as follow:

$$\begin{aligned} \Delta Y_{it} = \pi_{0i} + \pi_{1i}Y_{it-1} + \pi_{2i}X_{it-1} + \sum \pi_{3i}\Delta X_{it} + \pi_{1i}\overline{Y_{t-1}} + \pi_{2i}\overline{X_{t-1}} \\ + \sum \pi_{3i}\overline{\Delta X_t} + \sum \pi_{4i}\overline{\Delta Y_t} + \mu_{it} \end{aligned} \quad (5)$$

Two main estimators are developed: the common correlated effect means group estimators (CCEMG) and the common correlated pooled mean group (CCEP) estimators (Pesaran, 2006). The estimation approach has the advantage that ordinary least squares can compute it (OLS) applied to an auxiliary regression where the observed regressors are augmented by cross-section averages of the dependent variable

and the individual-specific regressors. Pesaran (2006), Chudik and Pesaran (2015), and Banerjee and Carrion-i Silvestre (2017) show that the mean group estimator is based on the individual-specific CCE estimators is asymptotically unbiased as $N \rightarrow \infty$ for both T fixed and $T \rightarrow \infty$. Similar results are also obtained from a standard pooled version of the CCE estimator (CCEP). In addition, based on Monte Carlo experiments, they show that the CCEP estimator performs better than the CCEMG in small samples. Finally, we run CCEP regressions to identify the short and long-run relationships as we have a limited period. However, Pesaran et al. (1999) have shown that if the pooled mean group's residual is stationary and cross-section independent, there is no urgency to consider the cross-section dependence in the estimation.

5. Results

5.1 Unit root tests and cross-section dependence.

Table 1 shows the results of the unit root test of Im et al. (2003), Maddala and Wu (1999) and Pesaran (2007). Results show that we cannot reject the null hypothesis of non-

stationarity since the p-values of the Pesaran (2007) test that considers cross-section dependence are all above 10%. This table provides the results of the cross-section dependence test. It tests the presence of dependence across individuals and their weak or strong dependency. It indicates that the null hypothesis of cross-section independence cannot be accepted and that the weakness dependency is also to be rejected. Thus, it needs to consider this dependency while estimating our model.

Table 1: Unit root test

	IPS		Maddala Wu		Pesaran	
	Statistic	P-value	Statistic	P-value	Statistic	P-value
ltax	0.6864	0.7538	193.2954	0.4199	2.167	0.985
lfd	-0.6173	0.2685	228.3302	0.0300	2.416	0.992
Lgdp_capita	1.1962	0.8842	118.2631	1.0000	0.350	0.637
ltrade	-0.3210	0.374	195.4309	0.3782	-1.264	0.103
lagriculture	0.9943	0.8400	206.7878	0.1919	-4.422	0.100

Table 2: Cross Section dependence test

Variable	Cross-section dependence		Weak/Strong dependence	
	CD-test	P-value	CD-test	P-value
Itax	30.94	0.000	318.791	0.000
Lfd	111.73	0.000	31.580	0.000
Lgdp_capita	190.77	0.000	320.334	0.000
Ltrade	50.75	0.000	319.843	0.000
Lagriculture	99.40	0.000	298.747	0.000

5.2 General results and cointegration test

5.2.1 Baseline estimate

Table 3 provides results for cointegration relationships between variables in the model. The error correction term and the underlined restoring force back to the equilibrium is negative and significantly different from 0. This result is provided in column 4 of Table 3. It tells the existence of a long-run relationship between financial development and tax

revenue. The convergence speed is close to 7,37%, indicating that 7,37% of short-run disequilibrium are corrected each year to reach the long-run equilibrium. The cross-sectional dependence test (CD test p_value) is above 10%, indicating that the model successfully removed cross-section dependence in the data.

Our results broadly suggest that, while financial development positively impacts tax revenue in the short run, this effect became negative in the long run. The estimated elasticity is close to 0.65, which suggests that a 1% increase in financial development cause revenue increase by 0.65%. Elsewhere, in the long run, we find the estimated elasticity is 0.27. Therefore, the suppression of financial constraints and the broad-based strengthening of the financial system would increase the tax revenue-to-GDP ratio.

Table 3: Financial development and tax revenue

VARIABLES	D.ltax	D.ltax	D.ltax	D.ltax
Short Run				
D.lfd	0.590*** (0.207)	0.646*** (0.220)	0.700*** (0.247)	0.675*** (0.254)
D.lgdp_capita		0.405*** (0.0903)	0.357*** (0.0856)	0.386*** (0.0845)
D.trade			0.00253 (0.0283)	0.0193 (0.0292)
D.lagriculture				-0.0144 (0.0330)
Long Run				
L.ltax	-0.253*** (0.0228)	-0.269*** (0.0213)	-0.274*** (0.0206)	-0.276*** (0.0201)
lfd	0.391*** (0.0750)	-0.633*** (0.0786)	-1.042*** (0.0760)	-1.133*** (0.0745)
lgdp_capita		0.280*** (0.0173)	0.234*** (0.0164)	0.238*** (0.0196)
ltrade			0.343*** (0.0155)	0.310*** (0.0150)
lagriculture				-0.0125 (0.0146)
Observations	2,185	2,185	2,185	2,185
R-squared	0.847	0.772	0.703	0.669
Number of groups	95	95	95	95
CD test statistic	7.816	2.230	0.218	0.0426
p-value of CD test statistic	0	0.0257	0.828	0.966
IPS test statistic	-23.46	-24.49	-25.54	-26.02
p_value IPS test statistic	0	0	0	0

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5.2.2 Accounting for plausible non-linearities

Given the complexity of financial products, it would be interesting to analyse the linearity of the effect of financial development on resource mobilisation. For this reason, we have added the square of the financial development variable. So, if the variable sign is different from the sign of its square, then the effect will be non-linear. Table 4 shows the result of this equation. Furthermore, the coefficients of error correction terms are also significantly negative and more petite than unity (Table 4, columns 5). That implies the existence of cointegration relationships among variables in our model. Our findings indicate that in the short-run financial development effect on tax revenue is statistically positive and non-linear. While in the long run, the FD effects are concave in tax revenue. In addition, the threshold for inflexion is calculated to be 0.27. In other terms, our results show that the inverse U-shaped relation between FD and tax revenue with a threshold for FD index equals 0.27. These results can be attributed to the increase in financial development, which increases its complexity due to the emergence of financial products that can facilitate tax optimisation. Regarding the traditional

determinants of Tax revenue (see columns 5, table 4), in line with our theoretical predictions, we find that GDP per capita is essential for tax revenue mobilisation in developing countries. In addition, our results show that trade openness tends only to have a positive effect.

Table 4: Non-linearities

	(1)	(2)	(3)	(4)	(5)
VARIABLES	D.Idtax	D.Idtax	D.Idtax	D.Idtax	D.Idtax
Short Run					
D.lfd	0.516**	0.509**	0.534**	0.456*	8.046**
	(0.219)	(0.239)	(0.265)	(0.272)	(3.690)
D.lfdsq					-45.50
					(29.58)
D.lgdp_capita		0.385***	0.389***	0.433***	0.412***
		(0.0878)	(0.0852)	(0.0875)	(0.0938)
D.ltrade			0.0662**	0.0794**	0.0831**
			(0.0310)	(0.0319)	(0.0333)
D.lagriculture				-0.0217	-0.0210
				(0.0338)	(0.0350)
Long Run					
L.Itax	-0.0538***	-0.0688***	-0.0708***	-0.0737***	-0.0745***

	(0.00817)	(0.00782)	(0.00744)	(0.00736)	(0.00716)
lfd	0.461***	0.154***	-0.0616**	-0.173***	0.440***
	(0.0217)	(0.0310)	(0.0304)	(0.0295)	(0.0658)
lfdsq					-0.914***
					(0.0945)
lgdp_capita		0.00712**	0.0246***	0.0465***	0.0267***
		(0.00347)	(0.00344)	(0.00398)	(0.00373)
ltrade			0.239***	0.238***	0.200***
			(0.00479)	(0.00483)	(0.00465)
lagriculture				0.0184***	0.00320
				(0.00349)	(0.00338)
Constant	0.140***	0.173***	0.0987***	0.0891**	0.111***
	(0.0193)	(0.0240)	(0.0250)	(0.0355)	(0.0346)
Observations	2,185	2,185	2,185	2,185	2,185
R-squared	0.083	0.164	0.236	0.272	0.323
Number of groups	95	95	95	95	95
CD test statistic	2.728	1.291	0.488	0.393	-0.113
p-value of CD test statistic	0.00636	0.197	0.626	0.694	0.910
IPS test statistic	-32.19	-30.27	-31.55	-29.98	-30.43
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6. Robustness check

In the following sub-section, we undertake several series of Robustness. First, we check our baseline's sensitivity to the disaggregated financial development variable, mainly the financial institution's index. Second, we desegregate tax revenue in direct and indirect tax. Third, we build the sub-sample by institutional patterns and check if our results remain unchanged.

6.1 Disaggregating FD

In addition, the causal effect of specific financial variables on tax revenue seems to be an under-investigated area since previous studies do not sufficiently distinguish between financial institutions and financial markets. Policymakers continue to debate the relative merits of bank-based versus market-based financial systems (Levine, 2002). The study aims to respond to the debate by analysing which bank-based or market-based is suitable for the tax revenue response of FD. Because of the characteristic of our estimator PMG and FD data, we can only analyse the relationship between FD bank-based and tax revenue. Results are provided in table 5 and indicate that bank-based financial systems are increasing tax

revenue directly in the long run. In addition, the results corroborate the concavity of financial development's effect on tax revenue in the long term. The results of control variables remain unchanged.

6.2 Type of tax?

The literature also suggests that the nature of the relationship between financial variables and tax revenue might depend on the types of taxes (Arin et al., 2009). A body of studies document the relationship between financial development and tax policies but analyse this relation at an aggregate level of tax revenue, and they do not identify which tax policy is likely to benefit more from financial development. We aim to fill the gap by analysing the effect of financial development on direct and indirect taxes. We do this by disaggregating tax revenue into direct and indirect taxes. Our results show that while financial development does not influence tax revenue in the short term, in the long term, its effect becomes concave on both direct and indirect taxes (column 5 in table 6 and Table 7). One explanation is that financial development may help discourage the spread of the shadow economy, which is a more challenge

for direct taxes and may extend the taxable basis of the VAT through the trade via mobile money.

6.3 Accounting for institutional patterns

One mechanism through which financial development strengthen taxation is the quality of institutions. Several studies that explored factors that shape tax morale point out institutional quality (Dell'Anno, 2009; Macintyre et al., 2008; Ricciuti et al., 2019; Torgler and Schneider, 2007). Bird et al. (2014) stress that countries may tend to achieve an equilibrium position regarding the size and nature of their fiscal systems that primarily reflects the balance of political institutions and stay at this position until 'shocked' a new equilibrium. While several studies also point out the positive between institutional quality and financial development (Cherif and Dreger, 2016; Emenalo et al., 2018; Fernández and Tamayo, 2017; Ho et al., 2018; Huang, 2010), it is worth emphasising that the long-run tax response of financial development may depend on institutional quality. Institutional arrangements in ameliorating transaction costs characterise the development of the financial sector.

Moreover, the inter-temporal nature of financial contracting requires an institutional framework that promotes stability across time. Thus, financial development would affect tax revenue through better institutions. In countries where the government lacks effectiveness, transparency, and accountability, it cannot be assumed that the obligation of paying taxes is an accepted social norm, even with FD. One aspect of the institutional framework also concerns corruption. Corruption constrains tax revenue by constraining the depth of the financial sector since financial transactions often require mutual trust between agents.

In this section, we aim to deepen the relationship between FD and tax accounting for patterns of institutional quality. We do not introduce non-linearities in the error correction model since we are unsure about the right property and order of integration of an interacting variable of FD with institutional variables. This problem of introducing non-linearities in the error correction model is widely discussed (Eberhardt and Presbitero, 2013). We overcome this difficulty by resampling our data according to institutional quality. We split the data according to the median distribution of institutional variables, namely

rule of the laws and control of corruption, to distinguish high institutional countries from low institutional ones. Results are given in table column 5 in tables 8,9,10, and 11. Our results in these tables show that in the long run, the financial development effect on tax revenue is significantly in the U-shaped in the countries with high control of corruption or high rule of laws. As to the country with a weak corruption-control or rule of laws level, the relationship between tax revenue and financial development takes the inverse U-Shaped. The result shows that control of corruption and the rule of laws have a catalytic role in the relationship between financial development and tax revenue. Our results show that improving the policy and institutional environment is essential to link financial development and tax revenues. Specifically, the marginal impact of the depth of financial institutions on tax revenues

Conclusion

This chapter investigates the tax revenue effect of financial development. Because financial development is an essential tool that helps signal taxpayers' income and purchases and can contribute to the crowd-out shadow economy, we aim to

investigate its revenue effects in developing countries. We find that the inverse U-shaped relation between FD and tax revenue at a both in the short-long run. Moreover, our results are robust in the long run by taking the direct and indirect tax into account. Further, We find the same results when replacing financial development with Financial institutions. Finally, we find that institutional patterns are significant for tax revenue and Financial development relationship. This medium is not surprising since, in countries with better rules of the laws, the capability of enforcing tax contracts and protecting taxpayers' ownerships is better, leading to effective enrollment in tax obligations.

The chapter offers additional insights into the role of the policy and institutional environment in coordinating the role of financial systems in tax revenues. It suggests that promoting good governance through the rule of law and fighting corruption are no longer matters of choice but should be at the heart of government programs if the tax mobilisation capacity of developing countries is to be strengthened in order to lead economies towards the expected levels of growth and sustainable development characterised by a reduction in

poverty and aid dependency. A broad policy mix that focuses on financial development as a channel for tax revenues may be useless if political law and anti-corruption actions are not given strong attention and goodwill. These measures are coupled with practical strategies to increase. Finally, the government might encourage direct taxation with financial tools.

Appendix

Appendix 1 : List of countries

Albania Ghana Niger El Salvador Argentina Guinea Nigeria Guyana
Armenia Guatemala Nepal Colombia Azerbaijan Honduras Pakistan
Ecuador Burundi Haiti Panama Nicaragua Benin Iran. Rep. Peru
Algeria Burkina Faso Jamaica Philippines Botswana Bangladesh
Jordan Rwanda Gabon Belarus Kenya Senegal Dominica Belize
Cambodia Sierra Leone Trinidad and Tobago Bolivia Lao PDR Chad
Indonesia Bhutan Liberia Togo India RCA Sri Lanka Thailand Chile
Lesotho Tunisia Singapore Cote d'Ivoire Morocco Turkey Mongolia
Cameroon Madagascar Tanzania Tonga Congo. Rep. Macedonia
Uganda Comoros Costa Rica Uruguay Cape Verde Cyprus
Mozambique Venezuela Djibouti Vietnam Guinea-Bissau Egypt. Rep.
Mauritius South Africa Zimbabwe Fiji Malaysia Mexique Kazakhstan
Georgia Namibia Dominican R. Mauritania Grenada Ethiopia Malawi
Paraguay Suriname.

Table 5: Results with FD disaggregated in FI

VARIABLES	(1) D.Idtax	(2) D.Idtax	(3) D.Idtax	(4) D.Idtax	(5) D.Idtax
Short Run					
D.lfinancial institutions	0.479*** (0.135)	0.504*** (0.147)	0.481*** (0.156)	0.448*** (0.163)	-0.226 (2.542)
D.lfinancial institutions_sq					-5.745 (8.755)
D.lgdp_capita		0.376*** (0.0886)	0.373*** (0.0848)	0.423*** (0.0871)	0.382*** (0.0949)
D.lagriculture				-0.0257 (0.0344)	-0.0250 (0.0340)
D.ltrade			0.0711** (0.0306)	0.0831*** (0.0317)	0.0870*** (0.0320)
Long Run					
L.ltax	-0.0575*** (0.00904)	-0.0713*** (0.00821)	-0.0728*** (0.00770)	-0.0741*** (0.00758)	-0.0770*** (0.00761)
lfinancial institutions	0.700*** (0.0266)	0.428*** (0.0341)	0.228*** (0.0325)	-0.0227 (0.0307)	1.086*** (0.0815)
lfinancial institutions_sq					-1.834*** (0.117)
lgdp_capita		-0.0120*** (0.00332)	0.00565* (0.00327)	0.0373*** -0.00397	0.0545*** -0.00393
lagriculture				0.0219*** (0.00345)	0.0158*** (0.00338)
ltrade			0.227*** (0.00477)	0.224*** (0.00477)	0.173*** (0.00486)
Constant	0.144*** (0.0197)	0.184*** (0.0240)	0.110*** (0.0261)	0.0960*** (0.0368)	0.0980*** (0.0374)
Observations	2,185	2,185	2,185	2,185	2,185
R-squared	0.082	0.164	0.235	0.272	0.307
Number of groups	95	95	95	95	95
CD test statistic	2.498	0.797	0.107	-0.00329	-0.206
p-value of CD test statistic	0.0125	0.426	0.914	0.997	0.837
IPS test statistic	-32.40	-31.17	-31.62	-30.18	-29.99
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6: Results with Direct Tax

	(1)	(2)	(3)	(4)	(5)
VARIABLES	D.Idirect	D.Idirect	D.Idirect	D.Idirect	D.Idirect
Short Run					
D.IFinancial development	1.356* (0.780)	1.577* (0.868)	1.655* (0.945)	1.678* (0.955)	24.85 (17.26)
D.IFinancial development_sq					-108.3 (67.20)
D.Igdp_capita		0.412*** (0.132)	0.388*** (0.142)	0.473*** (0.135)	0.554*** (0.150)
D.Itrade			0.0245 (0.0463)	-0.000365 (0.0469)	-0.0167 (0.0533)
D.Iagriculture				-0.0189 (0.112)	-0.0382 (0.118)
Long Run					
L.Idirect	-0.0767*** (0.0108)	-0.108*** (0.0110)	-0.108*** (0.0107)	-0.108*** (0.0103)	-0.108*** (0.00924)
IFinancial development	3.563*** (0.0466)	0.831*** (0.0471)	0.771*** (0.0461)	0.527*** (0.0473)	3.367*** (0.117)
IFinancial development_sq					-4.809*** (0.160)
Igdp_capita		0.348*** (0.00705)	0.316*** (0.00695)	0.313*** (0.00692)	0.255*** (0.00642)
Itrade			0.280*** (0.00856)	0.251*** (0.00849)	0.215*** (0.00810)
Iagriculture				-0.0385*** (0.00534)	-0.0688*** (0.00498)
Constant	0.0610*** (0.0108)	-0.157*** (0.0426)	-0.254*** (0.0535)	-0.226*** (0.0649)	-0.186*** (0.0621)

Observations	2,185	2,185	2,185	2,185	2,185
R-squared	0.167	0.223	0.268	0.314	0.356
Number of groups	95	95	95	95	95
CD test statistic	2.171	1.492	0.384	0.534	1.005
p-value of CD test statistic	0.0299	0.136	0.701	0.594	0.315
IPS test statistic	-35.11	-32.63	-32.42	-32.21	-32.12
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses . *** p<0.01, ** . p<0.05, * p<0.1

Table 7: Results with indirect tax

	(1)	(2)	(3)	(4)	(5)
VARIABLES	D.lindirect	D.lindirect	D.lindirect	D.lindirect	D.lindirect
Short Run					
D.lfinancial development	0.598** (0.256)	0.523* (0.278)	0.509* (0.297)	0.498* (0.299)	4.662 (3.388)
D.lfinancial development_sq					-22.06 (14.91)
D.lgdp_capita		0.410*** (0.103)	0.339*** (0.0974)	0.413*** (0.0937)	0.394*** (0.0969)
D.ltrade			0.0509 (0.0398)	0.0471 (0.0443)	0.0510 (0.0444)
D.lagriculture				0.00724 (0.0454)	0.00825 (0.0485)
Long Run					
L.lindirect	-0.0647*** (0.00935)	-0.0836*** (0.00872)	-0.0804*** (0.00864)	-0.0826*** (0.00829)	-0.0867*** (0.00833)
lfinancial development	0.212*** (0.0185)	-0.652*** (0.0297)	-0.753*** (0.0303)	-1.031*** (0.0307)	0.960*** (0.0828)
lfinancial development_sq					-3.639*** (0.119)
lgdp_capita		0.118*** (0.00323)	0.117*** (0.00323)	0.0776*** (0.00359)	0.0569*** (0.00362)
ltrade			0.138*** (0.00526)	0.127*** (0.00527)	0.0932*** (0.00515)
lagriculture				-0.0927***	-0.120***

				(0.00384)	(0.00381)
Constant	0.141***	0.113***	0.0651**	0.120***	0.144***
	(0.0209)	(0.0254)	(0.0284)	(0.0397)	(0.0390)
Observations	2,185	2,185	2,185	2,185	2,185
R-squared	0.085	0.189	0.247	0.286	0.318
Number of groups	95	95	95	95	95
CD test statistic	1.726	0.729	0.248	-0.116	0.343
p-value of CD test statistic	0.0844	0.466	0.804	0.908	0.732
IPS test statistic	-35.96	-36.23	-35.80	-35.13	-34.79
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 8: Results with Control of corruption above

VARIABLES	(1) D.Idtax	(2) D.Idtax	(3) D.Idtax	(4) D.Idtax	(5) D.Idtax
Short Run					
D.Ifancial development	0.947*** (0.312)	0.583** (0.259)	0.450* (0.261)	0.174 (0.174)	1.611 (2.364)
D.Ifancial development_sq					-3.265 (8.369)
D.lgdp_capita		0.435*** (0.101)	0.411*** (0.104)	0.491*** (0.111)	0.510*** (0.109)
D.Itrade			0.0404 (0.0432)	0.0604 (0.0474)	0.0483 (0.0509)
D.lagriculture				-0.0321 (0.0343)	-0.00677 (0.0341)
Long Run					
L.Itax	-0.0390*** (0.00957)	-0.0597*** (0.00876)	-0.0548*** (0.00820)	-0.0588*** (0.00923)	-0.0607*** (0.00922)
Ifinancial development	-0.440*** (0.0263)	-0.989*** (0.0545)	-1.501*** (0.0525)	-1.133*** (0.0528)	-2.731*** (0.0989)
Ifinancial development_sq					2.449*** (0.105)
lgdp_capita		0.0400*** (0.00637)	0.0926*** (0.00631)	0.103*** (0.00753)	0.110*** (0.00617)
Itrade			0.000272 (0.00596)	0.0256*** (0.00605)	0.0543*** (0.00429)
lagriculture				0.0695***	0.0464***

				(0.00524)	(0.00368)
Constant	0.114***	0.157***	0.126***	0.109*	0.117***
	(0.0272)	(0.0414)	(0.0433)	(0.0589)	(0.0446)
Observations	1,090	1,063	1,026	1,007	961
Number of groups	61	56	51	49	45
CD test statistic	4.138	1.997	1.011	0.488	0.680
p-value of CD test statistic	3.51e-05	0.0458	0.312	0.626	0.497
IPS test statistic	-20.60	-18.80	-19.58	-16.64	-16.13
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 9: Results with CCE_Below

	(1)	(2)	(3)	(4)	(5)
VARIABLES	D.Idtax	D.Idtax	D.Idtax	D.Idtax	D.Idtax
Short Run					
D.lfinancial development	0.454 (0.387)	0.541 (0.480)	0.617 (0.571)	1.003* (0.558)	11.84 (9.241)
D.lfinancial development_sq					-83.24 (69.98)
D.lgdp_capita		0.324* (0.169)	0.213 (0.167)	0.330* (0.170)	0.240 (0.195)
D.ltrade			0.0110 (0.0557)	0.0524 (0.0541)	0.0594 (0.0600)
D.lagriculture				-0.0369 (0.0830)	-0.0755 (0.0964)
Long Run					
L.Itax	-0.0629*** (0.0211)	-0.0796*** (0.0169)	-0.0891*** (0.0199)	-0.0784*** (0.0154)	-0.0858*** (0.0126)
lfinancial development	1.595*** (0.0986)	1.865*** (0.0780)	1.692*** (0.0767)	0.946*** (0.0644)	4.276*** (0.225)
lfinancial development_sq					-10.70*** (0.636)
lgdp_capita		-0.0689*** (0.00588)	-0.100*** (0.00578)	-0.147*** (0.00679)	-0.174*** (0.00528)
ltrade			0.538*** (0.0159)	0.447*** (0.0118)	0.378*** (0.00952)

lagriculture				-0.144***	-0.156***
				(0.0105)	(0.00771)
Constant	0.147***	0.214***	0.0602	0.151*	0.192***
	(0.0468)	(0.0477)	(0.0538)	(0.0806)	(0.0645)
Observations	890	890	875	847	767
Number of groups	52	52	50	47	40
CD test statistic	1.383	1.207	0.448	0.521	0.187
p-value of CD test statistic	0.167	0.227	0.654	0.602	0.852
IPS test statistic	-17.77	-16.29	-15.61	-16.97	-14.54
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: Result with RLE_ABOVE

VARIABLES	(1)	(2)	(3)	(4)	(5)
	D.Idtax	D.Idtax	D.Idtax	D.Idtax	D.Idtax
Short Run					
D.lfinancial development	0.432 (0.267)	0.531* (0.277)	0.508* (0.283)	0.448 (0.316)	1.364 (4.518)
D.lfinancial development_sq					0.221 (19.40)
D.lgdp_capita		0.284** (0.133)	0.308** (0.130)	0.350** (0.148)	0.318 (0.198)
D.ltrade			0.0261 (0.0433)	0.0654 (0.0410)	0.0553 (0.0457)
D.lagriculture				0.00877 (0.0347)	0.00561 (0.0379)
Long Run					
L.Itax	-0.0442*** (0.0134)	-0.0829*** (0.0145)	-0.0794*** (0.0138)	-0.0875*** (0.00935)	-0.0954*** (0.0101)
lfinancial development	-0.228*** (0.0331)	-0.652*** (0.0702)	-0.803*** (0.0701)	-0.989*** (0.0418)	-1.347*** (0.0872)
lfinancial development_sq					1.037*** (0.110)
lgdp_capita		0.0678*** (0.00839)	0.0839*** (0.00846)	0.141*** (0.00623)	0.0896*** (0.00664)
ltrade			-0.0134* (0.00711)	0.00729 (0.00487)	-0.00534 (0.00623)
lagriculture				0.0419***	0.0389***

				(0.00391)	(0.00396)
Constant	0.126***	0.195***	0.182***	0.149***	0.212***
	(0.0351)	(0.0515)	(0.0591)	(0.0494)	(0.0603)
Observations	1,092	1,070	1,062	1,013	955
Number of groups	59	55	54	49	44
CD test statistic	2.135	0.916	1.020	1.169	2.236
p-value of CD test statistic	0.0328	0.360	0.308	0.242	0.0254
IPS test statistic	-16.28	-13.84	-14.55	-13.98	-12.45
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 11: Result with RLE_BELOW

	(1)	(2)	(3)	(4)	(5)
VARIABLES	D.Idtax	D.Idtax	D.Idtax	D.Idtax	D.Idtax
<hr/> Short Run <hr/>					
D.Ifancial development	0.594 (0.385)	0.364 (0.415)	0.434 (0.471)	0.363 (0.496)	10.60 (8.063)
D.Ifancial development_sq					-72.94 (63.39)
D.Igdp_capita		0.433*** (0.130)	0.402*** (0.138)	0.390*** (0.142)	0.379*** (0.146)
D.Itrade			0.0749 (0.0499)	0.0523 (0.0584)	0.0916 (0.0613)
D.Iagriculture				-0.0628 (0.0712)	-0.0841 (0.0692)
<hr/> Long Run <hr/>					
L.Itax	-0.0566*** (0.0200)	-0.0621*** (0.0166)	-0.0788*** (0.0190)	-0.0737*** (0.0123)	-0.0781*** (0.0112)
Ifinancial development	0.247*** (0.0892)	0.472*** (0.0877)	0.967*** (0.0844)	0.191*** (0.0561)	4.268*** (0.205)
Ifinancial development_sq					-13.53*** (0.537)
Igdp_capita		-0.120*** (0.00651)	-0.103*** (0.00629)	-0.115*** (0.00579)	-0.172*** (0.00519)
Itrade			0.661*** (0.0132)	0.597*** (0.00927)	0.578*** (0.00884)

lagriculture				-0.0800***	-0.107***
				(0.00749)	(0.00723)
Constant	0.144***	0.205***	0.0249	0.0761	0.101
	(0.0460)	(0.0512)	(0.0512)	(0.0634)	(0.0620)
Observations	945	933	926	888	842
Number of groups	56	54	53	49	45
CD test statistic	1.258	1.050	0.183	-0.0228	-0.202
p-value of CD test statistic	0.208	0.294	0.855	0.982	0.840
IPS test statistic	-19.57	-17.77	-17.32	-17.90	-17.60
p_value IPS test statistic	0	0	0	0	0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Chapter 2: Does South-South cooperation crowd out tax revenue mobilisation in Africa? Evidence of Chinese Aid to Africa.

Abstract

Since the early 2000s, China's interest in Africa has been growing, generating much attention and debate. However, western media and analysts have generally been highly critical of China's increasing African financial flows. In contrast, many African leaders have greeted what they consider a new approach to development and an increased potential for meaningful South-South cooperation. However, these criticisms do not consider the contribution of Chinese aid in African economies' tax revenue mobilisation. This chapter analyses the effect of Chinese aid on non-resource tax mobilisation for African countries. The estimation results indicate that the impact of Chinese aid on non-resource tax mobilisation in African countries is positive and statistically significant at the

conventional levels of significance. However, the results show that Chinese aid associated with Chinese FDI does not affect non-resource tax mobilisation. Moreover, the results show that the origin of aid matters in reducing tax efforts, suggesting that Chinese ODA increases tax revenue mobilisation while DAC country's ODA does not statistically affect tax revenue mobilisation.

Keywords: Foreign aid, non-resource tax revenue, China, System GMM estimator, Africa

JEL codes: F35, H20, F21, H81, L72.

1.Introduction

Governments use taxation as their primary source of revenue to provide public services and foster human and economic development in their countries. However, developing countries, mainly African countries, cannot finance all desirable public expenditures and investments from tax revenues collected². To address budgetary constraints, some bilateral and multilateral donors provide development assistance. However, depending on whether foreign aid is simply a supplement to the national budget or partly a substitute, recipient countries can either increase spending and investment by the total amount of aid or previous tax effort or borrowing while keeping planned expenditures constant.

² Only 15% of GDP in Sub-Saharan African economies is collected in taxes. While the ability to collect taxes is essential for a country to finance social services such as health and education, essential infrastructure such as electricity and roads, and other public goods. Given the vast needs of poor countries, this low level of tax collection jeopardises economic development.

https://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS?most_recent_value_desc=false

Nevertheless, if development aid is aimed at helping countries in difficulty to overcome their financial constraints, sooner or later, they will need foreign aid. In this case, it may be crucial to know whether the aid contributes to an increase in the national budget and the revenues needed for public services and the performance of government tasks. In general, assistance can affect tax revenues in several ways. First, the policies and conditions associated with aid (the broader donor-recipient relationship) can affect tax revenues. For example, recipient governments could use support to strengthen institutions and tax administrations to raise revenue. Still, other policy reforms may reduce them, at least in the short term (for example, tariff reductions as part of trade reforms).

Second, at the most general level, since aid has macroeconomic effects and tax revenues are affected by macroeconomic performance, it may indirectly affect revenues. For example, if aid effectively supports growth, revenues should increase as the tax base expands (even if the tax/GDP ratio does not necessarily increase). Finally, there may be direct budgetary effects: as most aid finances public goods and services, it may substitute for efforts to raise tax revenues or, for a given level

of taxation, support a higher level of public expenditures. These direct effects could be related to the amount of aid relative to the level of taxation. It is not easy to disentangle these different potential effects in analysing the relationship. However, African countries generally have low tax revenues, so the main concern is further reducing the tax effort. In this respect, the impact of aid on the tax structure of recipient countries is crucial.

Several recent studies have investigated the relationship between foreign aid and tax revenue from various aspects, taking advantage of the increased accessibility of data to assess the impact of support and its components on tax effort in developing countries. They, however, yield very mixed conclusions. Some studies report a negative association, while others find no significant results or even a positive relationship (Baunsgaard and Keen, 2010; Bräutigam and Knack, 2004; Brun et al., 2011a; S. Gupta, 2004; Mahdavi, 2008; Mascagni, 2016; Morrissey and Torrance, 2015)

This ongoing debate on the impact of foreign aid on tax revenues has focused on assistance from North-South cooperation or international financial institutions. However, the

relationship between development aid and tax policy in South-South cooperation, particularly China-Africa³, has received little attention. While China committed USD 73 billion in official flows to Africa between 2000 and 2011, USD 15 billion is equivalent to ODA defined by the OECD DAC. This USD 73 billion represents "more than one-fifth of total OECD DAC flows (USD 361 billion) and almost as much committed by the US (USD 83 billion)" to Africa over the same period. The USD 15 billion in ODA represents 4% of total OECD DAC ODA flows over the same period (USD 347 billion) and 19% of US ODA flows (USD 81 billion) (Strange et al., 2017).

Besides this background, the contribution of this manuscript to the empirical literature on the impact of foreign aid on tax revenues is twofold. First, we focus on African aid recipients and the total Chinese aid for providing precise policy-oriented

³ The Chinese development cooperation policy, which is based on a model of financing infrastructure in exchange for natural resources, but opportunely presented as a "win-win" financial alternative that can be easily mobilised in the short term, is at the heart of a wave of South-South convergences as an alternative to the dominant Western system and is today China's strong point and entry point in developing countries. (Wintgens, 2016)

conclusions. Many studies analysed foreign aid and tax revenue relationship. Still, to the best of our knowledge, a few studies focus on Chinese aid's effect on African tax revenue mobilisation. Besides, China assists in the manner of its choice and challenges the current foreign aid paradigm in four main ways: challenging the donor-recipient relationship through a partnership south-south that could be more beneficial than the partnership north-south, with China emphasising mutually beneficial aid, China insisting on sovereignty and non-interference in domestic affairs, which challenges the use of conditionalities, and China preferring to lead major foreign aid projects alone, which challenges multilateralism. Thus, this article fills an important gap in the related economic literature by providing the first cross-country evidence on the impact of Chinese aid on African tax revenue mobilisation.

Second, as Pivovarsky et al. (2003) point out and test empirically for 107 economies, the impact of aid on tax revenue mobilisation depends on the decomposition of aid. They show that concessional loans generate higher domestic revenues, grants reduce domestic tax effort. Previous studies on the effect of foreign aid decomposition on tax effort have ignored the

source of aid, in particular Chinese assistance in African countries. This chapter fills this critical gap in the related economic literature by providing the first evidence on the decomposition of Chinese aid on African tax revenue mobilisation.

The rest of the chapter is structured as follows: Section 2 reviews the literature on the relationship between foreign aid and tax revenue. Section 3 develops the empirical methodology used to estimate the impact of Chinese support and tax revenue effort. Section 4 presents and interprets the estimation results and checks the robustness of these results. Finally, section 5 concludes the article.

2. Literature Review.

2.1 Theoretical framework

The relationship between aid and tax revenue can be situated within the broader debate on the Effectiveness of Aid, even though it is just one strand. The question of aid effectiveness remains at the heart of the policy debate on developing countries, although it is still far from offering clear answers.

Focusing on the fiscal consequences of aid in this context is a way of highlighting more direct links between foreign aid and policy. Given that a significant part of the aid is a direct financial support to governments and budgetary decisions are central to fiscal policy, a direct relationship between foreign aid and taxation seems credible. More specifically, a potentially harmful tax consequence of aid is the crowding out of tax revenues. Thus, assistance can influence the taxation of African states in several ways, which can lead to a negative or positive relationship. A negative relationship could result from crowding out, or substitution, effect between aid and tax revenue. This effect can occur for various reasons, not least because aid can be seen as a source of income with lower political costs. The main argument is that the government must obtain tax revenues by negotiating with the population and engaging in a reciprocal relationship. Thus, the government provides services in exchange for tax revenues.

On the other hand, aid can be seen as an unearned revenue source, as it does not require the same level of widespread commitment and reciprocity. As a result, governments can partly avoid the process of democratic dialogue and revenue

collection by relying more on foreign than on domestic resources. The negative effect of aid on tax collection performance can be direct and indirect. For example, it may come from adverse incentives to collect taxes, difficulties in political administration or economic instability. On the other hand, the recipient country may see aid as avoiding social costs by reducing tax burdens. Devarajan et al. (1999), in their study on the expenditure of aid, demonstrate that aid leads policymakers to put inaccurate policies and weak institutions in place. In addition, aid can lead policymakers to favour donors over their populations. Martens et al. (2008), Moss et al. (2006) and Svensson (2003) have highlighted this by concluding that foreign aid leads the central government to consider and favour aid-funded projects at the expense of tax administration efficiency.

Furthermore, Brunet et al., (2011), in their study on aid and tax mobilisation in developing countries, consider the lack of coordination between different donors as a cause of the increasingly adverse effects of aid on tax mobilisation. Thus, while support can directly negatively affect tax mobilisation, it also has indirect effects.

However, it is essential to note that aid is often subject to conditionality and political influence, generating political and administrative costs for the recipient. An argument put forward in the literature is that aid can harm domestic accountability and institutions, implying a general weakening of the level of tax revenues and the quality of institutions involved in tax policy. On the other hand, aid can positively impact tax revenues by imposing tax policy conditions or providing financial and technical support to tax administrations. This assistance could bring the skills, knowledge, and political legitimacy to implement tax reform, increase revenues and improve tax administration. Technical assistance and advice on tax policy are especially pertinent in Africa, where there is widespread recognition that donors are one of the main drivers of reform. Tax reforms in Africa have been, by all accounts, driven mainly by a global agenda. The main driver of this plan has been the International Monetary Fund (IMF), although the influence of other bilateral and multilateral donors is growing. In addition, the various costs associated with the volatility of aid can encourage decision-makers in recipient countries to

reduce their dependence on foreign aid and, in particular, reduce their tax effort (Brun et al., 2011a).

Furthermore, Morrissey, (2015) shows in his review of the literature on the effect of aid on the fiscal behaviour of recipient countries that aid should improve the budgetary performance of recipient countries by improving the efficiency of public spending and tax compliance. Therefore, the impact of aid on taxation is likely to be determined by various factors. An econometric analysis of panel data can clarify whether positive or negative effects dominate.

2.2 Review of the empirical literature on the relationship between foreign aid and tax revenue

The literature on the effect of foreign aid on tax mobilisation gives us very controversial results. Indeed, the theoretical analysis argues that aid can have a crowding-out effect on the one hand, or it can encourage tax collection on the other.

Empirically, Heller (1975), in his study of 11 African countries, finds that aid discourages tax effort, while Khan and Hoshino (1992) argue that aid positively affects tax revenue. Furthermore, they conclude that the effect differs from one

component to another when decomposing aid into grants and loans.

Moreover, recent empirical studies on the relationship between aid and resource mobilisation are highly controversial. For example, Benedek et al. (2014) and Pivovarsky et al. (2003) find that aid lowers tax revenues. Furthermore, they show that grants negatively affect tax revenue while loans encourage it because of the repayment constraint. These results have been challenged by (Clist, (2016), Clist and Morrissey (2011), Morrissey et al. (2014). The problem is the quality of the data used in these older studies and that their conclusion is not robust given the accumulation of multiple data sources. Using different data from those of Pivovarsky et al (2003) and Benedek et al (2014), their results are not robust.

Bräutigam and Knack (2004), Ghura (1998) and Mahdavi (2008) found a negative relationship between aid and taxes, using different specifications of the basic tax effort model. Examining aid heterogeneity more specifically, Pivovarsky et al. (2003) suggest that loans positively affect tax effort due to the need to repay them, while grants crowd out domestic revenues and therefore have a negative effect. Although this

conclusion is echoed in other studies, including a recent IMF chapter (Benedek et al., 2014), this is not viewed as robust by other authors such as Morrissey et al. (2006, 2014). In particular, this latest study suggests that the claim that aid discourages tax effort is not supported: the relationship between aid and tax does not appear to be systematically significant, although where it is, it is of positive sign. Clist and Morrissey (2011) suggest that the evidence for a positive effect is more significant after the 1980s when factors such as structural adjustment and conditional lending became more important to donors. Carter (2013), Gupta (2007), and Morrissey et al. (2006) also argue that there is a positive relationship or that there is no evidence of a crowding-out effect. Benedek et al. (2012) show that the adverse impact they found for grants appears to diminish over time, suggesting a more positive, though generally weakly significant, relationship.

3. Empirical Analysis

3.1 Empirical model specification

To assess the impact of Chinese official finance on tax revenue mobilisation, we follow a fiscal response model of Heller (1975) used by (Benedek et al., 2014; Brun et al., 2011b; S. Gupta,

2004). Our estimation starts with several tests to decide whether to favour fixed effects or random effects. Therefore, these tests suggest fixed effects specification. Consequently, we consider a panel fixed effect model as follow:

$$Tax_{it} = \alpha + \beta(Aid)_{it} + \theta X_{it} + \vartheta_i + \mu_t + \varepsilon_{it} \quad (1)$$

where $(Tax)_{it}$ is the non-resource tax revenues in the proportion of GDP for country i in year t while $(Aid)_{it}$ represents Chinese official finance for the host country i at the period t . X_{it} stands for other tax revenue determinants identified by previous studies on tax revenue mobilisation in developing countries. These determinants include agriculture value-added, resource rent, trade openness, GDP per capita, exchange rate and control of corruption (Brun and al., Gupta, 2007). Temporal effects (μ_t) are included to control the standard shocks affecting developing countries, ϑ_i represents a country-specific effect and ε_{it} is the error term.

Agriculture value-added and resource rent are added to control the economy's sectoral composition, while trade openness controls the effect of exposure to international trade on tax ratio. We also include control of corruption among the

explanatory as a proxy of the institutional policy, GDP per capita to measure the development level, and exchange rate to control the effect on exchange policy.

In equation (1), ϑ_i is included among the right-hand side variables to control for unobserved time-invariant country-specific characteristics that are potentially correlated with tax revenues and μ_t to control for time-varying shocks and economic fluctuations that affect all developing countries.

3.2 Identification strategy

We need to solve some econometric problems when estimating the baseline specification (equation 1). First, Chinese aids are likely to be endogenous. Indeed, the countries with the lowest tax revenue are generally also the most significant aid recipients. Second, the characteristics of the tax revenue data, showing persistence over time, emphasise the possibility of a serial correlation. We used the Generalised system Methods of Moments (GMM) estimator to address these issues. This estimator is most appropriate for dynamic panel data sets when the temporal dimension is small and the individual dimension is large (Roodman, 2009b). The system GMM estimator combines both the level equation and the differential equation

into a system and uses the lagged differences as instruments of the level variables, whereas the lagged level variables instrument the different variables. This improves the performance of the system GMM estimator relative to the difference GMM estimator as the system GMM exploits both the time series dimension and the cross-sectional variations in the data. Finally, the GMM difference estimator (Arellano and Bond, 1991) suppresses the unobserved country fixed effects in equation (1) using first differences. This addresses the question of the potential correlation between the unobserved country fixed effects and the explanatory variables. Then, the lagged values of the level variables became the instruments of the first differentiated variables. Furthermore, with the GMM system estimator, the number of instruments should not exceed the number of countries to avoid the problem of 'instrument proliferation' in the estimates (Roodman, 2009a).

4. Data

To achieve our objectives, we construct an unbalanced panel dataset of 54 African countries from 2000 to 2012. The

availability of data dictates the choice of the sample and the period covered.

4.1 Dependent variable: Non-resource tax revenue(TAX)

One of the difficulties in analysing the effect of aid on tax mobilisation is the choice of the dependent variable. Thus, several variants of government revenue have been used in previous studies on this topic. Gupta (2004), Brun et al. (2011b) and Clist (2016) used total revenues from the IMF and ICTD databases (Prichard, et al. 2014). At the same time, Morrissey and Torrance (2015) used tax revenues from the ICTD database (Prichard et al., 2014). Thus, they extracted non-tax revenues, namely mining rents and oil resources, from the total revenue. We use as the dependent variable total tax revenue as a percentage of GDP. Given the high dependence of several African countries in our sample on natural resource revenues, we decided to use the non-resource tax revenue as a percentage of GDP from the ICTD database as the dependent variable in our analysis. This variable is represented by tax in our model.

4.2 The primary explanatory variable: Aid

Aid flows to African countries generate significant shares to finance public expenditure. Thus, a higher aid flow should encourage the state to make less effort in mobilising tax revenue. Nevertheless, on the other hand, conditionalities around aid may also encourage states to maintain their level of tax mobilisation. Since Chinese support does not consider the conditionalities of the West and is primarily made up of investment projects. Grants are mainly intended to implement and support small and medium-sized social projects, as well as activities involving the provision of physical aid (i.e. money, food), human resource development and medical assistance. Interest-free loans are mainly intended to finance the construction of public facilities and to support operations that improve the living conditions of local populations. On the other hand, Exim Bank's concessional loans are used to finance medium and large-scale infrastructure projects and other industrial projects that can generate economic and social benefits (Bräutigam, 2010). These could be increase economic activity and thus raise tax revenues. The existing literature on the relationship between aid and tax mobilisation has not given

a clear conclusion on this issue. The Chinese aid data were obtained from (Dreher et al., 2018). The Chinese government does not publish official foreign aid activity information at the project level. Therefore, this data is based on AidData's Tracking Underreported Financial Flows (TUFF) methodology.

4.3 Control variables

As already mentioned in the paragraph following the empirical model, the control variables include the agriculture value-added as the share of GDP, resource rent as the share of GDP, the trade openness measured by the sum of exports and imports in the ratio of GDP, the exchange rate, and the control of corruption. These variables were obtained from the World Development Indicators database (WDI) and World governance indicators (WGI), the World Bank and WGI. Let us now discuss the expected effect of control variables on tax revenue.

Agriculture value-added.

Agriculture value added as a proportion of GDP is employed to proxy the economy's structure or sectoral composition. In

developing countries, the agriculture sector is dominated by many smallholder farmers who produce for self-consumption or sell their productions in informal markets or exchange their output for other goods. Besides, most farmers in African countries do not keep contemporary accounts for managing their farms. All these factors mentioned above make it hard to tax the agriculture sector in Africa (Fox and Gurley, 2005; Gupta, 2007; Janet Gale Stotsky and Asegedech WoldeMariam, 1997). We, therefore, expected a negative effect of Agriculture value-added on tax revenues in our estimations.

Resource rent

As a proportion of GDP, resource rent is employed to capture natural resource endowment. Therefore, resource-rich countries tend to neglect other sources of tax revenue. Besides, tax performance is lower, the bigger the share of resources rent in the host country. We, therefore, expected a negative effect of resource rent on tax revenues in our estimations.

Trade openness

Trade openness, expressed as the sum of exports and imports as a percentage of GDP, is predicted to increase tax

mobilisation, as trade openness boosts the volume of trade and thus trade taxes. However, trade liberalisation policies in developing countries took place through tariff reductions. These measures have resulted in a loss in tax revenue for some countries (Baunsgaard and Keen, 2010), while some others have compensated losses in tariffs by an increase in domestic tax revenue (Bird and Gendron, 2007; Cnossen, 2015). Within this background, the impact of trade openness on tax revenue is a priori difficult to predict. Therefore, in this study, the expected effect of trade openness on the revenue variables remains a priori unknown.

Control of corruption

The level of corruption in the country may affect its tax collection performance. Indeed, some taxpayers may reduce their tax base with the collaboration of a tax administration official. Therefore, we monitor the impact of corruption on tax revenues. To do so, we include the indicator "control of corruption index from World Government Indicators (WGI) (Kraay et al., 2010). The index measures corruption's

perception, ranging from -2.5 to 2.5, with higher values indicating a better control of corruption in the host country.

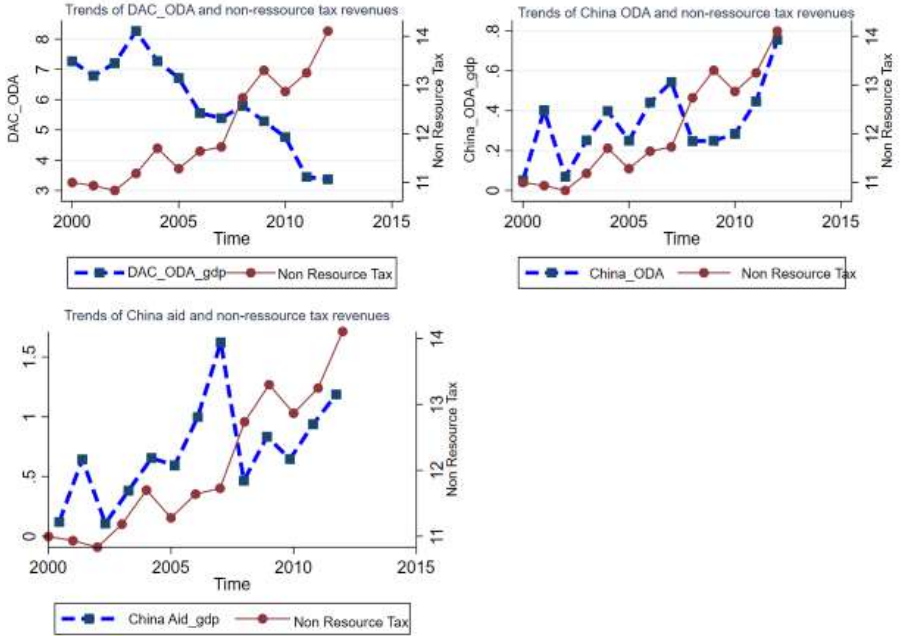
Exchange rate

Exchange rate policy also affects the government's ability to raise resources. Indeed, the real depreciation of the exchange rate favours the profitability of the tradable goods sector. Thus, the real depreciation shifts the revenue distribution to those sectors whose income depends on the price of tradable goods, i.e., the producers of tradable goods and the importing traders. As these sectors are the biggest taxpayers, real depreciation increases tax revenues for a given level of GDP. However, given the reduced taxation of exports, this effect is mainly due to the import substitution sector and importing traders.

The level of development

The structural variable most often used is the level of income, measured by gross domestic product per capita, which is also a proxy for the economy's level of development. It is reasonable to assume that the higher the level of development of a country, the stronger its capacity to draw resources.

Figure 4 Trends of AID and Tax revenue of China and Western



Source: Authors' calculations from AidData's Chinese Official Finance (Strange et al., 2017), ICTD-GRD database (UNU-WIDER Government Revenue Dataset, 2020).

Table 1 provides descriptive statistics for all the variables used in this analysis. The average China assistance is 0.71 per cent of GDP, while the average non-resource tax revenue, for our sample, is 12.05 per cent, with the lowest assistance 0 (applied in Burkina Faso, Eswatini and Gambia over the period 2000–

2012)⁴ and the highest at 26.8 per cent (used in the Congo Democratic Republic over the period 2007). On average, for our sample, the top five recipient countries of China assistance in ratio of PIB, over the observation period, are Angola, Congo Democratic Republic, Nigeria, Ghana, and Sudan.

Long-term trends show a positive relationship between Chinese official finance and non-resource tax revenues (Figure 1). This graph shows that a variation on Chinese aid leads to the same variation in tax revenue in the following year. For example, while Chinese financial support peaked in 2007, non-resource tax revenues peaked in 2008. As for the ODA, since those of the Western are downward, China's ODA⁵ type aid follows a relatively positive trend. Several factors could explain this—first, the difference between Chinese ODA and Western

⁴ Burkina Faso, Eswatini and Gambia maintained diplomatic relations with Taiwan during the period 2000-2013.

⁵ In 2004, the International Monetary Fund (IMF) made its post-war reconstruction loans to Angola subject to transparency conditions. The government was unwilling to sign such an agreement, but the country was in dire need of financing. Unexpectedly, China offered to provide \$2 billion in loans, without any conditions relating to corruption or transparency. The country declined IMF assistance and agreed to provide China with 40,000 barrels of oil per day (Condon, 2012).

countries in conditionality. Secondly, Western countries emphasise good governance, while China emphasises sovereignty.

5. Results from the estimation

This section presents the main findings from the regressions and then analyses the robustness of these findings. Before discussing the estimation results, we offer the results from the specification tests carried out for corroborating the choice of the panel fixed effects to estimate the impact of China's official finance and non-resource tax revenue in Africa. We first estimate a panel fixed-effects model (Table 2, column 1). Second, we estimate the random panel effect. Then, we run the Hausman test that rejects the null hypothesis of no systematic difference in coefficient at the 5 per cent threshold (Hausman's test Statistic = 99.12; P-value=0.000), suggesting that the fixed effects model is preferred. Furthermore, Table 2 presents the results of a GMM system for the impact of Chinese foreign aid on resource tax mobilisation. The coefficients of Chinese aid on the FE model and the GMM system are positive and statistically significant. This result indicates that China's aid inflows

increase tax mobilisation. However, since the aid coefficients in the GMM system are somewhat larger than those in the FE model, it suggests that the estimates of the aid-tax revenue linkages are biased due to endogeneity problems. Interestingly, the EF estimates are biased downwards, meaning that existing studies underestimate the extent to which aid affects tax effort.

Table 7: Descriptive statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
Non-Resource Tax	597	12.048	7.122	.846	59.980
China Total aid	648	.707	1.907	0	26.769
China ODA	648	.337	1.057	0	15.419
China_Grant	648	.137	.497	0	5.359
China_Loan	648	.500	1.760	0	26.770
DAC_ODA	649	.503	3.056	0	49.690
Resource Rent	682	13.810	13.879	.002	84.229
Trade	663	73.71	38.322	20.964	311.354
Agriculture	722	21.656	14.344	.893	79.042
Exchange rate	641	99.929	34.004	49.373	848.519
Control	of				
Corruption		700	-.614	.592	-1.773
Log(GDP per capita)	686	7.196	1.075	5.272	9.930

Table 2: Foreign aid and non-resource tax mobilisation

VARIABLES	(1) Fixed Effect	(2) Random Effect	(3) System GMM	(4) System GMM	(5) System GMM
China-Aid (%gdp)	0.2022** (0.0902)	0.2312** (0.0950)	0.3895* (0.1979)		
Agriculture (%gdp)	-0.1198*** (0.0173)	-0.0797*** (0.0249)	-0.0145 (0.0200)	-0.0237 (0.0187)	0.0079 (0.0365)
exchange rate	-0.0203*** (0.0063)	-0.0055 (0.0073)	0.0342 (0.0229)	-0.0011 (0.0189)	0.0231 (0.0433)
trade (%gdp)	0.0095 (0.0059)	0.0127 (0.0088)	0.0239* (0.0119)	0.0124*** (0.0046)	0.0283** (0.0132)
rents (%gdp)	-0.0538** (0.0241)	-0.0722** (0.0248)	-0.1115*** (0.0374)	-0.0900*** (0.0332)	-0.1373*** (0.0509)
log (gdp per capita)	7.3311*** (0.3756)	2.2309** (0.8185)	0.7976* (0.4214)	1.1527** (0.5531)	1.2158* (0.6969)
Control of corruption	0.2438 (0.2696)	2.0283** (0.7528)	2.3232** (0.9570)	1.8976* (1.0589)	2.8227** (1.1268)
Lag.(Non-Resource tax)			0.3598*** (0.1334)	0.4877*** (0.1773)	0.2608** (0.1095)
China-Loan(%gdp)				0.2968* (0.1631)	
China-Grant (%gdp)				1.2021 (0.8421)	
China-ODA (%gdp)					0.9347** (0.3816)
Dac-ODA (%gdp)					-0.1386 (0.0849)
Constant	-35.2739*** (2.5093)	0.1660 (7.7748)			
Observations	444	444	441	441	440
Number of groups	45	45			
Number of id			45	45	45
Number of instruments			41	41	37
AR1			0.0755	0.0201	0.0731
AR2			0.166	0.184	0.0966
Hansen			0.389	0.455	0.350

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: author.dta

5.1. Main Results

Finally, we test the specification of the equation for each regression using Hansen's overidentifying restrictions test and subsequently using the Arellano-Bond test for second-order serial correlation. The tests show that all regressions meet the specification tests, indicating that our instruments are valid and that there is no evidence of second-order serial correlation in our regressions.

The results from the baseline estimation show that Chinese aid is positive and statistically significant at the 10 per cent significance level (Table 2 column 3). This result suggests that increasing Chinese foreign aid may trigger non-resource tax mobilisation in the host country. For example, the Chinese aid foreign in Africa focus on infrastructure investments in transportation, power, and communications. Therefore, this could bring positive externalities, reduce costs, encourage most investment in the private sector, and increase the tax base.

Moreover, we find that non-resource tax's past value positively affects current non-resource tax mobilisation. The result

indicates that previous experiences from the mobilisation of tax revenue matter for increasing tax revenue mobilisation.

For control variables, our results show that the level of development, the trade openness and the control of corruption have positive and significant impacts on non-resource tax mobilisation. These results suggest that structural and institutional factors positively affecting tax mobilisation are essential to increasing tax revenue. Besides, resource rent has a negative and significant impact on non-resource tax collection. These results suggest that resource rent could lead African countries to focus only on resource base tax and neglect other tax sources.

The results of control variables remain unchanged. For example, trade openness, control of corruption, and the level of development in host countries encourage tax and mobilisation, while resource rent discourages non-resource tax revenue and mobilisation.

5.2 Robustness analysis

5.2.1 Considering the potential impact Chinese foreign direct investment

Chinese assistance could take the form of the so-called package, where technical solutions get combined with state bank supported financing, with Chinese companies employing Chinese workers for construction (Samy, 2010; Wang and Ozanne, 2000). Therefore, the effect of Chinese foreign aid on tax revenues could be through Chinese foreign direct investment, which could influence the tax revenues of host countries. Therefore, we there include the Chinese foreign direct investment to consider that the role of Chinese FDI may influence the tax assiette of host countries. The data on Chinese FDI as a percentage of GDP comes from China Africa Research Initiative (2017).

The main results of this chapter remain unchanged when we control the impact of Chinese FDI. In the other word, the impact of Chinese's foreign aid on tax revenue is positive and statistically significant. In addition, as expected, the impact of Chinese FDI on host countries' non-resource tax mobilisation is

positive and statistically significant at 10 per cent (Table 3 Column 1). This result suggests that Chinese FDI through the growth may increase tax revenue mobilisation of African countries. However, the interaction of Chinese aid and FDI is negative and statistically insignificant, suggesting Chinese aid combined with Chinese FDI may not affect non-resource tax revenue mobilisation.

5.2.2 Considering the potential impact of government effectiveness on non-resource tax

We control for the impact of government effectiveness on non-resource tax revenue mobilisation in the baseline specification to test whether government effectiveness in the host country influences tax revenue mobilisation.

The index for government effectiveness from the World Governance Indicators (Kraay et al., 2010) is used as the quality of public service indicator. The index measures the perceived quality of public services, the performance of the civil service and its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to these policies

and it range from -2.5 to 2.5, with higher values indicating better government effectiveness in the host country. Although the main results of this chapter remain qualitatively stable when the government effectiveness index is included in the basic equation, we find that public service has a positive and statistically significant impact on tax resource mobilisation (Table 3, columns 2). The result suggests that a better quality of public service could increase tax revenue mobilisation through tax compliance.

5.2.3. Considering the potential impact of public debt on tax revenue mobilisation

China's greed for resources and its growing presence in Africa may significantly impact debt sustainability on the African continent. Thus, public debt could influence the relationship between Chinese foreign aid and revenue mobilisation. Therefore we control the public debt. We collect public debt data from World Development Indicators (WDI). The inclusion of public debt among the control variables does not change the main result of this chapter. The estimation results confirm the positive correlation between Chinese aid and

non-resource tax mobilisation in African countries. Furthermore, public debt positively and significantly impacts non-resource tax revenue mobilisation. This finding is not unexpected as the reduction in the primary deficit, the need to service the primary deficit and the need to service the debt provides incentives for the government to increase the capacity to mobilise fiscal resources. (Table 3, columns 3).

Table 3: Foreign aid and non-resource tax mobilisation: estimates with additional controls

VARIABLES	(1) Tota aid	(2) Tota aid	(3) Tota aid
L.(Non-Resource tax)	0.3555*** (0.0577)	0.4359*** (0.1158)	0.4086*** (0.1154)
China-Aid (%gdp)	0.4092* (0.2043)	0.3956* (0.2235)	0.5576* (0.2946)
Agriculture (%gdp)	-0.0052 (0.0242)	-0.0146 (0.0173)	-0.0214 (0.0223)
exchange rate	0.0220* (0.0122)	0.0069 (0.0236)	0.0029 (0.0238)
trade (%gdp)	0.0170 (0.0102)	0.0076 (0.0103)	0.0078 (0.0158)
rents (%gdp)	-0.1007*** (0.0352)	-0.0812** (0.0304)	-0.0891*** (0.0309)
log (gdp per capita)	1.0398*** (0.2600)	0.8612** (0.3387)	0.9343** (0.3866)
Control of corruption	2.6872*** (0.8258)	2.3288*** (0.7674)	2.7490*** (0.9887)
China-FDI (%gdp)	0.7336** (0.3310)		

China-FDI*China-aid	-0.2833 (0.5028)		
Government effectiveness		0.2757** (0.1053)	
Debt (%gdp)			0.0981** (0.0376)
Observations	391	441	441
Number of countries	43	45	45
Number of instruments	41	43	39
AR1	0.0178	0.0428	0.0672
AR2	0.381	0.193	0.228
Hansen	0.679	0.361	0.330

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: author.dta

5.3 Does Official Development Assistance (ODA) origin matter for tax mobilisation: Evidence of China and DAC countries approach.

There are currently two contrasting approaches to aid policy in Africa: the position adopted by the Western world that characterise both conditionality and targeting. It focuses on direct financial support, while the approach adopted by China has no conditionality and focuses on building infrastructure and production (mining , and agriculture). Critics of the Chinese approach point to the lack of direct job creation for African skilled and unskilled labour, while the lack of conditionality is

said to hamper good governance in Africa (Adisu, Sharkey, and Okoroafo 2010; Wegenast et al. 2019; Zhao 2014). We analyse the effect of ODA from OECD-DAC donors and China on non-resource tax revenue mobilisation. In addition, we collect the data of ODA from World Development Indicators and (Strange et al., 2017).

The results show Chinese ODA affect positively and significantly non-resource tax. In comparison, ODA from west countries does not influence tax revenue mobilisation. Three possibilities could explain these results. First is the approach used by these different sources of aid. Western countries will recognise the importance of good governance for aid effectiveness. However, the corrupt and incompetent government is part of the development problem, not just the cause, so aid should help solve the government problem. As a result of this endogeneity problem, the Western approach to aid faces a dilemma: on the one hand, conditionality is supposed to prevent the misuse of monetary aid; on the other hand, African countries need aid to foster development that will fight corruption and improve governance.

Given the Chinese approach directly targets development constraints. The direct provision of infrastructure could reduce the host country's intermediary role, reducing the potential for corruption in recipient countries. This would exempt aid from certain conditions as government involvement becomes minimal. The resulting improvements in infrastructure, particularly in transport and telecommunications, reduce the cost of doing business and thus increase the opportunities for economic actors to realise their potential. Second The idea is that from a political economy perspective, states that receive funding in terms of budget support relax their mobilisation efforts (Clist, 2016). The mobilisation of domestic resources creates pressure to be accountable to citizens, whereas aid does not. Therefore, the government that receives aid in the form of budget support has more flexibility in mobilising resources without increasing the tax base and therefore, from this point of view, one could expect that aid that comes in the form of budget support has a lesser effect or no effect on revenue mobilisation than aid that comes in the form of projects. In this situation, one could understand that aid from DAC countries has no effect while aid from China, more project aid, increases

revenue mobilisation. Third, Chinese aid can be delivered more quickly because certain socio-economic and environmental safeguards do not constrain it (Swedlund, 2017). While this raises essential and legitimate concerns, what matters most is that the project is actually completed and quickly for recipient governments. In addition, there is a prevailing perception, which may or may not be justified among recipient government officials, that Chinese project aid proceeds more quickly than traditional donors. Thus the speed of project implementation could create growth and thus broaden the tax base.

5.4 Does the type of aid matter for tax mobilisation:

Evidence of China aid disaggregated

The results of Chinese aid at the aggregate level do not allow policymakers to assess the effect of loans and grants on tax revenue mobilisation. However, since grants require no counterpart and loans require repayment, we analyse the effects of grants and loans on tax revenue. We, therefore, expect a different result.

The regression reveals that loans positively affect revenues while grants have no statistically significant effect. The effect

of Chinese loans on tax revenue mobilisation is in line with the literature of sources of loans (Clist and Morrissey, 2011; S. Gupta, 2004). Indeed, because of the repayment obligation, loans lead policymakers to better fiscal management and encourage them to mobilise more effort to increase tax revenue.

Conclusion

Chinese foreign aid flows to African economies have increased substantially in recent years and have financed an increasing share of their social and economic infrastructure projects. While there are several reasons to expect aid-receiving countries to supplement their inflows with additional domestic tax revenues, some theoretical and some empirical evidence suggest that foreign aid, in general, may reduce domestic fiscal effort. However, few empirical studies have examined the effect of Chinese aid and the origin of aid on resource mobilisation. This chapter analyses the effect of Chinese foreign aid inflows on domestic tax revenues in African economies. We find strong support for the hypothesis that Chinese aid reduces tax effort using GMM system estimators. However, while aid recipient countries seem to respond to Chinese loan aid by increasing

their tax revenues, grant aid does not affect their revenue mobilisation behaviour.

Furthermore, considering the package that accompanied Chinese aid via Chinese FDI, we find no statistically significant impact of Chinese aid associated with Chinese FDI on tax revenue mobilisation. These results suggest that African governments could negotiate a significant share of domestic companies to implement Chinese aid projects. This option could increase the tax base of host countries.

Furthermore, the estimation results show that trade openness, government efficiency and control of corruption, and the level of development contribute to the increase in the tax base. These results encourage policymakers to build a sound public administration and promote actions that increase domestic demand and supply. Besides, our findings show that resource rents discourage tax revenue mobilisation. From a policy perspective, this result suggests that governments should make all possible to promote non-resource activity to increase tax revenue. Furthermore, we find that the effect of aid on tax revenue depends on the origin and approach used. These results

suggest that western donors could reduce financial support and increase project aid on infrastructure, increasing taxpayer compliance and supporting tax reforms through advice on strengthening tax administrations and taxpayer compliance in recipient countries.

Appendix

Brief description of the GMM estimation technique.

We employed the system GMM technique to estimate the effect of china aid on non-resource tax revenue. The estimated equation is specified as follows:

$$tax_{i,t} - tax_{i,t-1} = (\delta - 1)tax_{i,t-1} + \beta X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

Where is $tax_{i,t}$ is non-resource tax revenue in % of GDP.

$X_{i,t}$ represents the regressors.

μ_i country fixed effects.

γ_t time fixed effects.

$\varepsilon_{i,t}$ idiosyncratic errors. i indicate countries and t the time.

Equation (1) can be equivalently rewritten as:

$$tax_{i,t} = \delta tax_{i,t-1} + \beta X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t}$$

(2)

The estimation of equation (2) with the FE estimator will produce biased estimates because the lagged dependent variable is included among the explanatory variables (dynamic model). Therefore, two estimation techniques are usually used for estimating dynamic panel data model for which, in addition to the lagged dependent variable, another control variable could be endogenous: the estimator of Arellano and Bond (1991) or difference GMM and the system GMM estimator of Blundell and Bond (1998).

Using Monte Carlo simulations, Blundell and Bond (1998) demonstrate that the system GMM estimator is more efficient than the difference GMM estimator explaining, therefore our preference for the former estimator. The system GMM method simultaneously estimates the following two equations by the method of the generalised moment:

$$tax_{i,t} = \delta tax_{i,t-1} + \beta X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t}$$

(3)

$$tax_{i,t} - tax_{i,t-1} = \delta(tax_{i,t} - tax_{i,t-1}) + \beta(X_{i,t} - X_{i,t-1}) + (\gamma_t - \gamma_{t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (4)$$

Note that the transformation in the first difference removes the individual fixed effect

Equation 3 is called equation in level while equation (4) is called equation in first difference. The variables in the first differences instrument the variables in level while the variables in first differences are instrumented by the lagged values of the variables in level. The instruments are generated using the following moment conditions:

For the equation in the first difference

$$E[tax_{i,t-s} \cdot (\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } s \geq 2; t = 3, \dots, T \quad (5)$$

$$E[X_{i,t-s} \cdot (\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } s \geq 2; t = 3, \dots, T \quad (6)$$

For the equation in level

$$E[(tax_{i,t-s} - tax_{i,t-s-1}) \cdot (\mu_i + \varepsilon_{i,t})] = 0 \text{ for } s = 1 \quad (7)$$

$$E[(X_{i,t-s} - X_{i,t-s-1}) \cdot (\mu_i + \varepsilon_{i,t})] = 0 \text{ for } s = 1 \quad (8)$$

The conditions (5) to (6) are combined with the generalized method of moments for estimating the model's coefficients. The

System GMM has the advantage to account for unobserved heterogeneity of countries, omitted variables bias and bias resulting from measurement error problem on variables (Diallo, 2013).

Part 2: External Financial Flows and
Development Funding in Developing
countries: The role of Foreign Direct
Investment.

Chapter 3: The Effect of Foreign Direct Investment on Tax Revenue in Developing Countries⁶

Abstract:

Internal resource mobilisation remains a big challenge for developing countries. While many studies have attempted to highlight several strategies to increase tax revenues, the contribution of Foreign Direct Investment (FDI) flows in this process has received little attention. Two opposing mechanisms may come into play in analysing the link between FDI and tax revenues: First, FDI inflows might increase tax revenues by broadening the corporate tax base with a new entry (new investment); Second, in order to attract FDI, many developing countries grant significant tax exemptions to new investors who may sometimes lead to unfair competition, FDI inflows may not lead to a significant increase in tax revenues. This chapter provides an empirical answer to the crucial role of FDI inflows

⁶ A version of this chapter is published in *Comparative Economic Studies*.

in tax revenue mobilisation. Using a System GMM system estimator for 90 developing countries over the period 1996 – 2017, our results strongly suggest that FDI inflows lead to a significant tax revenue increase. Nevertheless, this effect is not observed in resource-exporting countries where tax revenues seem statistically insensitive to FDI inflows.

Keywords: Foreign direct investment, tax revenue, System GMM, resource exporting countries.
JEL Codes: F21 - H20 – E62

1. Introduction

A considerable financing gap threatens the achievement of the sustainable development goals (SDGs) included in the 2030 schedule, especially in developing countries. According to UNCTAD (2014), developing countries should mobilise an average of \$5 trillion per year to cover their financing needs. Still, only about half of this amount can be mobilised, that is, \$2.5 trillion per year. Consequently, the mobilisation of all sources of financing is becoming imperative.

In this context, since the United Nations conference in Addis Ababa in 2015, much hope has been placed in tax revenues. According to the World Bank (2017), tax revenues should represent between 50 and 80% of the resources needed to finance SDGs. However, the tax revenues mobilised by most of these countries are below the standard proposed by the International Monetary Fund (IMF) for this purpose, that is, 20% of GDP. For example, in 2018, out of a sample of 92 developing countries, the share of revenue in the GDP of 74 developing countries was less than 20%. Besides, 65 countries in the sample had a ratio of less than 17%. This lack of internal

resources has led several academics and institutions to address the issues through key determinants of internal revenue mobilisation (Baunsgaard and Keen, 2010; Brun et al., 2005; Chambas, 2005). Alongside this, it would be relevant to analyse the correlation between external sources of finance and internal revenue mobilisation, particularly Foreign Direct Investment (FDI) and tax revenues.

FDI is the primary source of external financing for developing countries, ahead of migrant remittances and official development assistance (ODA). In 2018, developing countries had mobilised \$699.3 billion in FDI (UNCTAD, 2020), \$529 billion in remittances, and \$160.4 billion in ODA (Barne and Pirlea, 2019). The importance of FDI has thus given rise to significant academic and practical debates on its effects on the host country's economy through careful testing of its main determinants. Its effects on growth, knowledge transfer, and poverty have received considerable attention in the literature, but its contribution to tax revenues remains little explored to date.

In principle, by contributing to A considerable financing gap threatens the achievement of the sustainable development goals (SDGs) included in the 2030 schedule, especially in developing countries. According to UNCTAD (2014), developing countries should mobilise an average of \$5 trillion per year to cover their financing needs. Still, only about half of this amount can be mobilised, that is, \$2.5 trillion per year. Consequently, the mobilisation of all sources of financing is becoming imperative.

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From a direct point of view, companies benefiting from FDI will increase their productivity. Therefore, this medium could increase its industrial and commercial profit (ICP). Thus, the increase in the ICP of these companies will widen the taxable base of the corporation tax and thus increase tax revenues. Besides, when FDI flows go to labor-intensive sectors, the job supply and the wage bill increase. Therefore, this medium could

increase the personal income tax base. According to Zhang (2001), FDI increases tax revenues through job creation. In addition, the diffusion of technology and knowledge transfer resulting from FDI could increase productivity in the host country and thus generate income (Danielova and Sarkar, 2011; Gajigo et al., 2012; Nguyen et al., 2014). This will allow multinational companies to benefit from dividends and allow the public administration to increase its tax revenues through income taxes.

Indirectly, FDI could result in consumption in two ways: through supply and through demand. First, when FDI contributes to an increase in the production of goods and services offered on the domestic market, it can increase VAT revenues. Second, on the other hand, increased demand for goods and services because of increased employment could increase VAT receipts. Again, this would lead to an increase in tax revenues.

Notwithstanding these likely benefits, they may be neutralised or even cancelled under certain conditions. Indeed, multinational companies can implement tax optimisation

policies through transfer pricing practices that favor reducing revenues from international companies. This reduces the tax potential of this activity and reduces corporate tax (Fuest and Riedel, 2009; Gropp and Kostial, 2001; UNCTAD, 2012). Moreover, competition between countries to attract FDI leads them to implement tax incentive policies through tax exemptions as well as tax rate reductions, which could offset the expected positive effects (Fuest and Riedel, 2009; International Monetary Fund Staff, 2011; Zee et al., 2002). Also, the practice of bribery between tax administrators and foreign companies in specific industries could lead to lower tax revenues (Bornhorst, Gupta, and Thornton, 2009; Ehrhart, 2011).

Because of the above, we cannot predict the effects of FDI on tax revenue mobilisation. Thus, this effect will be positive if the advantages outweigh the disadvantages, neutral if the two outweigh each other, and negative if the disadvantages outweigh the disadvantages. Therefore, to analyse the effect of FDI on tax revenues, an empirical study needs to be carried out to determine this relationship.

The chapter's contribution is twofold: firstly, it expands the literature on the effect of FDI inflows and the drivers of tax revenues in developing countries. Some studies (Bénassy-Quéré, Fontagné, and Lahrière-Révil, 2005; Rochananonda, 2006; Becker, Fuest, and Riedel, 2012) have examined the correlation between tax revenues and FDI, but they have focused only on the impact of tax and fiscal policies on attracting FDI without exploring the opposite direction. Moreover, most studies on the determining factors of tax revenues have not considered the impacts of FDI.

Secondly, it contributes to the literature by estimating the impact of FDI on tax revenue mobilisation for developing countries in general and resource-exporting economies more particularly. To our knowledge, this is the first study to analyse the effect of FDI on tax mobilisation for resource-exporting economies from developing countries.

The remainder of the chapter is structured as follows. Section 2 presents theoretical and empirical literature on the relationship between FDI and tax revenue mobilisation. Section 3 presents the empirical methodology used to estimate the impact of FDI

inflows on tax revenue. Section 4 describes the data used and provides stylised facts for this study. Section 5 discusses the empirical results and runs some robustness checks, while section 6 concludes the study.

2. Theoretical And Empirical Literature On The Impact Of Fdi On Tax Revenue

This subsection reviews the theoretical studies on the relationship between FDI inflows and tax revenue collection. The theoretical framework section analyses the transmission channels through which variation in FDI net flows may affect tax revenue. The empirical reviews section reviews the literature on the effect of FDI net inflows on tax revenue.

2.1 Review of theoretical literature

The literature on FDI partly indicates that FDI can positively impact tax revenues. However, for other studies, the positive effects of FDI on tax revenues do not automatically materialise. FDI can hurt tax revenues in several ways. The direction of the impacts of FDI depends on the political and economic structure prevailing in the host country.

2.1.1 The positive effect of FDI on tax revenue

This positive impact can be direct (through productivity, technology transfer, job creation) or indirect (consumption, trade, employment). By providing financial resources for establishing activities in the formal sector, FDI inflows are likely to generate additional value-added tax (UNCTAD, 2012). Besides, by contributing to new jobs, FDI inflows might generate tax revenue on labor income (Fuest and Riedel, 2009; UNCTAD, 2012). By improving exports and facilitating access to markets or supplies, FDI increases customs-duties revenue (Anwar and Nguyen, 2011). Knowledge transfer and technology dissemination are ways in which FDI can also fund the exploitation of natural resources and generate income. FDI's capital gains and profits contribute to corporate tax revenues in the host country (Danielova and Sarkar, 2011; UNCTAD, 2012). Fuest and Riedel (2009) highlighted that most poor populations in developing countries are not taxed. Therefore, FDI inflows can contribute to revenue mobilisation by broadening the taxpayer base and generating more tax revenue by supporting investment and employment opportunities. For countries with critical natural resources, FDI inflows directed toward those sectors are likely to develop royalties, which might be large enough.

Ehrhart (2011) illustrated that in resource-rich countries, democratic institutions are vital because of their higher levels of transparency, leading to the positive effects of the initial natural-resource rent on

domestic tax revenues. Furthermore, given that most FDI is directed to natural-resource exploitation activities in developing countries, it can be inferred that higher levels of transparency can positively impact the income that FDI can generate. Thus, an excellent institutional environment will attract more foreign investors and ensure their effective participation in tax revenues.

2.1.2 The negative effect of FDI on tax revenue

Many studies explain how FDI can shrink the tax base through several mechanisms and factors. For example, revenue mobilisation could be affected by the "negative consequences" of tax incentives, tax evasion, and tax fraud and avoidance by multinational companies, overly competitive conditions that can crowd out domestic and local companies, and the pursuit by tax authorities and international companies of income from rent-seeking activities.

UNCTAD (2012) shows that FDI can generate financial resource outflows in the repatriation of income or costs. According to Gropp and Kostial (2001), multinational groups can transfer taxable income to countries with a less restrictive tax system through "transfer pricing" and other tax mechanisms such as debt financing. Gropp and Kostial (2001) take the

example of a multinational in a high-tax country that produces a good with a branch's inputs in a low-tax country. For business-to-business (B2B) trade, the multinational has an incentive to overestimate the price of inputs, increasing profits in the low-tax country and reducing profits in the high-tax country, thereby minimising global tax obligations. Fuest and Riedel (2009) explain that profit displacement by multinationals acts by distorting trade prices. They argue that the prices of goods exported to developing countries are distorted upwards. On the other hand, the prices of goods imported from developing countries remain artificially low, so income generated in developing countries accrues to developed economies.

Zee et al. (2002) point out that the widespread use of tax incentives to attract FDI has several negative consequences (in terms of lost revenue). According to Zee et al. (2002) and Fuest and Riedel (2009), FDI can produce tax revenue losses through the existence of tax incentives such as Free Economic Zones, where goods are generally exempt from duties and corporate taxes are low or zero. Zee et al. (2002) explain this as follows: First, these incentives reduce the tax base. Second, tax

incentives distort the allocation of resources toward activities that benefit from tax advantages to the detriment of others. Finally, tax exemptions create opportunities for corruption and rent-seeking. Therefore, the lack of visibility in the treatment of exemptions may impact revenue. In this line, IMF (2011) shows that the revenue effects of FDI could be substantially reduced when significant tax cuts accompany FDI.

According to UNCTAD (2012), FDI can, in some situations, crowd out domestic corporations, particularly Small and Medium-Sized Enterprises. Nevertheless, in the same vein, FDI can reduce the proportion of taxpayers and limit these national units' taxation.

Zee et al. (2002) state that tax incentives to attract FDI create corruption and business opportunities that generate socially unacceptable profits and enormous income. Pursuing rents is likely linked to natural-resource exploitation activities (Bornhorst et al., 2009). Most foreign companies are involved in this sector, particularly in African countries. Corrupt practices between tax officials and foreign companies in this sector can lower tax revenues. Because of this analysis, it is

difficult to determine the net impacts of FDI on tax revenues a priori.

2.2 Review of the empirical literature

The economic literature has focused a great deal on the effect of taxation on attracting FDI and revealed that taxation is a crucial determinant of FDI inflows, and there was a negative relationship between tax rates and FDI inflows (Bénassy-Quéré et al., 2005; Devereux and Freeman, 1995; Loretz, 2008; Tabasam, 2014). Nevertheless, a few studies analysed the effect of FDI on tax revenue. Furthermore, the rare studies on these issues found an ambiguous result (Gropp and Kostial, 2000; Gnanon, 2017; Mahmood and Chaudhary, 2013; Tabasam, 2014).

The earlier literature typically found a positive relation between FDI and government revenue.

Dunning (1993) and Raff and Srinivasan (1998) focus their investigation on the FDI effect through the determinants of tax revenues. Dunning (1993) argued that the welfare effects of FDI in the host country depend on the bargaining power of the host country with foreign investors, including either by offering the

tax rebates on energy or labor costs to attract foreign investment or by imposing the tax. Raff and Srinivasan (1998), on the other hand, have claimed that FDI could create employment, transfer technology through training local labor, and improve management skills; the government should lose some tax revenue to attract foreign investment inflow.

In one of the early empirical studies, Gropp and Kostial (2000) analysed the correlation between FDI, taxation, and corporate tax revenues in 19 OECD countries over 1987–1997 using panel data analysis and found that FDI inflows affected the corporate tax revenues positively. Furthermore, Mahmood and Chaudhary (2013) analysed the effect of FDI on the total tax revenue in Pakistan during 1972–2010 and revealed that FDI inflows affected the total tax revenues positively. However, the results may not be generalised to other countries in the Middle East and North Africa (MENA) regions.

Okey (2013) also studied the effect of FDI inflows on tax revenue mobilisation in West Africa over 1989–2009. Using a panel regression, he concluded that FDI inflows positively impact tax revenues. However, the findings may not be

generalised to other countries of South Saharan Africa because the investigation is limited to only French-speaking members of ECOWAS (Economic Community of West African States), and these countries have political and economic characteristics different from those of English speaking countries in the West African Region.

In another study, Bunescu and Comaniciu (2014) studied the economic and non-economic factors that affect tax revenues in 27 EU countries over 1995–2011. Using correlation analysis, they revealed that FDI inflows had a weak positive effect on tax revenues. On the other side, Tabasam (2014) investigated the interaction between tax revenues and foreign capital inflows (FCIs) in Pakistan during 1975–2012. Using time series analysis, he concluded that FDI inflows hurt tax revenues. Besides, Aslam (2015) examined the long-run relationship between FDI inflows and tax revenues in Sri Lanka over 1990–2013 and discovered that FDI inflows made a significant positive contribution to tax revenues.

Bal and Fazl (2016) also studied the impact of FDI inflows on firms' tax payments at different levels of technology in Turkey

over 2004–2012. They found that FDI inflows increased firms' tax payments and that the effect was more extensive in high-technology firms.

Gnangnon (2017) analysed the effect of FDI on government revenue. Using panel data over the period 1980–2013, he found that the impact of FDI on government revenue depends on the level of FDI inflows. Finally, Bayar and Ozturk (2018) investigated the effect of FDI inflows on tax revenues in OECD countries with a panel cointegration and causality analysis during the 1995–2014 period. They found that there was one-way causality from FDI inflows to total revenues.

3 Specification Of The Model And Econometric Methods

This section focuses on the specification of the empirical model for estimating the impact of FDI flows on total tax revenues and the estimation method used to evaluate this empirical model.

3.1 Empirical Model specification

Because of the inertial tax structure of developing countries and the fact that a country's current fiscal capacity depends on its inherited fiscal capacity from the past (Besley and Persson, 2013), previous studies on tax effort estimate that the level of current tax revenue in each country is affected by its past values (Gnangnon and Brun, 2017; Gupta, 2007; Leuthold, 1991; Yogo and Ngo Njib, 2018). Therefore, we consider and specify a dynamic panel data model to estimate the impact of income inequality on non-resource-related tax revenues. Precisely, the estimated model is defined as follows:

$$\log (Tax)_{it} = \alpha + \delta \log (tax)_{it-1} + \beta \log (FDI)_{it} + \theta X_{it} + \vartheta_i + \mu_t + \varepsilon_{it} \quad (1)$$

where $(Tax)_{it}$ is the ratio of total tax revenues to GDP for country i in year t while $(tax)_{it-1}$ is its value in year $t - 1$. $(FDI)_{it}$ represents the ratio of FDI net inflows to GDP for the host country i in the period t . We want to point out that in Equation (1), for the variable $(FDI)_{it}$, which contains negative values, we follow Gnangnon (2017) by applying the following log formula:

$$\log(FDI) = \text{sign}(FDI) * (\text{Log}(1 + \text{abs}(FDI))) .$$

X_{it} stands for other tax revenue determinants identified by previous studies on tax revenue mobilisation in developing countries. These determinants include GDP per capita, agriculture value-added, manufacturing value-added, trade openness, and corruption (Brun and al., 2005; Gupta, 2007). Temporal effects (μ_t) are included to control for the common shocks affecting developing countries, ϑ_i represents a country-specific effect, and ε_{it} is the error term.

Agriculture and manufacturing value-added include controlling the economy's sectoral composition, while trade openness contains the effect of exposure to international trade on the tax ratio. Finally, we also retain control of corruption among the explanatory variables as a proxy for the institutional policy and GDP per capita to measure the level of development.

In Equation (1), ϑ_i is included among the right-hand side variables to control for unobserved time-invariant country-specific characteristics that are potentially correlated with tax revenues and μ_t to control for time-varying shocks and economic fluctuations that affect all developing countries.

3.2 Identification strategy

We must fix some econometric issues when estimating the baseline specification (Equation 1). First, FDI is likely to be endogenous due to the inverse causality between fiscal policy and the decision to invest. Indeed, governments may choose to reduce their tax burden to attract foreign investors. Consequently, FDI could be correlated with the error term. Besides, a lagged dependent variable among the right-hand variables creates a dynamic panel bias (Nickell, 1981) due to the correlation between the lagged dependent variable and the error term. This bias is particularly significant for panel data with a short time dimension ($T = 5$ for our panel). In this case, applying a panel fixed effects estimator would not be appropriate (Roodman, 2009b).

Following the literature on estimating dynamic panel data, we use the system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). Gnanon (2017) adopts the same approach using the system GMM estimator to estimate the impact of FDI inflows on total non-resource tax revenue and non-resource corporate tax revenue.

In the system GMM estimator, the level and difference equation are combined as a system, and their lagged differences are used as instruments for the level variables. The lagged level variables instrument the different variables. This increases the efficiency of the system GMM estimator relative to the difference GMM estimator because the system GMM simultaneously exploits the time-series dimension and the variations in the cross-section of the data. The difference GMM estimator (Arellano and Bond, 1991) uses the first differences to remove unobserved country fixed effects in Equation (1). This solves the problem of potential correlation between unobserved country fixed effects and the explanatory variables. Then, the first differentiated variables are instrumented by the lagged values of the level variables. However, the difference GMM estimator's problem is that lagged levels of variables may be imperfect instruments (weak instrument problem) if those variables follow a random walk process, as lagged values of the level variables provide less information about future changes (Blundell and Bond, 1998). Therefore, in this study, our preferred estimator is the system GMM one (Arellano and Bover, 1995; Blundell and Bond, 1998). The validity of the instruments in system GMM

estimation is checked by the Hansen test of over-identifying restrictions, which tests the validity of the instrumental variables used in the regressions and the Arellano and Bond autocorrelation tests. Furthermore, with the system GMM estimator, we must ensure that the total number of instruments does not exceed the number of countries to avoid the problem of "instrument proliferation" in the estimations (Roodman, 2009a).

4 Data

To achieve our objectives, we construct an unbalanced panel dataset of 90 developing countries from 1990 to 2017. The availability of data dictates the choice of the sample and the period covered. Since the 1990s, globalisation has meant a new phase in the global integration of economic, financial, ecological, and cultural phenomena. Furthermore, our model specification contains the variables capturing corruption whose data start from the year 1996. We, therefore, retain the period from 1996 to 2017 as the analysis period of this study.

4.1 Dependent variable: Tax revenue (TAX)

Tax revenue includes national government revenue collected from tax sources aggregated at the central and local level, taxes, and social contributions taxes. It is the ratio of tax revenue to GDP. The variable total tax revenue is extracted from the ICTD-GRD database (UNU-WIDER Government Revenue Dataset, 2020).

4.2 The primary explanatory variable: Foreign direct investment net inflows (FDI)

FDI means the acquisition of 10% of a foreign company's share capital in a foreign country different from that of the investors. It comprises the sum of equity, reinvested earnings, and other long- or short-term capital as they appear in the balance of payments. Because of the above in section 2, we cannot predict the effect of FDI⁷ on tax revenue mobilisation. Thus, the impact will be positive if the advantages outweigh the disadvantages,

⁷ UNCTADstat – documentation, available at <https://unctadstat.unctad.org/wds/TableViewer/summary.aspx?ReportId=96740>

neutral if the two outweigh each other, and negative if the disadvantages outweigh the advantages.

As in the empirical literature on economic growth and according to Islam, Madsen, and Doucouliagos (2018), we divide the panel data period into five-year intervals without overlap to obtain panel data for seven periods, except for the last sub-period, which is three years: 1995–1999; 2000–2004; 2005–2009; 2010–2014; 2015–2017. This transformation eliminates cyclical fluctuations in the data (Pickering and Rajput, 2018; Yogo and Ngo Njib, 2018) and mitigates the problem of measurement errors (Yogo and Njib, 2018), thus allowing a focus on long-term relationships. Moreover, this transformation is consistent with volatile FDI flows data for developing countries. However, the most recent years' FDI data are still preliminary and subject to revision by national authorities at the time of publication.

4.3 Control variables

As already mentioned in the paragraph following the empirical model, the control variables include GDP per capita as a proxy for the level of development, the ratio of agriculture value-

added to GDP, the ratio manufacturing value-added to GDP, trade openness measured by the ratio of the sum of exports and imports to GDP, and the control of corruption. These variables were obtained from the World Development Indicators (WDI) database and World Governance Indicators (WGI). Let now discuss the expected effect of control variables on tax revenue.

Agriculture value-added.

The ratio of agriculture value-added to GDP is employed as a proxy for the economy's structure or sectoral composition. In developing countries, the agricultural sector is dominated by many smallholder farmers who produce for self-consumption, sell their output in informal markets, or exchange their products for other goods. Besides, most farmers in African countries do not keep current accounts for managing their farms. All these factors, as mentioned above, contribute to making it hard to tax the agricultural sector in Africa (Fox and Gurley, 2005; Gupta, 2007; Stotsky and WoldeMariam, 1997). We therefore expected a negative effect of agriculture value-added on tax revenues in our estimations.

Manufacturing value-added.

The ratio of manufacturing value-added to GDP is employed as a proxy for the economy's structure or sectoral composition, like agriculture value-added. Hence, more extensive manufacturing in developing countries is easier to monitor and tax. Besides, the smaller the share of manufacturing in the host country, the lower the tax performance. We therefore expected a positive effect of manufacturing value-added on tax revenues in our estimations.

Trade openness

Trade openness expressed as the ratio of the sum of exports and imports to GDP is expected to increase tax mobilisation as trade openness stimulates trade volume and therefore trade taxes. However, trade liberalisation policies have been implemented in developing countries through cuts in tariffs. These measures have resulted in a loss in tax revenue for some countries (Baunsgaard and Keen, 2010), while others have compensated for losses in tariffs by an increase in domestic tax revenue (Bird and Gendron, 2007; Cnossen, 2015). Therefore, trade openness could also affect tax revenues through domestic tax revenues. This phenomenon is mainly due to the impact of export earnings on the wages of domestic traders and their

domestic consumption. Due to the expansion of exports, greater trade openness is likely to generate more export revenues for traders who participate in international trade activities. As a result, traders' profits would increase and develop a positive employment dynamic for the companies concerned. This would imply an increase in direct tax revenues and total tax revenues. This positive income effect could increase domestic consumption and thus indirect tax revenues. Within this background, the impact of trade openness on tax revenue is a priori difficult to predict. Therefore, in this study, the expected effect of trade openness on revenue variables remains a priori unknown.

Control of corruption

The functioning of tax administrations is nevertheless affected by elements of the institutional context, so in this study, we pay particular attention to the effects of corruption. The level of corruption in the country may affect its tax collection performances. For example, some taxpayers may erode their tax bases in collaboration with a tax administration official. Therefore, we control for the impact of corruption on tax revenue. To do so, we include the indicator “control of

corruption index” from WGI (Kraay, Kaufmann and Mastruzzi, 2010). The index measures the perception of corruption, ranging from -2.5 to 2.5, with higher values indicating a better control of corruption in the host country.

GDP per capita.

GDP per capita measures the level of development. A high level of development tends to be associated with a greater ability to pay and collect taxes. In addition, the level of development is associated with a high demand for public goods and services (Wagner's law). The impact of GDP per capita should therefore be positive.

Table 1 provides descriptive statistics on the averaged five non-overlapping years' data of all the variables from the sample used to estimate this study. The average non-resource tax revenue equals 13.39% of GDP, while total tax revenue for the selected countries under investigation accounts for 15.42% of GDP (Table 1). The average FDI net flows are 4.03% of GDP, with the lowest FDI flows are negative at -7.76% and the highest are positive at 42.19%. The following section is devoted

to analysing the results obtained from estimating the impact of FDI on tax revenue.

FDI net inflow and tax revenue trends

We first look at the nature of the relationship between FDI net inflows as GDP and tax revenues as GDP through graphical analysis. Figure 2 depicts the relationship between FDI net inflows as GDP and tax revenues as GDP in a sample of developing countries from 1990 to 2017.

FDI flows have increased significantly since the early 1990s (Figure 1). However, they accounted for only 1.74% of GDP in 1990. Moreover, they peaked at 6% of GDP in 2011 before falling back to 3.7% of GDP in 2010. Nevertheless, this growth has not been stable over time, only on closer inspection. Indeed, since the 1990s, following economic liberalisation through the vast privatisation movements under structural adjustment programmes, developing countries, and more precisely those in our sample, have experienced a sustained increase in FDI share in their economies. Moreover, between the late 1990s and the early 2000s, this was followed by a decline in the FDI ratio associated with, among other things, weak economic growth in

most parts of the world and falling stock markets that reduced capital flows (UNCTAD, 2003). In other words, the reduction in global growth led to a decline in demand and production. Moreover, the fall in stock markets reduces investor confidence in the short-term prospects for recovery. This situation is a natural consequence of the decline in investment. On the other hand, the downturn of FDI flows since 2008 partly reflects the results of the financial crisis of the subprime crisis of 2007/2008 and secondly, the difficulties encountered by globalisation since the early 2010s when a sharp decline in almost all aspects of globalisation (FDI, migration, foreign trade) occurred.

Table1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total Tax Revenue	405	15.424	7.653	.740	52.645
FDI net inflow	450	4.035	4.785	-7.761	42.193
Agriculture added value	450	17.658	14.153	.0183	74.584
Manufacturing added value	409	12.907	6.930	.673	47.110
Trade openness	450	76.143	39.265	17.327	279.088
Control of Corruption	449	-.442	.698	-1.739	1.565
Non-Resource Tax Revenue	414	13.391	6.607	.548	56.809
Exchange rate	435	111.267	124.323	52.177	2665.717
Financial Development	440	.213	.142	.031	.730
income Tax	382	4.807	2.971	0	22.319
Tax on goods and services	408	6.178	3.350	.009	17.488
Corporate Tax	314	2.286	1.474	0	8.216
Direct Tax	412	4.563	3.040	.056	19.133
Political Stability	449	-.390	.848	-2.763	1.304
GDP per capita	447	4225.11	6727.866	122.622	46527.75

Source: Author's calculation using data from UNU-WIDER, WDI, UNCTADsta and WGI(Kraay et al.,2010)

Long-term trends show a positive relationship between FDI flows and tax revenues (Figure 1), although, at times, we can observe negative correlations or no correlation at all. For example, tax revenues stagnated from the mid-1990s to the early 2000s while FDI flows peaked at around 5% of GDP. This reflects, on the one hand, incentives and trade liberalisation and the adoption of trade agreements relating to FDI. In other words, since the early 1990s, developing countries have introduced incentives through tax exemptions and reductions in tax rates to attract foreign investors. Also, to alleviate double taxation problems, governments have established non-double taxation treaties with individual partner states. These measures have increased the share of FDI in the economy, but tax revenues do not follow this FDI growth.

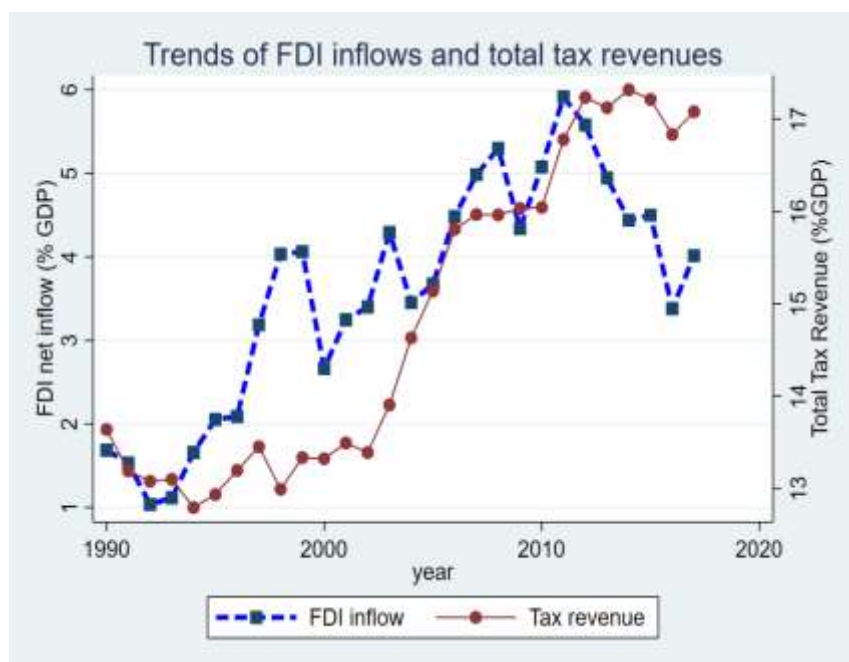
As a highlight in Figure 2, most countries have the lowest average FDI as GDP over 1990–2017. Figure 2 shows that

resource-rich countries tend to have a higher level of FDI as GDP while their performance in collecting tax revenue is lower than that of the non-resource-rich countries in the continent. This is not to say that resource dependence is attracting FDI inflows but indicates that resource dependence may reduce the effort to collect taxes from tax bases.

The trend line in Figure 2 below shows a positive correlation between FDI inflow and tax revenue, whereas countries like Liberia, Equatorial Guinea, Mozambique, and the Republic of Congo have higher FDI inflow as GDP. Still, their tax performances are less than 10% of GDP on average. The trend line represents, in fact, a correlation, not causality. This suggests that the relationship obtained from the graphical analysis could be biased by econometric problems like reverse causality from taxes to the attraction of FDI inflow and the existence of other factors that affect the nexus between FDI

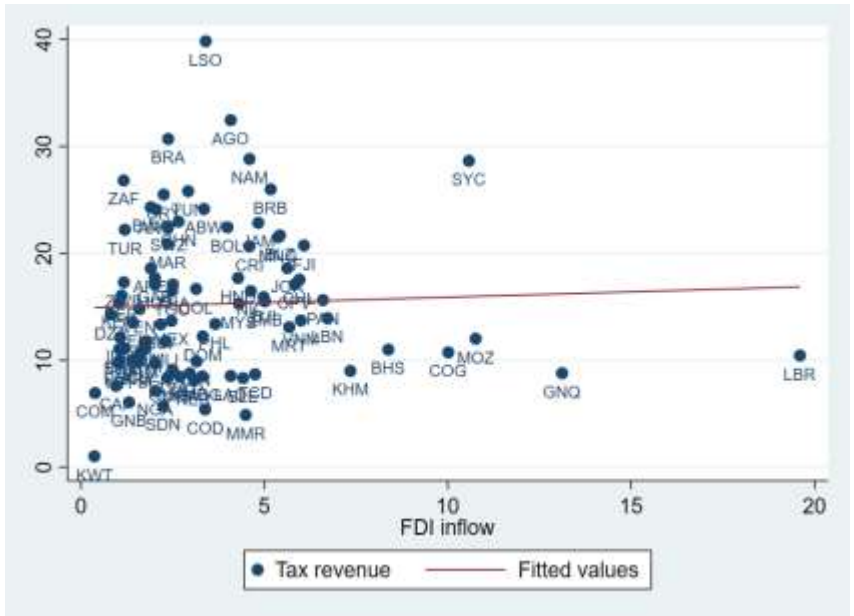
inflow and taxes. Therefore, we undertake an econometric analysis to explore further the impact of FDI net inflow on tax revenue collection.

Figure 5 Trends of FDI and tax revenue



Source: Author's calculation using data from UNU-WIDER, UNCTADst

Figure 6: Correlation between FDI and tax revenue



Source: Author's calculation using data from UNU-WIDER, UNCTADsta

5 Mains Results

We present the main results obtained from estimating the base equation and those obtained from the various robustness analyses to check whether the main results are robust under certain circumstances.

5.1 Baseline results

Before analyzing and commenting on our results, it is essential to point out that the system GMM estimator's regressions pass all standard diagnostic tests. There is no evidence of second-order residual autocorrelation, and Hansen's test confirms that all instrumental variables are exogenous. Besides, for each system GMM regression performed, the number of instruments does not exceed the number of countries (see the last rows of Tables 2, 3, and 4). Table 2 presents the results from estimating the basic specification (Equation 1). The results show that the impact of FDI on total tax revenue is positive and statistically significant at 10%.

Furthermore, the estimates indicate that a 1% increase in FDI flows will lead to a 1.5% increase in developing countries' total tax revenue ratio (column 1 of Table 2). This result suggests that FDI flows are a non-negligible source of tax revenue mobilization. Therefore, policymakers can consider reasonable measures to make FDI flows more attractive and improve their countries' tax revenue collection. As regards the classical determinants of tax revenues, in line with the literature on the subject, our estimation results indicate that the coefficient of

the lagged dependent variable is statistically significant at 5% in all specifications (columns 1 to 4 of Table 2), which supports the prediction of inertia in tax collection in developing countries.

As expected, we find that manufacturing value-added is positively correlated with total tax revenue in developing countries (column 1, Table 2). These results may show that the manufacturing industry regularly illustrates the importance of sectoral share indicators. Tax collection is likely to be based on a range of relevant elements – reflecting the fact that a more concentrated, complex, and formalized economic activity is more amenable to tax collection. Besides, we find a positive correlation between tax revenue mobilization and the control of corruption. These results are in line with the literature

Table 2: Effect of FDI on total tax revenue

VARIABLES	(1)	(2)	(3)	(4)
	Baseline	Exchange rate	Political stability	Financial Development
L.Log(Total tax revenue)	0.682*** (0.103)	0.672*** (0.105)	0.643*** (0.110)	0.738*** (0.092)
Log(FDI Flow)	1.497* (0.782)	1.603* (0.829)	1.156* (0.636)	1.854** (0.713)
Log(GDP per capita)	-0.048 (0.043)	-0.029 (0.043)	-0.022 (0.055)	-0.048 (0.054)
Log(Agriculture)	-0.076 (0.067)	-0.061 (0.068)	-0.057 (0.075)	-0.050 (0.062)
Log(Manufacturing)	0.083** (0.039)	0.092** (0.044)	0.082* (0.042)	0.062* (0.036)
Log(Trade openness)	0.051 (0.063)	0.019 (0.074)	0.033 (0.072)	-0.029 (0.072)
Control of corruption	0.013*** (0.005)	0.013*** (0.005)	0.028** (0.013)	0.012*** (0.004)
Log(Exchange rate)		-0.000* (0.000)		
Political Stability			-0.031 (0.029)	
Financial Development				0.192* (0.280)
Constant	-0.373	-0.493	-0.576	-0.327

	(0.379)	(0.405)	(0.436)	(0.344)
Observations	324	324	324	319
Number of Countries	68	68	68	67
Number of instruments	28	27	30	26
AR1_Pvalue	0.00124	0.00164	0.00304	0.00168
AR2_Pvalue	0.360	0.365	0.484	0.214
Hansen_Pvalue	0.497	0.277	0.279	0.130

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: author

In contrast to expectations, the impact of trade on total tax revenue is positive but non statistically significant in the results reported in Table 2. One possible explanation could be a reduction in the rate of customs duties (Gupta, 2007; Keen and Simone, 2004). Gupta (2007) concluded that lower tariff rates lead to lower tax revenues. Besides, Keen and Simone (2004) suggested that in parallel with reducing tariff rates, revenues could increase if trade liberalization occurs through quota pricing, removal of exemptions, reduced tariff peaks, and improved customs procedures. It follows that policies aimed at further trade liberalization in developing countries may be detrimental to revenue generation. This could be addressed by

revising trade agreements that discourage corruption in customs divisions through better service and prosecution conditions. Given the positive impact of FDI inflows on tax revenue mobilization, we subject this result to various robustness tests.

5.2 Robustness check

We perform various robustness analyses to check whether the positive impact of FDI inflows on tax revenues found by the empirical research holds when specific considerations are considered.

5.21 Analysis of transmission channels of FDI inflows to total tax revenue

This subsection discusses how FDI may affect tax collection, highlighting that political stability, exchange rate, and Financial development are potential transmission channels of FDI inflows to tax revenue. Thus, adding these variables as a control in the baseline specification may only lead to weak FDI inflows. This is the background approach we follow to test the transmission channels of FDI inflows to total tax revenue in developing countries.

5.2.11 Political stability

In discussing how net FDI inflows affect tax revenue mobilisation, we have suggested that increasing net FDI inflows can favor government stability and significantly promote tax collection. Therefore, we need to control government stability to effectively capture the effect of net FDI inflows on the tax revenue ratio. We use the government stability index from the WGI (Kraay et al., 2010). This index captures perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. It ranges from – 2.5 to 2.5, with higher values indicating the most stability. While this article's main findings remain qualitatively stable when control of the government stability index is included in the equation, we find that political stability does not significantly impact total tax revenue mobilisation (Table 2, column 3)

5.2.12 Exchange rate

We control the exchange rate because the volume of FDI is a function of the exchange rate's stability (Udomkerdmongkol, Morrissey, and Görg, 2009). Still, this stability also reflects a

better economic policy and therefore is favorable to a better taxation that may be likely to attract FDI. Moreover, developing countries' economic policies are most frequently observed with the existence of an often-negative relationship between a country's tax revenues and the real level of its official exchange rate. An appreciation of the real official exchange rate – that is, a decline in national currency units per unit of foreign currency – leads, all other things being equal, to a decrease in the ratio of tax revenue to GDP. A significantly overvalued exchange rate implies a much lower tax ratio than would otherwise have existed. The exchange rate data is taken from Darvas (2021).

The chapter's main results remain unchanged when the impact of the exchange is controlled. The effect of the FDI inflows on tax revenue is positive and significant. Furthermore, as expected, the exchange rate has overvalued significantly reduced tax revenue collection by 10% (Table 2, column 2).

5.2.13 Financial Development

In discussing how net FDI inflows affect tax revenue mobilisation, we have suggested that increasing net FDI inflows

can favor financial development and significantly enhance tax collection. Therefore, we need to control the impact of financial development to effectively capture the effect of net FDI inflows on the tax revenue ratio. We use a new composite index introduced by the IMF's Policy and Strategy Review Department, constructed from various financial systems indicators using Principal Component Analysis (PCA).

According to Svirydzenka (2016), the index captures financial development in a multidimensional way, involving banking and non-banking institutions and stock market development. Three dimensions of these systems are considered in calculating the index: their depth, access, and efficiency.

The chapter's main results remain unchanged when the impact of the exchange is controlled. The effect of the FDI inflows on tax revenue is positive and significant. Furthermore, as expected, the suppression of financial constraints and the improvement of the financial system would increase the total tax revenue (Table 2, column 4).

5.22 Disaggregated tax revenue.

Moreover, these overall results could mask considerable contrasts depending on the types of tax revenues from which this capital could benefit. A series of studies document the relationship between FDI inflows and tax policies but analyse this relationship at an aggregate level of tax revenues and do not identify which particular tax policy is likely to benefit most from FDI inflows. We seek to fill this gap by analysing the effect of FDI inflows on disaggregated tax revenue.

5.2.21 FDI effect on non-resource tax

As tax revenues do not wholly exclude natural resource revenues (they contain the tax on mining/oil companies), we replace the chosen indicator with an indicator of tax revenues excluding natural resources. Our results show that FDI inflow increases non-resource tax mobilisation (Table3, Column 1). Moreover, the estimated elasticity is close to 2, suggesting that a 1% increase in FDI inflows may cause a non-resource tax increase of 2%. This means that policymakers could implement FDI-attracting policies that improve non-resource activities.

5.2.22 FDI effect on direct tax

Given the role of FDI in growth, business productivity, and employment, we estimate the relation of FDI with direct tax. The results show that the impact of FDI inflows on direct tax mobilisation is positive but not statistically significant (Table 3, column 2). We can offer two possible explanations for this non-significant correlation. The first possibility is that because of competition between domestic and foreign companies, FDI flow could crowd out certain domestic companies. This may offset the positive effect of FDI on direct tax revenue. However, we believe that this is unlikely because the less competitive domestic companies would crowd out, and this crowding out will be compensated. The second possibility is that many developing countries provide tax incentives to foreign investors to encourage investment. However, this distorts resource allocation and is detrimental to long-term growth. This appears to be more plausible because the tax practices of multinational companies via tax evasion put the financing of sustainable development at risk. In fact, this interpretation would be consistent with the evidence of Glencore.⁸ Glencore's head office

⁸ Telerama (2011)

is located in Switzerland in the canton of Zug. The group is present in more than 50 countries and has a turnover of more than \$170 billion.

Table 3: FDI effect on disaggregated tax revenue

VARIABLES	(1) Non-Resource tax	(2) Direct Tax	(3) Goods and service tax
L.Log(non-resource tax)	0.680*** (0.053)		
Log(FDI inflow)	1.982** (0.900)	1.360 (1.546)	1.663* (0.923)
Log(GDP per capita)	0.008 (0.036)	-0.126* (0.075)	-0.155** (0.063)
Log(Agriculture)	-0.002 (0.044)	-0.158* (0.093)	-0.298*** (0.084)
Log(Manufacturing)	0.101*** (0.032)	0.108 (0.067)	-0.009 (0.048)
Log(Trade openness)	-0.017 (0.055)	0.038 (0.138)	-0.065 (0.060)
Control of corruption	0.010*** (0.004)	0.024*** (0.007)	0.011 (0.007)
L.Log(direct tax)		0.755*** (0.074)	
L.Log(tax on goods and service)			0.611*** (0.059)
Constant	-0.662*** (0.208)	-0.126 (0.525)	-0.791* (0.468)
Observations	294	297	237

Number of Countries	66	66	60
Number of instruments	25	25	24
AR1_Pvalue	0.00158	0.0178	0.0803
AR2_Pvalue	0.613	0.247	0.174
Hansen_Pvalue	0.604	0.727	0.401

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: author

The Glencore group is the subject of severe accusations by NGOs relating to its abusive transfer pricing practices in Africa, particularly in Zambia and the DRC. Glencore has been in production in the DRC since 2008 with a turnover of \$210 million. This will increase to \$808 million in 2013. However, it has been systematically posting negative results since 2008. Due to accumulated losses, the company has lost its entire capital of US\$100 million. Therefore, it has paid no corporate tax for at least five years (Peyer and Maillard, 2011).

5.2.23 FDI effect tax on goods and services

The effect of FDI inflows on tax on goods and services depends on whether FDI activities are conducted primarily to serve the domestic market or export oriented. If FDI activities are mainly carried out to serve the domestic market, they could increase its goods and services, increasing VAT revenues. On the other

hand, increased demand for goods and services resulting from increased employment could increase VAT receipts. However, this would lead to an increase in tax revenues. On the other hand, if FDI activities are primarily for export, they could reduce VAT via the problem of VAT credit or increase indirect tax through increasing demand. Indeed, the expansion of the export earnings could lead to a wage rise, which affects domestic demand and thus increases taxes on goods and services. However, the increase in exports for the activity of capital-intensive FDI activity could raise the problem of VAT credit, affecting tax on goods and services.

For this reason, we estimate the relationship between FDI flows and the mobilisation of tax on goods and services. The results show that FDI inflows significantly affect tax on goods and services. This suggests that governments could put in place policies to attract FDI to increase the production of domestic goods and services and increase domestic demand.

5.2.3 What is the effect of FDI on resource exporting countries?

The phenomenon known in the literature as the natural-resource curse could influence the effect of FDI inflows on tax revenues. Therefore, it will be essential to analyse the impact of FDI net inflows on the countries' net exporters of natural resources compared to other countries.⁹ Table 4 presents the findings for the resource-exporting countries (column 1) and other countries (column 2). Like the general results, when nations are resource exporting, FDI inflows affect government tax revenue positively. However, the tax revenues of these countries are not statistically sensitive to an increase in FDI.

These findings could be explained by the excessive tax incentive and tax holidays accessible to multinational enterprises operating in the national economy. Another explanation could be that the leaders of resource-rich countries tend to neglect the sectors of activity and what could increase their level of fiscal effort. Besides, the extractive-resources

⁹ We consider a country a natural-resource exporter if its exports of natural resources represent more than 60% of its total exports for more than ten years.

sector, which needs more capital, is dominated by foreign companies. Therefore, excessive tax exemption can significantly reduce the involvement of FDI in tax revenues. Also, companies operating in the extractive-resources sector often advance corrupt relationships with tax officials to take advantage of substantial tax and royalty exemptions and thus reduce their liability in host countries. In addition, companies operating in this sector practice the price transfer method to avoid corporate tax, thereby reducing their corporate tax liability in host countries. However, when countries are not-resource exporters, the magnitude of the effect of FDI on tax mobilisation is consistent with the results of this study and most of the literature on the relationship between FDI and government revenues.

6 Conclusion

Usually seen as a significant factor of economic growth in developing countries, FDI allows transfer from home countries to host countries. It stimulates local investment, which improves human capital and the quality of institutions in developing countries. Through these channels, FDI can improve

tax mobilisation in developing countries. However, on the other hand, tax incentives and tax complexity and natural resources often lead FDI to affect tax mobilisation in developing countries negatively. A few studies about the relationship between government tax mobilisation and FDI inflows in developing countries are inconclusive.

This chapter contributes to empirically investigating a large sample of developing countries by finding out how FDI affects government tax mobilisation, using a system GMM approach. Furthermore, we find that FDI affects government tax mobilisation positively. We analyse this question for resource-exporting countries given the resource curse in developing countries due to tax incentives. The results suggest that FDI inflows do not affect government tax mobilisations for resource-exporting countries.

From a policy perspective, this chapter shows that the promotion of FDI through tax incentives should consider the role of tax evasion. The results also suggest it is necessary to substitute or combine these policies with non-tax measures such as subsidies to foreign investors, institutional environment

improvement, and infrastructure development, attracting FDI without much loss of tax revenue. Besides, countries must also consider the crucial role of natural resources, agriculture, and trade openness in tax revenue mobilisation.

Table 4: FDI and Tax revenue relationship by resource country types

VARIABLES	(1)	(2)
	Resource exporters	Non-Resource exporters
L.log(total tax revenue)	0.497*** (0.147)	0.701*** (0.088)
Log(FDI inflow)	0.928 (1.409)	0.827** (0.344)
Log(GDP per capita)	-0.023 (0.063)	-0.109*** (0.029)
Log(Agriculture)	-0.031 (0.095)	-0.164*** (0.039)
Log(Manufacturing)	0.136** (0.051)	-0.040 (0.030)

Log(Trade openness)	0.240 (0.176)	0.099* (0.051)
Control of corruption	0.023** (0.010)	0.010*** (0.003)
Constant	-0.790 (0.741)	-0.196 (0.299)
Observations	147	210
Number of Countries	35	47
Number of instruments	18	28
AR1_Pvalue	0.00439	0.00103
AR2_Pvalue	0.697	0.704
Hansen_Pvalue	0.749	0.140

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: author

Appendix

List of countries

Aruba, Angola, United Arab Emirates, Argentina, Burundi, Benin, Burkina Faso, Bahamas, Belize, Bolivia, Brazil, Barbados, Botswana, Central African Republic, Chile, China, Cote d'Ivoire, Cameroon, Congo Democratic Republic, Congo Republic, Colombia, Comoros, Cabo Verde, Costa Rica, Djibouti, Dominican Republic, Algeria, Egypt, Ecuador, Ethiopia, Fiji, Gabon, Ghana, Guinea, Gambia, Guinea-Bissau, Equatorial Guinea, Guatemala, Honduras, Haiti, Indonesia, Jamaica, Jordan, Kenya, Cambodia, Kuwait, Lao PDR,

Lebanon, Liberia, Lesotho, Morocco, Madagascar, Mexico, Mali, Myanmar, Mongolia, Mozambique, Mauritania, Mauritius, Malawi, Malaysia, Namibia, Niger, Nigeria, Nicaragua, Pakistan, Panama, Peru, Philippines, Paraguay, Rwanda, Sudan, Senegal, Sierra Leone, El Salvador, Chad, Togo, Thailand, Tunisia, Turkey, Tanzania, Uganda, Uruguay, Venezuela, Vietnam, South Africa, Zambia, Zimbabwe.

Chapter 4: The end of tax incentives in mining? Tax policy and mining foreign direct investment in Africa.¹⁰

Abstract

African countries generally cut corporate income tax (CIT) rates in the hopes of attracting foreign direct investment (FDI), but the effectiveness of tax rate reductions in attracting extractive industries FDI is controversial. This chapter estimates the impact of CIT rates, as applied to mining companies, on FDI inflows to the gold and silver sectors of African economies. The estimation results indicate that the impact of the mining CIT rate on the host country's gold and silver FDI inflows is negative but not statistically significant, at the conventional levels of significance. These results indicate that cuts in CIT rates applied to mining companies will not necessarily attract FDI to gold and silver projects. Moreover,

¹⁰ A version of this chapter which has been drafted in collaboration with Coulibaly Seydou, is published in the *African Development Review*.

we find a strategic complementarity in gold and silver FDI inflows between countries, suggesting that an increase in the host country's gold and silver FDI inflows may stimulate FDI to gold and silver projects in neighbouring countries. Furthermore, the results show that infrastructure, government stability and gold and silver reserves positively affect gold and silver FDI inflows. The chapter's main findings suggest that, instead of granting corporate tax incentives, governments may consider improving the quality of socio-economic infrastructure, the availability of geological information, and promoting political and economic stability for attracting mining investments.

Keywords: FDI in gold and silver, mining corporate tax rate, panel data, spatial econometrics, Africa

JEL codes: C23, E62, F21, H25, L72

1. Introduction

Foreign direct investment (FDI) in the mining sector holds significant development benefits, including infrastructure financing, job creation, transfers of technology, and revenue generation (Hanusch et al., 2019). To attract investments in the mining sector, African governments often design mining fiscal regimes toward offering corporate income tax incentives (Van Blerck, 1994). However, the effectiveness of tax cuts in attracting FDI in the mining sector is controversial. Opponents of tax incentives argue that these incentives are ineffective in attracting FDI and are even harmful to economic growth and development because they deprive developing countries of tax revenue that would have been used to finance the supply of public goods and services (IMF, 2014; N'guessan and Esse, 2017; Oates, 1972; World Bank, 2005). However, the proponents of tax incentives argue that these incentives are needed to compensate for the disadvantages of the poor business environments in developing countries (socio-political instability, corruption, poor infrastructure). Moreover, they argue that the revenue-losses argument is misplaced since

revenue losses from tax incentives may be compensated for by the positive effects of FDI on economic growth and thereby increase the income tax base (OECD, 2008).

This persistent debate around the impact of tax policy on FDI has, thus far, considered aggregate FDI inflows to all the economic sectors of the host country, whereas the specifics of some economic sectors, like the mining sector, might influence the relationship between tax policy and FDI inflow in these sectors (Vivoda, 2011, 2017). Moreover, corporate mining tax is basically a tax on rent rather than a tax on capital applied for other sectors. To the best of our knowledge, only two studies (Ali-Nakyea and Amoh, 2018; Obeng, 2014) have estimated the effects of tax policy on FDI in the mining sector in Africa. This scarcity of studies on the determinants of FDI in the mining sector is surprising given the relative importance of FDI inflows to the natural resources sector in Africa (Morisset, 1999; UNCTAD, 1999). However, the two existing empirical studies on the impact of tax policy on FDI in the mining sector in Africa have some limitations. In fact, by comparing trends in FDI inflows and tax incentives in the mining sector in Ghana, the conclusion from the study of Ali-

Nakyeya and Amoh (2018) could not be interpreted as causality between tax incentives in the mining sector and the FDI flows. Moreover, their analysis is somewhat biased because they compare the evolution of tax incentives in the mining sector with the evolution of aggregate FDI flows, and not FDI flows for the mining sector specifically. Again, in Ghana, Africa's largest gold producer since 2018, Obeng (2014) finds that the corporate tax rate has a negative and significant effect on FDI flows into the mining sector over the period 1986–2012. The main result from the study of Obeng (2014) must, however, be taken carefully because this author uses statutory corporate tax rate to predict FDI to the mining sector, whereas the corporate income tax (CIT) rate as applied to mining companies was not strictly the same as the statutory corporate tax rate in Ghana over the entire period 1986–2012. In addition, because the dependent variable is available quarterly, Obeng (2014) uses an algorithm to transform annual data into quarterly data for the explanatory variables, something which is likely to lead to biased estimations due to measurement errors in the explanatory variables.

More generally, beyond these potential intrinsic limitations, previous studies on the impact of tax policy on mining FDI provide country-specific evidence based on time series data. Panel data has advantages over time series in terms of accurate statistical inference and the efficiency of econometric estimates (Hsiao, 2007). The results from a panel data analysis could be used to inform policy orientations in more than one country, whereas policy implications from the country-specific study based on time series cannot be generalized to many countries. Against this background, the contribution of this chapter to the empirical literature on the impact of tax policy on FDI is threefold.

First, we focus on African economies and the mining sector to provide precise policy-oriented conclusions since African countries tend to grant more tax incentives than their peers in Asia and Latin America to attract FDI to the mining sector (IGF,¹¹ 2019). This chapter also fills an important gap in the related economic literature by providing the first cross-

¹¹ IGF is the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development.

country evidence on the impact of the CIT rate, as applied to mining companies, on FDI inflows to the mining sector in Africa.

Second, as emphasized by Blonigen et al. (2007) and empirically tested by Boly et al. (2020) for African economies, an increase in FDI in one country can affect the level of FDI in neighbouring countries. These spillover effects of FDI inflows are more plausible in the mining sector, where a mineral deposit can cross borders and generate foreign investments in another country, in addition to the first host country. Previous studies on the effects of tax policy on FDI in mining, which are country-specific studies (Ali-Nakyea and Amoh, 2018; Obeng, 2014), have ignored potential spillover effects from FDI and from corporate tax policy between countries. Technically, LeSage and Pace (2009) warn that ignoring the spatial interactions in regression models can create severe econometric issues, including biased standard errors and biased estimates.

Finally, because mining operations are risky and capital-intensive, and given the limited number of major multinational mining companies, countries tend to engage in

competition among themselves to attract mining investments through grants of generous fiscal provisions for mining projects (Obeng, 2014; Van Blerck, 1994). In practice, when the multinational mining companies generally negotiate for preferential tax treatment for their investments, they bring to the attention of the host government the offers of neighbouring governments, such as tax incentives to mining investors.¹² From that perspective, a host country may react to changes in other countries' mining tax regimes by modifying its own mining tax regime to retain its attractiveness for mining investments. This implies that the FDI inflows for a host country are influenced by its own corporate tax rate for the mining sector and other countries' mining tax regimes. The dynamic spatial Durbin

¹² The mining companies urged the government of Zambia to review the mining fiscal regime, to remove the provision of non-deductibility of royalties for the calculation of corporate tax income, by arguing that this provision is harmful to mining investments and by also mentioning that it has been removed from the mining tax regimes of two neighboring countries: Namibia and Zimbabwe (Zambia Chamber of Mines, Media Statement, 28th September 2020. <http://mines.org.zm/no-green-light-for-mining-investment-in-the-2021-budget-zcm/>).

model (DSDM) allows controlling for spillover effects on mining taxation between countries.

Similarly, the degradation of the quality of the standard determinants of FDI inflows to the mining sectors (e.g., infrastructure, political and social stability) in neighbouring countries could lead FDI to move from these countries to a given host country's mining sector and vice versa, all other things being equal. In fact, the degradation of infrastructure, the occurrence of political and social instability, or the depletion of reserves may lead multinational mining companies to withhold and reduce new investments in a host country and increase their investments abroad. This suggests that the key determinants of FDI inflows to the mining sector in other countries may also affect a host country's mining FDI inflows. The DSDM allows for taking onboard these spillover effects between countries of the key drivers of FDI in the mining sector.

This chapter takes into account these cross-border considerations by estimating a spatial econometric panel-data model to control for spillover effects in mining tax policy and

FDI inflows to the mining sector for African economies. The rest of the chapter is structured as follows: Section 2 reviews the literature on the relationship between tax policy and FDI in the mining sector. Section 3 develops the empirical methodology used to estimate the impact of corporate tax rates applied to mining companies on FDI in gold and silver projects. Section 4 presents and interprets the estimation results and checks the robustness of these results. Section 5 concludes the chapter.

2. Literature review

The literature on the impact of tax policy on FDI inflows is inconclusive. Tax incentives could attract FDI because the incentives may offset the negative effects of bad tax systems and counterbalance the effects of weak macroeconomics, poor infrastructure, and a lack of effective institutions in developing countries and, thereby, reduce the cost of doing business (Hassett and Hubbard, 2002; Holland and Vann, 1998; Owens, 2004; Tavares-Lehmann et al., 2012; Wilson, 1999). In the same vein, Wilson (1999) emphasizes that when capital is perfectly mobile, any policies aimed at changing the tax rate could affect

the net return on capital and thus influence the multinationals' investment location decisions.

However, tax incentives may distort investment decisions, promote corruption, and lead to the misallocation of resources (Bird, 1993; Easson and Zolt, 2002). Tax incentives generate significant revenue losses because they erode the tax base and multinational companies tend to abuse tax incentives to reduce their tax burden through tax avoidance (Bond et al., 2000). Weaknesses in tax revenue collection reduce the capacity of the government to finance basic infrastructures and thereby reduce the country's performance in attracting FDI. Furthermore, as Easson and Zolt (2002) outlined, the enforcement of tax incentives may be difficult, and this could open doors to corruption and rent-seeking activities from tax officials and therefore discourage FDI inflows.

As for the theoretical framework, the empirical literature on the impact of tax policy on FDI is controversial as well (Abbas and Klemm, 2013; Ali-Nakyea and Amoh, 2018; Babatunde and Adepeju, 2012; Boly et al., 2020; Cleeve, 2008; Lin and Wang, 2014; Van Parys and James, 2010; Zee et al.,

2002). Some studies find that tax cuts increase FDI net inflows (Abbas and Klemm, 2013; Boly et al., 2020). However, Kinda (2018) and Van Parys and James (2010) conclude that tax policy has no significant impact on FDI inflow. These studies specifically focus on the impact of tax policy on the aggregated FDI net inflows.

For African economies, only a handful of studies have analyzed the impact of taxes on FDI in the natural resources sector (Ali-Nakyea and Amoh, 2018; Babatunde and Adepeju, 2012). Ali-Nakyea and Amoh (2018) find that tax incentives for foreign investors in Ghana did not have their expected positive effect on FDI inflow in the natural resource sectors. However, their study does not analyze causality between tax incentives and FDI inflows. More specifically, for the mining sector, Obeng (2014) finds that the corporate tax rate negatively affects mining FDI inflow in Ghana. The results from Obeng (2014) should, however, be regarded carefully because this author

considers the statutory corporate tax rate¹³ in his analysis, whereas the corporate tax rate applied to mining companies (35 percent) was different from the statutory CIT rate (25 percent) in Ghana over the period 2012–2015. In Côte d’Ivoire, N’guessan and Esse (2017) use a financial model to simulate the profitability of the Yaoure gold mining project under a scenario where no tax holiday is granted to the mining company. They find that the tax holiday was unnecessary to attract mining companies to the project. The results from their simulations reveal that even without the five-year tax holiday, the mine’s internal rate of return was 25 percent, a level of profitability that is sufficient enough to induce investment. In a general perspective, Saidu (2007) concludes that while an unattractive mining tax regime can drive away investment, an attractive mining tax regime will not necessarily attract foreign direct investment to mining sectors in Niger and Indonesia.

¹³ In Ghana, the statutory corporate income tax rate is not equal to the corporate income tax rate, as applied to mining companies for all the years over the period 1986–2012.

3. Empirical Analysis

Following Boly et al. (2020) and Blonigen et al. (2007), we specify a DSDM for estimating the impact of corporate tax rates applied to mining companies on FDI inflows to gold and silver sectors. The DSDM captures both the spatial interactions between FDI inflows among countries and the cross-border effects generated by changes in a host country's tax policy on its neighbouring countries' FDI inflows. For example, when a mining company is developing a mining project in a host country, that mining company may realize that the mineral deposit crosses borders between that host country and at least one of its neighbouring countries. Accordingly, the neighbouring country, which was not initially concerned about the mining operations, may attract the mining company's attention to exploring and exploiting minerals because the discovered mineral deposit geologically extends into that neighbouring country. Moreover, when mining companies find positive prospects from exploration in any given country, additional motivation exists for them to invest in exploration activities in neighbouring countries because neighbouring countries may have similar geological deposits in the

surrounding areas. The DSDM considers these potential interactions by including, as an explanatory variable, the average weighted value of FDI inflows in gold and silver sectors in other countries (WFDI).

As mining operations are risky by nature, countries tend to grant generous fiscal terms to attract mining companies. Accordingly, the country may react to changes in other countries' corporate tax policies for mining companies by modifying its tax policy to preserve its mining corporate tax base and remain attractive for FDI inflows to its mining sector. Therefore, FDI inflows for a host country depend both on the domestic corporate tax policy for the mining sector (CIT_m) and the other countries' corporate tax policies for their mining sectors (WCIT_m). The DSDM allows controlling for such interactions.

Similarly, the deterioration of the quality of the standard determinants of FDI to the mining sector (e.g., infrastructure, political and social stability) in neighbouring countries could lead FDI to move from these countries to a given host country's mining sector, all other things being equal.

This suggests that the standard determinants of FDI inflows to the mining sector in neighbouring countries (WX) may also influence a host country's FDI inflows to the mining sector.

The experiences from previous FDI made in a host country's mining sector may influence foreign investors' decisions to invest in mining activities in that country, suggesting that the current level of FDI in the mining sector could be affected by the history of FDI in this sector. The DSDM accounts for this aspect by including the one-period lagged value of the dependent variable (Y_{t-1}) among the explanatory variables. Technically for identification, the inclusion of the time-lagged dependent variable helps control for autocorrelations of errors and indirectly controlling for the impact of omitted factors from the model, which may have impacted gold and silver FDI inflows in the past (Singh and Jun, 1999).

However, the full DSDM model may suffer from identification problems. To circumvent the identification problem with the full DSDM, we follow Elhorst (2010), who imposed as a restriction the nullity of the parameter for the

time and space-lagged dependent variable in the full DSDM ($\eta=0$) of the following equation:

$$FDIm_{it} = \delta FDI_{i,t-1} + \eta WFDIm_{j,t-1} + \rho WFDIm_{jt} + \beta_1 \tau CITm_{it} + \beta_2 W\tau CITm_{jt} + \theta_1 X_{it} + \theta_2 WX_{it} + \vartheta_i + \mu_t + \varepsilon_{it} \quad (1)$$

This is the least-restrictive model, although this restriction limits the variability of the ratio between indirect and direct effects (Elhorst, 2012). The same restriction for the identification of DSDM is considered in Franzese and Hays (2007), Kukučnova and Monteiro (2009), Jacobs et al. (2009), and Brady (2011).

The estimated empirical model is specified as follows:

$$FDIm_{it} = \delta FDI_{i,t-1} + \rho WFDIm_{jt} + \beta_1 \tau CITm_{it} + \beta_2 W\tau CITm_{jt} + \theta_1 X_{it} + \theta_2 WX_{it} + \vartheta_i + \mu_t + \varepsilon_{it} \quad (2)$$

where $FDIm_{i,t}$ is the amount of FDI inflows to gold and silver sectors in country i , in year t ; and $FDI_{i,t-1}$ is its value in year $t-1$, for country i ; W is a spatial weight matrix; $WFDIm_{jt}$ is the amount of FDI in neighbouring countries; $CITm_{it}$ is the statutory CIT rate applied to mining companies in the country, in year t ; $WCITm_{jt}$ is the statutory CIT rate applied to mining

companies in neighbouring countries multiplied by the weighting matrix W ; X_{it} is a vector of FDI determinants in the mining sector in the country, in year t ; $WFDIm_{jt}$ is the weighted average values of FDI determinants in the mining sector in other countries, except country i ; ϑ_i is country fixed effects to control for time-invariant, unobserved country heterogeneity; μ_t is time dummies controlling for common shocks affecting African economies each year; ε_{it} is the usual independent and identically distributed error term; and ρ is a spatial autocorrelation term.

The estimation of Equation (2) requires the specification of the connectivity matrix W . Since geographically close countries are likely to have similar geological properties—and, since transport costs are generally relatively lower for geographically close countries—tax policy interactions for attracting FDI into mining sectors, and spillover effects from FDI inflows to mining sectors, are likely to be large for geographically close mineral-rich countries. Based on this consideration and following the literature in spatial econometrics, we use geographical distance to measure closeness

using a spatial weighting matrix W . Algebraically, an element w_{ij} of the geographic distance spatial connectivity matrix is specified as follows:

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

with d_{ij} as the Euclidean distance between the capitals of countries i and j .

To our knowledge, this chapter is the first to control for both the spatial spillover effects of FDI and corporate tax policy for the mining sector, using a Dynamic Spatial Durbin Model estimated with geographic neighbourhood matrices.

The estimation of Equation 1 raises endogeneity issues that need to be addressed. In fact, while the host country's mining tax policy may affect FDI inflows into the mining sector, mining investors may request preferential tax treatments before they concretize their investments intentions. This reverse causality between FDI inflow and tax regime causes the endogeneity of the tax rate variable in Equation 1. In addition, the mutual spillover effects in FDI into mining sectors between

countries creates an endogeneity issue of the spatially lagged dependent variable ($WFDIm_{jt}$). The inclusion of the time-lagged dependent variable ($FDIm_{i,t-1}$) among the explanatory variables creates a dynamic panel data bias (Nickell, 1981) in the estimations due to potential correlation between omitted variables in the equation and $FDIm_{i,t-1}$.

To address the endogeneity issues in the regressions, we use the bias-corrected Quasi-maximum-likelihood (QML) estimator developed by Yu et al. (2008) for a dynamic model with spatial-fixed effects and extended to the time-fixed effects spatial model by Lee and Yu (2010). The bias-corrected QML estimator is an estimation method introduced by Elhorst (2003, 2010) to correct the bias in the maximum likelihood estimator and estimate dynamic spatial econometric models (Elhorst, 2012). In addition, the QML estimator produces consistent estimates for spatial models that have the spatial-lagged dependent variable among the explanatory variables (Lee, 2004). For Stata users, Belotti et al. (2017) have developed the command “xsmle” for estimating spatial dynamic panel-data models using a maximum likelihood estimator.

Vivoda (2011, 2017) summarize the key standard determinants of FDI in the mining sector. These determinants are classified into nine principal categories: geological, political, regulatory, marketing, fiscal, monetary, environmental, social, and operational and profit factors. In the regressions, we control for the variables, covering almost all the dimensions of the nine categories of factors that could affect foreign investors' decisions to invest in mining projects in Africa. In addition to the tax rate variable, the control variables include gold and silver reserves, political stability, infrastructure, and nominal exchange rate. The sources of these data are presented in the next section.

4. Data

We built a balanced panel dataset for 16 African countries, over the period 2003–2015, for estimating the impact of mining corporate tax rates on gold and silver FDI inflows. The availability of data dictated the construction of the dataset.

We start the construction of the database with data on FDI inflows to the mining sector. We collect data on the amount of FDI inflows to gold and silver projects for selected

African economies from FDI markets¹⁴. The database of FDI flows to gold and silver sectors covers 24 African economies over the period 2003–2015. The years over which data for the dependent variable (FDI in gold and silver sectors) are available is therefore retained as the time span of the panel dataset. FDI inflows to gold and silver projects from the FDI markets database are expressed in millions of US\$. We run regressions with FDI data in percent of gross domestic product (percent GDP). Data on FDI inflows to gold and silver projects in percent GDP are obtained by dividing FDI inflows in millions of US\$ by current GDP in millions of US\$. Data on current

¹⁴ We focus on gold and silver because we have FDI data only for these two minerals for African economies. *Africa is the third-largest gold producing continent in the world and has gold mining activities in more than 21 of its countries accounting for almost 21% of global gold production in 2020. The total gold mine production in Africa amounted to 663 metric tons in 2020.* (Statista, <https://www.statista.com/statistics/508145/african-gold-mine-production/>). The global average for 2018 was 449388 metric tons. The highest value was in Mexico: 6049000 metric tons and the lowest value was in Algeria: 50 metric tons. The average production of silver for Africa in 2018 was 37266 metric tons. The highest value was in Morocco: 348000 metric tons and the lowest value was in Algeria: 50 metric tons. The indicator is available from 2002 to 2018. (USGS, https://www.theglobaleconomy.com/rankings/silver_production/Africa/).

GDP in millions of US\$ are extracted from the World Development Indicators (WDI) of the World Bank.

Data on the statutory CIT rates applied to mining companies are extracted from the database on mining taxation in Africa¹⁵ developed by *La Fondation pour les Etudes et Recherches sur le Développement International (FERDI)* (The Foundation for Studies and Research on International Development) (Laporte et al., 2018). FERDI's database on mining taxation provides annual data on CIT rates applied to mining companies, for 21 African countries, over the period 1980–2019.

When we merged data on FDI in gold and silver with data on CITs for mining, we obtained 15 countries for which data on both were available over the period 2003–2015. However, this means that nine countries, for which we have data on FDI in gold and silver, could not be kept in the dataset under construction because data on CIT rates for mining were

¹⁵ [The database is available through the following link: https://fiscalite-miniere.ferdi.fr](https://fiscalite-miniere.ferdi.fr)

not available for these countries from FERDI's database¹⁶. As a result, the total number of observations for the 15 countries over the period 2003–2015 is 195.

We decided to increase the number of total observations to strengthen the statistical power of inferences from regressions to obtain efficient and robust estimates. Among the nine countries for which data on gold and silver FDI are available (but which could not be retained in the dataset due to unavailability of data on mining CIT rates), Morocco is the only country for which we found reliable documents and materials which provide information on mining CIT rates over a long period. Moreover, Morocco is the only country for which the standard determinants of FDI inflows to the mining sector (mentioned in Section 3) can be easily collected over long periods on an annual basis. Morocco is also Africa's largest

¹⁶ Algeria, Botswana, Egypt, Tunisia, Angola, Namibia, Mozambique, and Eritrea are the eight countries excluded due to missing values in CIT rate. These countries are nonetheless not major african gold producers. However, we regret that Eritrea the 3rd producer of silver in Africa (30.000metric tonnes of silver in 2018) is excluded from the sample due to lack of data issues.

producer of silver. We include Morocco as an additional country in the final dataset for these reasons. Data on CITs on mining for Morocco are collected from the tax authorities of Morocco.¹⁷ Regressions are therefore carried out on a final, balanced panel dataset for 16 countries over the period 2003–2015.

We use the African Infrastructure Development Index (AIDI) developed by the African Development Bank (AfDB, 2018) to measure access to infrastructure. AIDI is a weighted average of nine indicators of infrastructure articulated around four major components: transport, electricity, information, and communications technology (ICT), and water and sanitation (AfDB, 2018). The index ranges from 0 (low infrastructure development) to 100 (high infrastructure development). The methodology used to compute AIDI is described in greater detail in AfDB (2018). Infrastructures are critical for the development of mining projects. For example, good transport infrastructure (roads, railways, airports) and reliable energy

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http://www.apsf.pro/DOCS/ESPACE%20DOC/FICALITE_mesures-par-objectif-1990-2011.pdf

<http://saaidi-consultants.com/resources/tome-2-de-la-circulaire-n-717-commentant-les-dispositions-du-code-general-des-impots/>

sources (electricity) reduce production costs and could stimulate mining investments. We, therefore, expect the impact of infrastructure on FDI in gold and silver will be positive in our regressions.

The nominal exchange rate is included to control for the macroeconomic conditions. Data on the nominal exchange rate (local currency/US\$) have been extracted from Penn World Table version 9.0 (Feenstra et al., 2015). A stable exchange rate does not disturb the financial conditions and expectations of the mining company. Therefore, a depreciation of the nominal exchange rate is expected to affect mining investments negatively.

The endowment of natural resources plays a crucial role in attracting mining investments. In fact, countries that are well endowed with significant mineral deposits are more likely to attract large mining investments because high profitability perspectives are positively correlated to large deposits (Jara, 2017). Therefore, we control for the impact of resource endowment in the baseline equation. Data on proven gold and silver reserves are collected from the wealth account dataset of

the World Bank (Lange et al., 2018). The World Bank's wealth account dataset separately provides reserves data for each mineral, expressed in constant 2014 US dollars. We, therefore, add data on gold reserves and data on silver reserves to obtain data on gold and silver reserves. We anticipate a positive impact of gold and silver reserves on FDI in gold and mining projects due to high profitability perspectives positively associated with large minerals deposits (Jara, 2017).

Multinational mining companies pay greater attention to government stability for reducing political risks on their investments. In fact, in Africa, changes in government are often followed by attempts to renegotiate the fiscal terms of existing mining contracts, something which causes instability of mineral fiscal regimes and significantly disturbs mining investments.¹⁸ We take onboard these considerations and include the number of years the incumbent chief executive is in power as a proxy of government stability in the regressions. Data on the number

¹⁸ Recent experience in Mali corroborates this observation. The new transition government that took office in October 2020, after a military coup, announced that it intends to renegotiate all the mining contracts signed over the past decade when the former administration was in office.

of years the chief executive has been in office is extracted from the Database of Political Institutions (Cesi et al., 2018).

Table 1 provides descriptive statistics for all the variables used in this analysis. The average FDI inflows to gold and silver projects are 0.8 percent of GDP, while the average statutory CIT rate applied to mining companies, for our sample of 16 countries, is 28.26 percent, with the lowest rate at 15 percent (applied in Zimbabwe, over the period 2003–2014) and the highest at 40.5 percent (applied in Niger, over the period 2003–2005). On average, for our sample, the top five recipient countries of FDI in their gold and silver sectors, over the observation period, are Burkina Faso, the Democratic Republic of the Congo, Ghana, Mali, and Sierra Leone.

Figure 1 displays the statutory CIT rate applied to mining companies for each country in 2003 and 2015. The CIT rate applied to mining companies in 2015 is lower than its value in 2003 for all the countries in the sample except for the Democratic Republic of the Congo, Kenya, Mauritania, Morocco, Nigeria, and Tanzania, where the mining CIT rate is the same for the years 2003 and 2015. More precisely, Côte

d'Ivoire, Niger, and Mali are the countries that have cut their mining CIT rate the most, by around 10 percentage points from the year 2003 to 2015.

The fact that Mali and Burkina Faso, two of the three countries that have experienced the largest cuts in their mining CIT rates, are also among the top five recipients of FDI inflows to their gold and silver sectors, may suggest a positive correlation between cuts in mining CIT rates and gold and silver FDI inflows. This positive correlation between reductions in mining CIT rates and gold and silver FDI inflows is confirmed in Figure 2. Although the trend in FDI into gold and silver projects is decreasing for the sample of countries under observation, these countries experienced higher levels of gold and silver FDI inflows at the beginning of the super cycle of commodities¹⁹ in 2000 as compared with the level of gold and silver FDI inflows after the global recession in 2008 (Figure 2).

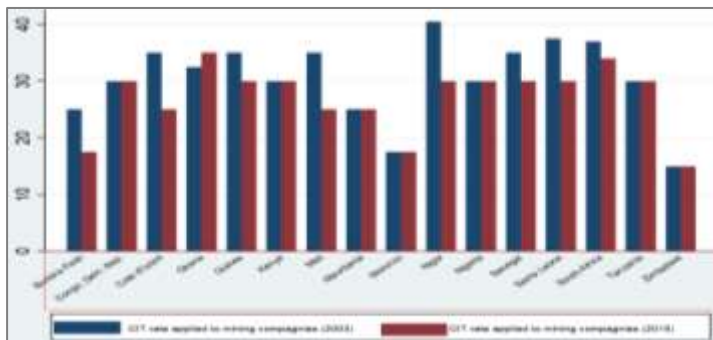
¹⁹ The commodity super cycle is a period of high demand and prices for commodities in the world market (Ballón et al., 2017).

The decline in gold and silver FDI inflows from 2003–2015, a period during which CIT rates applied to mining companies were also declining, shows the possible insignificance of the impact of mining CIT reductions on FDI inflows.

Table 1: Descriptive statistics

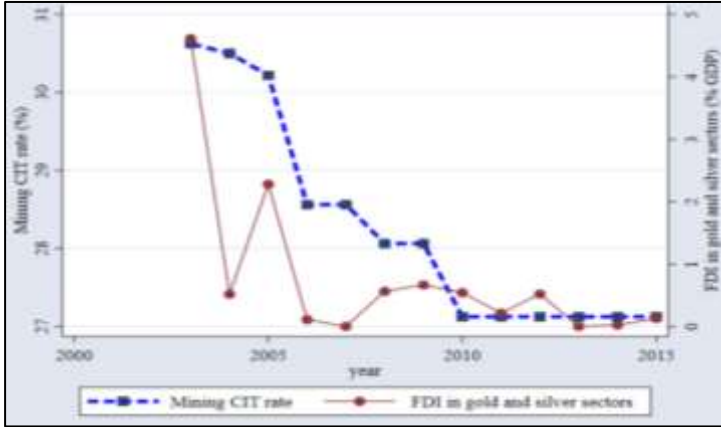
Variables	Observations	Mean	Std. dev.	Min	Max
Gold and silver FDI inflows (%GDP)	208	0.78	3.23	0.00	38.97
CIT rate mining	208	28.26	6.36	15.00	40.50
Resource tax revenue (%GDP)	208	1.57556	2.3121	0	8.8369
Exchange rate	208	871.88	1,491.80	0.87	7,485.52
Control of corruption	208	-0.7007	0.4623	-1.5252	0.5681
Government stability	208	7.8028	6.5256	1.00	28.00
Infrastructures	208	15.74	14.04	2.23	78.97
Manufacturing sector value-added (%GDP)	208	12.32	5.46	1.58	26.89
Log (gold and silver reserves)	208	20.77	3.43	2.29	25.32

Figure 1: Corporate income tax rates applied to mining companies in Africa



Source: Authors' calculations using FERDI's database and tax authorities of Morocco.

Figure 2: FDI inflows to gold and silver sectors and CIT rates applied to mining companies



Source: Authors' calculations from FERDI's database, tax administration websites, and FDI markets.

The relationship observed from the graphical analysis could be biased by econometric problems because the influence of other factors that may affect the tax policy and FDI nexus is ignored by the graphical analysis. Therefore, we undertake an econometric analysis to explore further the impact of CIT rates applied to mining on FDI into gold and silver sectors. The results from the econometric analysis are presented in the next section.

5. Results

This section presents the main findings from the regressions and then analyzes the robustness of these findings. Before discussing the estimation results, we present the results from the specification tests carried out for corroborating the choice of the DSDM with fixed effects to estimate the impact of mining CIT rates on FDI inflows to gold and silver sectors. We first estimate a non-spatial panel fixed-effects model with the ordinary least square (OLS) estimator with Driscoll-Kraay standard errors (Table 2, column 1). Then, we run the Moran I test on the residual from that OLS estimation to test for the presence of spatial autocorrelation in the data. The test rejects the null hypothesis of no spatial autocorrelation at the 5 percent threshold (Moran's I test Statistic = 0.2952; P-value=0.025), suggesting that there is a need to extend the non-spatial model with spatial interaction effects. Since the Moran I test does not tell us the functional form of the spatial interaction effects, we test the appropriateness of the dynamic spatial autoregressive (DSAR) model and the spatial error model (SEM) for estimating the impact of mining CIT rates on gold and silver FDI inflows against the DSDM. LeSage and Pace (2009) reveal

that the DSDM specification is reduced to DSAR specification if the coefficients of the spatially lagged independent variables are null. Accordingly, for evaluating the suitability of the DSDM against the DSAR, we test the joint nullity of the coefficients of the spatially lagged independent variables ($\beta_2 = \theta_2 = 0$, see Equation (1)). The test rejects the null hypothesis and thereby rejects the DSAR specification at the 1 percent level ($\chi^2(5) = 301.59$). The SEM is also reduced to the DSDM if $\rho\beta_1 + \beta_2 = 0$ and $\rho\theta_1 + \theta_2 = 0$ in Equation (1) (Burrige, 1981). The null hypothesis that $\rho\beta_1 + \beta_2 = 0$ and $\rho\theta_1 + \theta_2 = 0$ ($\chi(5) = 352.38$, $\text{Prob} > \chi^2 = 0.00$) is rejected at the 1 percent level, indicating that the DSDM is more appropriate than the SEM. Since the above two likelihood ratio tests confirm the appropriateness of the DSDM over the SEM and DSAR specifications, we use the Hausman test to finally discriminate between the fixed-effects and the random-effects DSDM. The result of the Hausman test ($\chi(11) = 472.78$, $\text{Prob} > \chi^2 = 0.0000$) leads to the rejection of the null hypothesis of independence between the unobserved country fixed effects and the independent variables suggesting that a fixed-effects DSDM is preferable to a random-effects DSDM for this study.

5.1. Main results

Table 2 reports the results of estimating the impact of mining CIT rates on gold and silver FDI. In column 1, we ignore the spatial spillover effects in FDI and CIT between countries by estimating a non-spatial model. We find that the impact of the CIT rate is positive but not significant at the conventional level of significance (Table 2, column 1). However, the estimation results reported in column 1 are biased because of the omission of the spatial variables in the regression. Yet, these variables are relevant as developed in Section 3 and corroborated by the Moran's I test and the spatial models' specification tests (Lagrange Multiplier tests) we ran. The omitted variable bias problem is addressed in the baseline specification by accounting for the impact of the spatially lagged variables through the estimation of a dynamic spatial Durbin model (DSDM).

The results from the estimation of the baseline fixed effects DSDM specification (Equation 1) show that the spatial interaction term (ρ) is positive and statistically significant at the 1 percent significance level (Table 2, column 2). This result suggests that an increase in FDI inflows to gold and silver sectors in a host country may stimulate FDI inflows to its

neighbours' gold and silver sector in Africa. The development pattern of the Canadian multinational mining company Endeavour Mining around the West African Birimian Greenstone Belt corroborates this empirical result. The Birimian Greenstone Belt across Burkina Faso, Côte d'Ivoire, Guinea, and Mali is highly prospective. Endeavour Mining has taken advantage of its presence in Côte d'Ivoire to expand over Burkina Faso and Mali to optimise the exploitation of the geological potential of the region after a sound mastery of the investment climate the commercial reserves of the gold deposit belt that spills over the three neighbouring countries.

Moreover, we find that past values of FDI to gold and silver projects positively affect current levels of FDI inflows to gold and silver sectors (Table 2, column 2). This result indicates that previous experiences from FDI in gold and silver projects matter for attracting FDI inflows to gold and silver sectors. The expansion of Endeavour Mining operations in Côte d'Ivoire illustrates this result. In fact, the good collaboration between Ivorian national authorities and Endeavour Mining, coupled with the profitability of the company's first mining project in Côte d'Ivoire (the Ity project located in west Cote d'Ivoire,

production started in 1991), have encouraged Endeavour Mining to expand that Ity project in 2019 with additional investments. Moreover, Endeavour Mining later invested in another mining project (Agbaou project) located in south Cote d'Ivoire (production started in 2014).

The direct and indirect impacts of mining CIT rates on gold and silver FDI inflows are reported in the results tables. The direct impact of CIT rates applied to mining corresponds to the impact of a change in the CIT rate applied to mining in country i on gold and silver FDI for that country i . The indirect impact refers to the impact of a change of the CIT rate applied to mining companies in country i on gold and silver FDI inflows in the other countries j , except country i (LeSage and Pace, 2009).

The direct impact of mining CIT rates on FDI inflows to gold and silver sectors is negative but not statistically significant at the conventional levels of significance in the short run and long run²⁰ (Table 2, columns 4 and 7). These results

²⁰Short-term effects are the partial derivatives of FDI, with respect to an independent variable, while ignoring δ in equation (1). Long-term

provide indications that a generous mining tax regime will not necessarily attract mining investments. Our results align with Saidu (2007), who finds that an attractive tax regime for mining companies will not necessarily translate into more FDI inflows to the mining sector. The absence of a statistically significant impact of mining CIT on gold and silver FDI could be explained by the fact that basically, mining investors will not take into consideration mining fiscal regimes and incentives that are “too good to be true” for deciding the destination country of their mining investment (IGF and OECD, 2018). The tax arrangements are an element of a broader set of tools for decision making, and, clearly, a mining company would be rigorously unlikely to make an investment where profitability depends on preferential tax treatment promised by a government (IGF and OECD, 2018). Furthermore, mining investors may prefer diversifying their investment locations to reduce the operational risks from dependence on a single host

effects are partial derivatives of FDI, with respect to an independent variable, while considering constant the share of FDI in %GDP in all countries $FDI_{i,t-1} = FDI_{i,t} = FDI^*$ and $W.FDI_{i,t} = W.FDI^*$ (Boly et al., 2020; Elhorst, 2014, p. 106).

country, regardless of the preferential tax treatment offered by that host country.

For the control variables, the results show that infrastructures, political stability, and gold and silver reserves have positive and significant impacts on FDI inflows to gold and silver sectors (Table 2, columns 4 and 7). These results suggest that structural and institutional factors that positively affect investment profitability and the geological potential (resource endowment), and the availability of geological information are crucial for attracting mining investments.

5.2. Robustness analysis

5.2.1 Considering the qualifications of domestic mining suppliers and local content

Given that the mining sector may source some of its intermediate input requirements from domestic suppliers of goods and services, as part of national local-content policy requirements, the mining sector is likely to be linked with the manufacturing sector (backward linkages). The manufacturing sector provides goods to the mining sector, including machinery and equipment, transport equipment, wood products,

fabricated metal products, non-metallic minerals (cement, bricks), chemicals, and petroleum products. We, therefore, include the manufacturing sector's value-added to consider that the manufacturing sector's performance may influence the choice of location for mining investments. Data on manufacturing value-added, as a percentage of GDP, are taken from the World Development Indicators (WDI) database of the World Bank.

The main results of this chapter remain unchanged when the impact of manufacturing value-added is controlled in the regression. As a result, the direct impact of mining CIT rates on gold and silver FDI inflows is negative and statistically insignificant (Table 3, columns 3 and 6). However, as expected, the impact of manufacturing value-added on FDI in the gold and silver mining sectors is positive and statistically significant at 5 percent (Table 3, columns 3 and 6), suggesting that the existence of a well-developed domestic mining suppliers' network/market may stimulate foreign investments in mining sectors.

Table 2: Impact of corporate tax rates applied to mining companies and FDI in gold and silver sectors: Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gold and silver FDI inflows (%GDP)	Non-Spatial model	Estimates		Short-run marginal effects			Long-run marginal effects		
		Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L. (gold and silver FDI inflows)	0.0275*** (0.0081)	0.0448*** (0.0138)							
CIT rate mining	0.0073 (0.0146)	-0.0299 (0.0257)	0.2044 (0.1737)	-0.0360 (0.0231)	0.1804 (0.1357)	0.1444 (0.1539)	-0.0380 (0.0241)	0.1877 (0.1409)	0.1498 (0.1598)
Infrastructure	-0.0171** (0.0057)	0.0399** (0.0157)	0.0526 (0.1395)	0.0407*** (0.0123)	0.0444 (0.1118)	0.0851 (0.1222)	0.0426*** (0.0128)	0.0458 (0.1162)	0.0884 (0.1269)
Government stability	0.0282** (0.0126)	0.0183* (0.0096)	0.1022*** (0.0368)	0.0149* (0.0080)	0.0736*** (0.0224)	0.0886*** (0.0270)	0.0155* (0.0083)	0.0760*** (0.0230)	0.0916*** (0.0278)
Exchange rate	-0.0001 (7.79e-05)	0.0000 (0.0001)	0.0021*** (0.0005)	0.0001 (0.0307)	0.0018 (0.0063)	0.0020 (0.0250)	0.0001 (0.0321)	0.0019 (0.0070)	0.0020 (0.0259)
Log (gold and silver reserves)	0.0374*** (0.0076)	0.1624*** (0.0182)	0.8616*** (0.1067)	0.1391*** (0.0167)	0.6237*** (0.1020)	0.7628*** (0.1171)	0.1447*** (0.0175)	0.6446*** (0.1072)	0.7893*** (0.1229)
rho		0.3635*** (0.1319)							
sigma2_e		1.3490*** (0.3937)							
Observations	192	192	192	192	192	192	192	192	192
Number of countries	16	16	16	16	16	16	16	16	16
Log-likelihood		-740.2	-740.2	-740.2	-740.2	-740.2	-740.2	-740.2	-740.2

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Notes: CIT rate mining: corporate income tax rate applied to mining companies. Sigma2_e is the standard deviation of idiosyncratic errors; rho is the coefficient of the spatial-lagged-dependent variable.

5.2.2 Considering the potential impact of corruption on mining FDI

We control for the impact of corruption on mining FDI in the baseline specification to test whether corruption in the host country influences investment decisions in mining projects (Kolstad and Wiig, 2013). The index for control of corruption from the World Governance Indicators (Kraay et al., 2010) is used as the corruption indicator. The index measures the perception of corruption, and it ranges from -2.5 to 2.5, with higher values indicating a better control of corruption in the host country. While the main findings of this chapter remain qualitatively stable when the control of corruption index is included in the baseline equation, we find that corruption does not have a statistically significant impact on gold and silver FDI inflows (Table 4, columns 3 and 6). A similar result is found in Canare (2017), which concludes that there is no significant relationship between corruption and FDI inflows for low- and middle-income countries. He explains this result by the fact that given low-income countries are perceived as most corrupt, investors select other institutional indicators, instead of corruption, to determine the locations of their investments

among low- and middle-income countries. We borrow this explanation from Canare (2017) for our estimation result, indicating the absence of a significant impact of corruption on gold and silver FDI in Africa. In fact, although the quality of institutions is important for choosing investment locations, mining investors examine different indicators of institutional environments for investment in African countries. For foreign mining investors, government stability tends to be a more important factor than corruption in discriminating between African countries for mining investments. The estimation results support this observation because the impact of corruption on FDI in gold and silver sectors is not significant, whereas government stability has a positive and significant impact on gold and silver FDI inflows (Table 2, columns 4 and 7; Tables 3 and 4, columns 3 and 6). This preference for political stability over corruption for deciding which African country to invest in could be explained by the fact that investors focus more on unpredictable factors like institutional stability than corruption, which is somewhat predictable in African countries. This consideration may explain the absence of statistically

significant impacts of corruption on FDI inflows to gold and silver sectors.

5.2.3 Controlling the impact of adjustments in mining CIT base and other fiscal instruments applied to mining companies

For making investment decisions, mining companies will consider the corporate tax burden and the overall tax burden of all other taxes payable by mining companies (extraordinary taxes on income, profits and capital gains, environmental taxes, property taxes, royalties). Furthermore, from a neutral tax reform perspective, policymakers may make significant adjustments to other fiscal instruments as well as to the CIT base, to compensate for changes in CIT rates applied to mining companies. We take these considerations into account by including resource tax revenue among the explanatory variables in the baseline equation. As a percent of GDP, the variable resource tax is extracted from the ICTD-GRD database (UNU-WIDER Government Revenue Dataset, 2020).²¹ The inclusion

²¹ Since spatial econometric models cannot be run with a variable containing missing values, we replace the missing values for the variable resource tax revenue with 30 percent of the value of total

of resource tax revenue among the control variables does not change the main result of this chapter. The estimation results confirm the absence of evidence of a direct impact of CIT rates applied to mining companies on **FDI inflows to gold and silver sectors (Table 5)**. Furthermore, we find that resource tax revenue does not significantly impact FDI in gold and silver projects (Table 5, columns 3 and 6).

5.2.4 Alternative weighting matrix: Geology and production costs

Beyond geographical proximity, countries with the same level of minerals reserves and similar production conditions may be more competitive with each other for attracting mining investments. Accordingly, the mineral rents²² difference reflects the similarity of mineral endowments and production costs, as

tax revenue, as a proportion of GDP, because, on average, resource revenue accounts for 30–40 percent of government revenue for resource-rich countries in Africa (UNECA, 2018, p.8 and p.78).

²² Mineral rents correspond to the difference between the revenue obtained from the sales of gold and silver produced and the costs incurred to produce these minerals.

determined by the quality of infrastructure and human capital and the geological and financial information collection costs. For example, the most gold-rich countries of sub-Saharan Africa (Ghana, Mali, and South Africa) are more likely to compete to attract FDI than less-gold-rich countries, such as Kenya, Mauritania, and Niger. In summation, countries are linked one to another, but the intensity of connectivity is stronger between countries with similar levels of mineral rents.

The mineral rents weighting matrix elements are based on the absolute difference in mineral rents (Rent) between countries i and j . The inverse of the absolute difference is taken such that the weighting matrix attributes a higher weight to countries that have a smaller absolute difference in mineral rents. Algebraically, an element w_{ij} of the rent difference weighting matrix is given as follows:

$$w_{ij} = \begin{cases} \frac{(|Rent_i - Rent_j|)^{-1}}{\sum_j (|Rent_i - Rent_j|)^{-1}}, & \text{for } i \neq j \\ 0, & \text{for } i = j \end{cases}$$

The main estimation results obtained with the geographic distance weighting matrix remain unchanged when differences in mineral rents between countries are alternatively used as the weighting matrix for estimating the baseline specification (Table 6). The results show that a reduction in CIT rates applied to mining companies does not have a statistically significant impact on FDI inflows to gold and silver sectors for the host country (Table 6, columns 3 and 6). However, the estimation results show that the impact of cuts in the host country on the other countries' gold and silver FDI inflows (indirect effects) turns statistically significant in the short and long run (Table 6, columns 4 and 7). These results provide indications that a too-generous mining tax regime will not necessarily attract investments to the mining sector, but it

is likely to divert mining investments from the host country to other countries. The mining FDI inflow diversion effects could be explained by the desire of mining investors to diversify their investment locations to reduce the risks of greater dependence on one host country, although that host country offers a preferential tax treatment for mining investments.

Conclusion

This chapter contributes to the more extensive literature on tax policy and FDI by estimating the impact of CIT rates applied to mining companies on FDI inflows to African economies' gold and silver sectors. In the tradition of Blonigen et al. (2007) and following Boly et al. (2020), we specify a dynamic spatial Durbin model with fixed effects for estimating the impact of mining CIT rates on gold and silver FDI inflows. This spatial econometric model considers previous experiences from foreign investments in mining sectors and interactions in mining FDI

as well as interactions in corporate tax policy for mining activities between countries.

We find no statistically significant impact of mining CIT rates on the host country's gold and silver FDI inflows. However, when differences in resource rents between countries are used as a connectivity matrix, we find preliminary evidence that an increase in CIT rates is likely to increase FDI inflows to neighbouring countries, whereas it has no significant impact on the host country's gold and silver FDI inflows. These results suggest an attractive mining tax treatment will not necessarily attract investments to mining sectors because investors may diversify their mining investments away from one location, to minimize operational risks, regardless of preferential tax treatments offered by a host country.

Moreover, the estimation results show that infrastructure, political stability, and manufacturing value-added positively affect FDI in the gold and silver sectors. These results urge policymakers to act toward creating an enabling investment environment instead of cutting corporate tax rates in the hopes of attracting mining investments. Furthermore, we find that past values of FDI in gold and silver projects positively affect the current level of FDI in gold and silver projects, suggesting that a country's history in mining operations is likely to stimulate mining investments. Finally, from a policy perspective, this result suggests that governments should make all possible arrangements to avoid a dispute or conflict with mining companies operating in their country, such that bad experiences from previous investments in the sector do not constitute an obstacle for attracting mining investments.

Annexe

List of countries

Burkina Faso, Côte d'Ivoire, the Democratic Republic of the Congo, Ghana, Guinea, Kenya, Mali, Mauritania, Morocco, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Tanzania, Zimbabwe.

Table 3: Impact of tax policy on mining foreign investments: Controlling for the impact of manufacturing value-added

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gold and silver FDI inflows (%GDP)	Estimates		Short-run marginal effects			Long-run marginal effects		
	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L. (Gold and silver FDI inflows)	0.0487** (0.0205)							
CIT rate mining	-0.0361 (0.0338)	0.1515 (0.1893)	-0.0412 (0.0309)	0.1409 (0.1383)	0.0996 (0.1605)	-0.0436 (0.0325)	0.1474 (0.1440)	0.1038 (0.1672)
Infrastructure	0.0304* (0.0172)	-0.0332 (0.1683)	0.0345*** (0.0128)	-0.0103 (0.1324)	0.0242 (0.1419)	0.0364*** (0.0134)	-0.0106 (0.1381)	0.0258 (0.1478)
Government stability	0.0232** (0.0113)	0.1373*** (0.0463)	0.0184** (0.0094)	0.0949*** (0.0246)	0.1133*** (0.0310)	0.0192* (0.0098)	0.0982*** (0.0253)	0.1174*** (0.0319)
Exchange rate	0.0000 (0.0001)	0.0024*** (0.0006)	-0.0000 (0.0021)	0.0026 (0.0229)	0.0026 (0.0221)	-0.0000 (0.0023)	0.0027 (0.0238)	0.0027 (0.0230)
Log (gold and silver reserves)	0.1339*** (0.0301)	0.7607*** (0.1499)	0.1136*** (0.0290)	0.5509*** (0.1379)	0.6645*** (0.1643)	0.1185*** (0.0305)	0.5711*** (0.1452)	0.6896*** (0.1729)
Log (manufacturing)	1.1202** (0.4469)	4.2248*** (1.4129)	0.9816** (0.4059)	2.8538*** (1.0712)	3.8353*** (1.3562)	1.0275** (0.4251)	2.9511*** (1.1175)	3.9786*** (1.4116)
rho	0.3940** (0.1719)							
sigma2_e	1.3211*** (0.4456)							

Observations	192	192	192	192	192	192	192	192
Number of countries	16	16	16	16	16	16	16	16
Log likelihood	-586.2	-586.2	-586.2	-586.2	-586.2	-586.2	-586.2	-586.2

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

Notes: CIT rate mining: corporate income tax rate applied to mining companies. σ_2 is the standard deviation of idiosyncratic errors; ρ is the coefficient of the spatial-lagged-dependent variable.

Table 4: Tax policy and FDI in gold and silver sectors:
Controlling for the impact of corruption

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gold and silver FDI inflows (%GDP)	Estimates		Short-run marginal effects			Long-run marginal effects		
	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.(gold and silver FDI inflows)	0.0462*** (0.0138)							
CIT rate mining	-0.0317 (0.0266)	0.1808 (0.2075)	-0.0370 (0.0234)	0.1626 (0.1549)	0.1256 (0.1727)	-0.0391 (0.0244)	0.1696 (0.1610)	0.1306 (0.1795)
Infrastructure	0.0379* (0.0210)	0.0259 (0.1689)	0.0398** (0.0168)	0.0308 (0.1324)	0.0705 (0.1467)	0.0418** (0.0174)	0.0319 (0.1377)	0.0736 (0.1526)
Government stability	0.0187** (0.0088)	0.0892** (0.0374)	0.0158** (0.0074)	0.0627** (0.0245)	0.0785*** (0.0281)	0.0165** (0.0077)	0.0648** (0.0253)	0.0813*** (0.0290)
Exchange rate	0.0000 (0.0001)	0.0020*** (0.0004)	0.0008 (0.0236)	0.0012 (0.0297)	0.0020 (0.0366)	0.0008 (0.0248)	0.0012 (0.0309)	0.0020 (0.0379)
Log (gold and silver reserves	0.1622*** (0.0256)	0.8475*** (0.1399)	0.1398*** (0.0253)	0.6153*** (0.1320)	0.7551*** (0.1561)	0.1457*** (0.0265)	0.6368*** (0.1385)	0.7825*** (0.1639)
Control of corruption	0.0209 (0.4463)	-1.3766 (1.0902)	0.0739 (0.3985)	-0.9645 (0.6811)	-0.8906 (1.0245)	0.0792 (0.4168)	-0.9991 (0.7027)	-0.9199 (1.0605)
rho	0.3631** (0.1412)							
sigma2_e	1.3483*** (0.4122)							
Observations	192	192	192	192	192	192	192	192
Number of countries	16	16	16	16	16	16	16	16

Log likelihood -717.9 -717.9 -717.9 -717.9 -717.9 -717.9 -717.9

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

Notes: CIT rate mining: corporate income tax rate applied to mining companies. Sigma2_e is the standard deviation of idiosyncratic errors; rho is the coefficient of the spatial-lagged-dependent variable.

Table 5: Tax policy and FDI in gold and silver sectors:
Controlling for the impact of resource tax revenue

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gold and silver FDI inflows (%GDP)	Estimates		Short-run marginal effects			Long-run marginal effects		
	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L. (gold and silver FDI inflows)	0.0406** (0.0168)							
CIT rate mining	-0.0142 (0.0418)	0.2349 (0.2265)	-0.0214 (0.0389)	0.1941 (0.1674)	0.1727 (0.1988)	-0.0225 (0.0405)	0.2011 (0.1731)	0.1786 (0.2058)
Infrastructure	0.0388** (0.0179)	0.0136 (0.1492)	0.0413** (0.0189)	0.0203 (0.1202)	0.0616 (0.1307)	0.0432** (0.0196)	0.0209 (0.1246)	0.0640 (0.1353)
Government stability	0.0162* (0.0096)	0.1023** (0.0520)	0.0120 (0.0242)	0.0751* (0.0397)	0.0871** (0.0437)	0.0124 (0.0252)	0.0774* (0.0410)	0.0898** (0.0450)
Exchange rate	0.0001 (0.0001)	0.0030** (0.0015)	0.0001 (0.0304)	0.0027 (0.0095)	0.0028 (0.0216)	0.0001 (0.0317)	0.0028 (0.0102)	0.0029 (0.0223)
Log (gold and silver reserves)	0.1798*** (0.0308)	1.0062*** (0.2021)	0.1522*** (0.0299)	0.7316*** (0.2003)	0.8838*** (0.2264)	0.1577*** (0.0311)	0.7542*** (0.2092)	0.9119*** (0.2364)
Resource tax revenue	-0.2386 (0.1905)	-1.8703** (0.9184)	-0.1986 (0.1784)	-1.4603* (0.7899)	-1.6589* (0.9637)	-0.2053 (0.1858)	-1.5085* (0.8206)	-1.7138* (1.0015)
rho	0.3736** (0.1623)							
sigma2_e	1.3186*** (0.4094)							
Observations	192	192	192	192	192	192	192	192
Number of countries	16	16	16	16	16	16	16	16
Log likelihood	-835.6	-835.6	-835.6	-835.6	-835.6	-835.6	-835.6	-835.6

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

Notes: CIT rate mining: corporate income tax rate applied to mining companies. Sigma2_e is the standard deviation of idiosyncratic errors; ρ is the coefficient of the spatial-lagged-dependent variable.

Table 6: Tax policy and FDI in gold and silver: Results with minerals rents as weighting matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gold and silver FDI inflows (%GDP)	Estimates		Short-run marginal effects			Long-run marginal effects		
	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L. FDI inflows (%GDP)	0.0171 (0.0160)							
CIT rate mining	-0.0387 (0.0290)	-0.1578*** (0.0315)	-0.0355 (0.0275)	-0.1430*** (0.0282)	-0.1785*** (0.0383)	-0.0361 (0.0279)	-0.1452*** (0.0286)	-0.1813*** (0.0389)
Infrastructure	0.0358*** (0.0065)	-0.0005 (0.0128)	0.0364*** (0.0064)	-0.0042 (0.0119)	0.0322*** (0.0116)	0.0370*** (0.0065)	-0.0043 (0.0121)	0.0327*** (0.0118)
Government stability	0.0215*** (0.0076)	-0.0077 (0.0129)	0.0212*** (0.0070)	-0.0095 (0.0113)	0.0117 (0.0151)	0.0215*** (0.0072)	-0.0097 (0.0114)	0.0119 (0.0153)
Exchange rate	0.0004** (0.0002)	-0.0007*** (0.0003)	0.0005** (0.0002)	-0.0007*** (0.0002)	-0.0002 (0.0002)	0.0005** (0.0002)	-0.0007*** (0.0002)	-0.0002 (0.0002)
Log (gold and silver reserves)	0.0672*** (0.0100)	-0.1174 (0.0796)	0.0693*** (0.0096)	-0.1152 (0.0739)	-0.0459 (0.0785)	0.0705*** (0.0098)	-0.1172 (0.0751)	-0.0467 (0.0798)
rho	0.0999*** (0.0323)							
sigma2_e	1.4111*** (0.4474)							
Observations	192	192	192	192	192	192	192	192
Number of countries	16	16	16	16	16	16	16	16
Log likelihood	-341.8	-341.8	-341.8	-341.8	-341.8	-341.8	-341.8	-341.8

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

Notes: CIT rate mining: corporate income tax rate applied to mining companies. Sigma2_e is the standard deviation of idiosyncratic errors; ρ is the coefficient of the spatial-lagged-dependent variable.

GENERAL CONCLUSION

The financing for development is central to the policy debate in developing countries. The need to mobilise substantial financial resources in developing countries requires unprecedented financing. However, in the face of unpredictable external resource flows and volatile commodity prices, combined with falling tariff revenues due to open trade policies, developing countries need to engage in increased public resource mobilisation. Thus, by increasing their capacity to mobilise their public revenues, developing countries could have sustainable and relatively stable resource flows to finance essential public goods and development programs. Besides, increased domestic tax revenue mobilisation is a well-established and recognised need for developing countries. However, the inflow of significant external financial flows, particularly FDI flows, which represent one of the most important external financial flows for developing countries, could help strengthen domestic tax revenues to adequately finance the continent's sustainable development. In developing countries, the mobilisation of non-resource tax revenues faces several challenges, including the informal economy, dependence

on foreign aid, weak institutions and insufficient financial development, to name a few. In addition, corporate tax rate reductions in the mining sector challenge domestic tax revenue mobilisation to attract FDI in this sector in Africa.

In this context, this thesis aims to contribute to the literature on development finance in developing countries. As underling by main results:

First, financial development has a non-linear impact on non-resource tax revenue mobilisation in developing countries in both the long and short run. However, the development of financial institutions affects non-resource tax revenues only in the long run. Furthermore, our results indicate that institutional characteristics are significant for the relationship between tax revenue and financial development. These findings suggest that a wide range of policies that focus on financial development as a channel for tax revenues may be useless if there is no attention and goodwill for the rule of law and anti-corruption actions. Finally, the government could encourage direct taxation with financial tools.

Second, Chinese aid encourages non-resource tax revenue mobilisation in Africa. In terms of policy implications, these results help inform policymakers that South-South cooperation is an essential lever for increasing economic infrastructure and thus improving tax compliance to boost non-resource tax revenue mobilisation in Africa.

Third, concerning the impact of FDI three significant findings emerge. Foreign direct investment positively impacts tax revenue mobilisation in African developing countries. However, our results indicate that FDI does not statistically influence tax revenue mobilisation in resource exporting economies. In terms of policy, this work shows that the promotion of FDI through tax incentives should take into account the role of tax evasion. The results also suggest that it is necessary to substitute or combine these policies with non-tax measures such as subsidies to foreign investors, improvement of the institutional environment and infrastructure development, to attract FDI without a considerable loss of tax revenue. In addition, countries should also consider the crucial role of natural

resources, agriculture and trade openness in mobilising tax revenues.

Finally, reductions in income tax rates applied to mining companies will not necessarily attract FDI to gold and silver projects. Furthermore, we find a strategic complementarity into gold and silver FDI flows between countries, suggesting that an increase in host country gold and silver FDI flows can stimulate FDI in this sectors projects in neighbouring countries. Furthermore, the results show that infrastructure, government stability, and gold and silver reserves positively impact FDI inflows into the gold and silver sector.

Policy implications

The central message that could be drawn from this thesis is that African countries should redouble their efforts to improve the social environment in which taxes are collected by promoting financial development and South-South cooperation, improving the quality of institutions and the economic infrastructure of their economies for better mobilisation of non-resource tax revenues. These efforts need to be complemented

by better management of resource revenues towards productive investments to sustain economic growth and streamlining tax incentives to attract foreign investors in the mining sector to limit net tax revenue losses.

Some policy direction could be derived from the findings. Financial development could significantly increase the collection of non-resource tax revenues if developing countries promote good governance by fighting corruption and strengthening the rule of law. In addition, developing countries should encourage the collection of direct and indirect taxes using financial tools.

Besides, African governments pay more attention to South-South cooperation, which could be the catalyst for strengthening economic infrastructure for better mobilisation of non-resource taxes. There are also opportunities to increase tax revenues by negotiating with lenders, especially China, to award a share of infrastructure projects to local companies.

In addition, developing country governments should put in place policies to attract FDI, taking into account the role of tax

evasion. Its findings also suggest the need to substitute or combine these policies with non-tax measures such as subsidies to foreign investors, improvement of the institutional environment and infrastructure development, to attract FDI without significant loss of tax revenue. Countries should also consider the crucial role of natural resources, agriculture and trade openness in mobilising tax revenues.

Finally, this thesis suggest the revision of tax laws and mining codes intending to reduce and rationalise the tax incentives granted to mining companies. In addition, policymakers may consider increasing investment in infrastructure and improving the business environment to attract mining FDI.

Limits and possible future researches

The present thesis was mainly based on empirical analyses, and sensitivity analyses were conducted to obtain robust results. However, as with other studies of this type, some limitations can be found to provide relevant opportunities for future research.

We estimated the effect of South-South cooperation on non-resource tax revenue through Chinese foreign aid in Africa. However, the impact of Chinese aid on tax effort may differ across countries depending on the characteristics of the aid and the country's economic circumstances. Thus, future research will attempt to estimate the impact of Chinese aid by sector on tax effort according to country economic specificities.

We analyse the impact of FDI on tax revenue mobilisation. Given that most of the FDI flow to developing countries, especially in Africa, are directed towards the resource sectors, it would be interesting to test the robustness of our results using FDI in the resource and non-resource sectors as the dependent variable. Thus, future research will attempt to estimate the impact of FDI by sector on tax effort.

Furthermore, the use of only 16 countries in the sample due to data limitations may limit the extent to which the results can be generalised to the rest of the 54 countries in Africa. Although the sample used tends to be pretty representative of the economic structure of the rest of the countries in Africa, future work should re-examine the data used and expand the sample

of countries so that it can be easily generalised for Africa. Similarly, the data used for the analysis in Chapter 4 covers 2003-2015. The mining FDI landscape has changed significantly in Africa since 2015 with the entry of China as the dominant source of mining FDI on the continent, which may alter the elasticity of mining FDI to changes in corporate tax rates. Future research can examine the possibility of extending the time dimension of the analysis to the year 2015 to test the robustness of the findings of this chapter to the consideration raised above.

In addition, given that the most significant proportion of FDI flows to Africa is directed not only to gold and silver but to all-natural resource sectors, it would be interesting to test the robustness of our results using FDI in natural resource sectors as the dependent variable. Such an approach would therefore require, for consistency in the analysis, the use of the corporate tax rate applied to resource projects instead of the corporate tax rate linked only to the statutory mineral resource. In fact, to our knowledge, the International Trade Centre and UNCTAD are the only ones to provide data on FDI in the resource sectors, but these datasets cover a minimal number of

African countries, making them somewhat unusable for this study. Moreover, the OECD provides data on FDI in natural resource sectors only for its member countries, while no African country is currently a member of this international organisation. Future research will continue to monitor data on FDI in the natural resources sector for African economies to take these issues into account.

Considering these points, some future research will focus on FDI impacts on tax revenue in natural resources sector, and on the effects on the Chinese's economic infrastructure projects aid on host countries economic activity.

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