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FINANCEMENT DURABLE DU DÉVELOPPEMENT : QUATRE ESSAIS SUR LA MOBILISATION DES RESSOURCES EN AFRIQUE

SUSTAINABLE FINANCING FOR DEVELOPMENT: FOUR ESSAYS ON RESOURCE MOBILIZATION IN AFRICA

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SUMMARY

Domestic resource mobilization and external financial flows are crucial for financing Sustainable Development Goals in Africa and the development objectives outlined in the African Union Agenda 2063. Financing for development in Africa is at the heart of this dissertation. We divided the dissertation into two parts. The first part comprising chapters 1 and 2 focuses on domestic tax revenue mobilization while the second part composed of chapters 3 and 4 deals with the issue of attracting one of the most important external financial flows, namely foreign direct investments.

Chapter 1 analyses the relationship between natural resources wealth and non-resource tax revenue in Africa. Three important results emerge from this chapter. The direct impact of natural resource rents on non-resource tax revenue is negative. However, natural resource rents positively affect non-resource tax revenue in countries with good institutional quality. Moreover, we find evidence that natural resource rents enhance non-resource tax mobilization in countries with greater economic diversification. These findings provide additional motivations to African governments to further increase the emphasis on economic diversification and to strengthen the quality of institutions so that natural resources revenues contribute to boost non-resource tax revenue mobilization in the continent.

Chapter 2 examines the impacts of social indicators, income inequality and poverty on non-resource tax revenue performance in Sub-Saharan Africa since the social environment in which taxes are collected could affect tax collection performances. We find that both income inequality and poverty reduce non-resource tax revenue in Sub-Saharan Africa. In terms of policy implication, these findings help inform policymakers that reducing income inequality and poverty could be viewed not only as a crucial dimension of development or a vector of

social justice, but also an important engine of non-resource tax revenue mobilization in Sub-Saharan African countries.

Chapter 3 deals with tax competition through cuts in tax rates, an important issue that is closely related to government revenue collection in Africa[1]. With limited empirical evidence, it is commonly thought that African countries are competing among themselves for attracting foreign capitals and that competition leads to significant losses of tax revenue for all the competitors in line with the race to the bottom hypothesis (Rota-Graziosi, 2018). We empirically test the existence of tax competition between these countries to shed light and guide public decisions on the topic. We find no evidence of corporate income tax rate competition between African economies. However, we find strategic complementarity between corporate income tax rates and corporate tax bases suggesting that cuts in foreign countries corporate tax rate reduce the host country's corporate tax base. The estimates show that if the host country reacts to reduction in abroad countries corporate tax rates but cutting in own corporate income tax rate in the same proportion, this could lead to a net deterioration of corporate tax base of 0.4%, representing a loss of corporate tax revenue by 2.3% GDP for the host country. We also find strategic complementarity between corporate tax bases indicating that countries react to measure that tend to reduce corporate tax liability (tax incentives) in other countries by also undertaking similar measures.

Finally, chapter 4, a direct extension of chapter 3 analyses the effectiveness of cuts in corporate income tax rate in attracting FDI net inflows in Africa. In contrast to previous studies on FDI determinants in Africa, we take into account FDI spillover effects between countries as suggested by Blonigen et al (2007). We find that in the short and long run, cuts in CIT rate increase FDI net inflows in the host country and in the neighboring countries. Furthermore, we

[1]"*Tax revenue is the cornerstone of any model of tax competition"* (Rota-Graziosi, 2018).

also find evidence of a strategic complementarity in FDI inflows between African economies, suggesting that an increase in FDI inflows in a host country is likely to stimulate the FDI inflows of its neighbors.

The central message that could be drawn from this thesis is that on the one hand, African countries should increase efforts in improving the social environment in which taxes are collected by addressing inequality and poverty, and on the other hand, improving the quality of institutions and diversifying their economies for better domestic non-resource tax revenue mobilization. These efforts must be complemented by a better management of revenue from natural resources toward productive investments for supporting economic diversification as well as the rationalization of tax incentives aiming at attracting foreign investors for limiting tax revenue losses.

Keywords: Non-resource tax revenue, Natural resource rents, Income inequality, Poverty, Corporate tax competition, Foreign direct investments, Africa.

RÉSUMÉ

La mobilisation des ressources internes et les flux financiers extérieurs sont essentiels pour le financement des objectifs de développement durable en Afrique et des objectifs de développement énoncés dans l'Agenda de l'Union Africaine 2063. Le financement du développement en Afrique est au cœur de cette thèse. Nous avons subdivisé la thèse en deux parties. La première partie, composée des chapitres 1 et 2, porte sur la mobilisation des recettes fiscales internes, tandis que la deuxième partie, composée des chapitres 3 et 4, traite de l'attractivité de l'un des importants flux financiers extérieurs entrant en Afrique à savoir les investissements directs étrangers.

Le chapitre 1 analyse la relation entre les revenus tirés des ressources naturelles et les recettes fiscales hors ressources en Afrique. Trois importants résultats ressortent de ce chapitre. Les rentes tirées des ressources naturelles exercent un impact direct négatif sur les recettes fiscales hors ressources en Afrique. Cependant, pour les économies dotées de bonnes institutions, les rentes des ressources naturelles affectent positivement les recettes fiscales hors ressources en Afrique. En outre, nos résultats indiquent que les rentes tirées des ressources naturelles renforcent la mobilisation des taxes hors ressources dans les économies relativement bien diversifiées. Ces conclusions invitent les gouvernements africains à mettre davantage l'accent sur la diversification économique et à améliorer la qualité des institutions afin que les recettes tirées des ressources naturelles contribuent à stimuler la mobilisation des recettes fiscales hors ressources sur le continent.

Le chapitre 2 examine l'impact des indicateurs sociaux, l'inégalité des revenus et la pauvreté sur les recettes fiscales hors ressources en Afrique sub-saharienne, étant donné que l'environnement social dans lequel les impôts sont collectés pourrait impacter les performances fiscales. Nous résultats d'estimation indiquent que l'inégalité des revenus et la pauvreté réduisent les recettes fiscales hors ressources en Afrique subsaharienne. En termes

d'implication politique, ces résultats aident à informer les décideurs politiques que la réduction des inégalités de revenus et de la pauvreté pourrait être considérée non seulement comme une dimension cruciale du développement ou un vecteur de justice sociale, mais constitue également un important levier pour booster la mobilisation des recettes fiscales hors ressources en Afrique sub-saharienne.

Le chapitre 3 traite de la concurrence fiscale par la réduction des taux d'imposition et de l'assiette fiscale, une question importante qui est étroitement liée à la mobilisation des recettes publiques en Afrique en raison des pertes de recettes fiscales associées aux incitations fiscales. Avec des preuves empiriques limitées, l'on pense généralement que les pays Africains se font la concurrence à travers l'impôt sur les sociétés pour attirer les capitaux étrangers et que cette concurrence entraîne des pertes importantes de recettes fiscales pour tous les concurrents, conformément à l'hypothèse de la course vers le bas (Rota- Graziosi, 2018). Nous testons empiriquement l'existence d'une concurrence fiscale entre ces pays pour faire la lumière et orienter les décisions publiques sur le sujet. Nos résultats ne corroborent pas l'existence d'une concurrence fiscale à travers les taux de l'impôt sur les sociétés entre les économies africaines. Toutefois, même s'il n'existe pas de concurrence fiscale pure entre les économies africaines par le biais du taux de l'impôt sur les sociétés, nos résultats indiquent par ailleurs que les réductions du taux d'imposition des sociétés à l'étranger réduisent l'assiette de l'impôt sur les sociétés du pays hôte. Les estimations montrent que si le pays hôte réagit à la réduction des taux d'imposition des sociétés dans les pays étrangers en réduisant à son tour son taux d'imposition des sociétés dans la même proportion, cela entraînerait une détérioration nette de l'assiette fiscale de 0,4% pour le pays hôte. En outre, nous constatons une complémentarité stratégique entre les assiettes fiscales de l'impôt sur les sociétés, indiquant que les pays réagissent à des mesures tendant à réduire les obligations fiscales des entreprises (incitations fiscales) dans d'autres pays en prenant également des mesures similaires.

Enfin, le chapitre 4, qui est une extension directe du chapitre 3, analyse l'efficacité des réductions du taux d'imposition des revenus des sociétés pour attirer des entrées nettes d'Investissement Directs Etrangers (IDE) 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). Nous trouvons qu'à court et long terme, les réductions du taux de l'impôt sur les sociétés entraînent une augmentation des entrées nettes d'IDE dans le pays hôte et dans les pays voisins. En outre, nous constatons également une complémentarité stratégique des flux d'IDE entre les économies africaines, ce qui suggère qu'une augmentation des entrées d'IDE dans un pays hôte pourrait stimuler les entrées d'IDE chez ses voisins.

Le message central qui pourrait être tiré de cette thèse est que les pays Africains devraient redoubler d'efforts pour d'une part, améliorer l'environnement social dans lequel les impôts sont collectés en s'attaquant aux inégalités et à la pauvreté et d'autre part, améliorer la qualité des institutions et diversifier 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 diversification économique et d'autre part par une rationalisation des incitations fiscales visant à attirer les investisseurs étrangers, pour limiter les pertes nettes de recettes fiscales.

Mots clés: Recettes fiscales hors ressources, Rentes tirées des ressources naturelles, Inégalité de revenus, Pauvreté, Concurrence fiscale, Investissements directs étrangers, Afrique.

TABLE OF CONTENT

GENERAL INTRODUCTION

Since the adoption of the Addis Ababa agenda action plan at the third international conference on financing for development in 2015, developing countries have placed growing interest on domestic revenue mobilization, emphasizing the role of tax revenue in the funding of basic infrastructures and public goods and services. In this dynamic, African governments, international development institutions and researchers highlight the crucial importance of increasing domestic tax revenue for ensuring sustainable financing of the development process in Africa.

The main rationale behind the imperative of increasing domestic resource mobilization lies in the fact that tax revenue is relatively more stable and predictable than external financial resources. In the same context, domestic resource mobilization appears as a crucial step towards reducing the dependence on external assistance. In practice, five key factors could explain the growing attention paid to domestic tax revenue mobilization in policy dialogue in African countries.

High uncertainties around the official development assistance (ODA).

First, the financial crisis of 2008 has demonstrated that aid is a vulnerable source of financing subjected to shocks in donor countries and therefore African countries cannot rely on this source for financing their development in sustainable manner. In fact, a choc on donor countries could significantly affect development funding through official development assistance (ODA)[2] in Africa. ODA is unstable and unpredictable and largely dependent on the economic situation of donor countries suggesting that choc on these countries may significantly affect

[2] In OECD statistical notes, ODA is defined as government aid provided bilaterally or through a multilateral development institution to developing countries for supporting their economic development. Loans and credits for military purposes are not considered as ODA. Aid includes grants, technical assistance and preferential loans.

development funding in African countries that are dependent on ODA. For instance, the crisis of 2008 has been followed by a decrease in aid inflows to developing countries. In fact, aid from OECD countries has decreased due to the crisis, falling by 2.7% in 2011 compared to the year 2010 and bilateral aid to sub-Saharan Africa has decreased by 0.9% in real terms from 2010 to 2011 (Mascagni et al, 2014). Furthermore, in real terms, ODA flows to Africa decreased by 1.7% in 2016 compared to 2015. Furthermore, the amount of aid allocated to 17 of the 27 low-income countries in Africa is projected to decrease at least up to 2019 (AfDB, 2017, Chapter 2) indicating that mobilizing domestic resources is imperative because Africa cannot keep relying on international aid for financing its development. In this respect, African government should reduce the proportion of their budget financed by official development assistance for preventing budgetary issues during recession periods in donor countries.

The level and the raising speed of public debt in Africa strongly limit the sustainability of financing through debt for the continent.

Second, relying on public debt as economic development financing source is becoming more and more restricted and would not be sustainable. In fact, after the Heavily Indebted Poor Country (HIPC) initiatives, public debt has rapidly increased and is reaching worrisome levels in some African countries even if the average public debt to GDP ratio is on average inferior to prior HIPC period (African Development Bank (AfDB), 2018, p24). Basically, the real source of potential threat is not the current volume of debt. But it is rather the speed in which public debt has increased in some African countries over the last five years which is worrisome. The average public debt in proportion of GDP passed from 40 percent in 2013 to almost 56 percent of GDP in 2017, and public debt levels exceed 50 percent of GDP in 25 of the 45 Sub-Saharan African countries (SSA) whereas in 2013 only 11 SSA had debt ratio higher than 50 percent (Coulibaly, 2018).

Debt service ratios have followed the same upward trends in the region. The Brooking Institution provides figures indicating that the median debt service-to-revenues ratio in SSA rise from 5 percent in 2013 to an estimated 10 percent in 2017 (Coulibaly, 2018). This picture is more critical for oil-dependent economies where debt service ratios exceeded 25 percent in 2017 (Coulibaly, 2018). The immediate consequence of these recent developments in public debt in SSA is that ratings agencies and international financial institutions could downgrade the sovereign debt rating for some countries in the region and this will thereby increase external financing costs for these countries. In addition, domestic debt has increased in the continent from 11% GDP in 2010 to 13.5% GDP in 2015 (AfDB, 2018). The accumulation of domestic debt could compromise the mobilization of domestic saving through regional capital markets.

Downward pressure on international trade taxes

Third, the mobilization of domestic revenue is also crucial to compensate potential tax revenue losses from trade liberalization policies in which African countries are embarked since 1990s. Indeed, African countries have engaged in trade liberalization policies through reduction in trade barriers and cuts in trade taxes. With forthcoming trade agreements between African countries and European Union, African countries are expected to pursue their tariff dismantling and further liberalize their markets. Basically, African governments were supposed to increase domestic tax revenues mobilization in order to compensate for tax revenue losses from reduction in trade taxes. However, this is not the case in all the African countries where trade taxes represent a high proportion of total tax revenues (representing almost half of their total revenue for countries like Ethiopia, Gambia, Liberia and Namibia). Baunsgaard and Keen (2010) reveal that low income countries have recovered at best 30 cents of each dollar lost in tariffs reductions in the framework of trade liberalization. Clearly, trade liberalization process is likely to put downward pressure on government revenue through decline in trade taxes in Africa. Accordingly, it appears important to strengthen the capacity of African countries to

increase revenue from domestic taxes in order to compensate potential losses from trade taxes so as not to jeopardize the supply of public goods and services aiming at reducing poverty and improving welfare in the continent.

Africa's financing needs are huge and urgent.

Fourth, African countries' current financial needs are huge and urgent. Indeed, with the 2030 agenda for sustainable development and the Africa Union's Agenda 2063, the ambition of African countries is to achieve concrete and significant development outcomes in terms of poverty reduction and inclusive prosperity for the coming decades. Depending on the target objectives in terms of poverty and inequality reduction as well as assumptions made on savings rate, FDI, ODA and remittances, the Economic Commission for Africa (ECA) estimates that the additional financial resources required for meeting the 2030 Sustainable Development Goals range from $6.5 billion to $246 billion a year from 2015 to 2030 (UNECA, 2017). More specifically, in its recent 2018 African Economic Outlook, the African Development Bank reveals that Africa's infrastructure needs are estimated to $130–170 billion a year, leaving a financing gap ranging from $68 to $108 billion (AfDB, 2018). Therefore, the continent will require unprecedented domestic revenue for financing the achievement of the Sustainable Development Goals within the expected time as highlighted by the Goal 17.1 "*domestic resource mobilization should be strengthened, including through international support, to improve countries domestic capacity for tax and other revenue collection*''.

Finally, beyond economic considerations, domestic taxation links government and citizens. In addition of been a social contract between policy makers and citizens, taxation is also an engine of democracy through accountability of policy makers vis a vis citizens and therefore enables citizens to participate in policy dialogue.

Tax revenue collection performances in Africa

While the relevance of domestic tax revenue mobilization in African countries for ensuring the supply of public goods and services and state building is increasingly established and recognized, it must be noted that tax effort in Africa is still relatively low compared to other developing regions. In fact, a report from OECD/ATAF/AUC published in 2017 indicates that. the average tax revenue in proportion of GDP for 16 selected African countries (Cabo Verde, Cameroon, Democratic Republic of Congo, Côte d'Ivoire, Ghana, Kenya, Mauritius, Morocco, Niger, Rwanda, Senegal, South Africa, Swaziland, Togo, Tunisia and Uganda) was 19.1% in 2015 whereas it was 18.7% in 2014 suggesting an increase of 0.4 percentage points from 2014 to 2015 (OECD/ATAF/AUC, 2017). The smallest performance has been recorded for the Democratic Republic of Congo with 10.8% GDP, while Tunisia has recorded the highest tax revenue performance with 30.3%. However, the tax to GDP ratio for these African countries in 2015 was lower than the ratio for Latin America and the Caribbean (LAC) which was 22.8% (OECD/ATAF/AUC, 2017). The same report of OECD/ATAF/AUC (2017) mentions that, for all the 16 African countries listed above, the tax revenue in share of GDP has increased by 0.5 % over the period 2000-2015. Regarding the composition of tax revenue for these 16 countries, taxes on goods and services were the main contributors to total tax revenues in 2015 (57.2%, on average) with VAT (31.5% on average). On average, the contribution of taxes on income and profits to total tax revenue represented 32.4%. Kenya, South Africa and Swaziland collected almost half of their total tax revenues from taxes on income and profits in 2015 whereas these taxes represented 18.6% of tax revenue in Togo and 37.6% in Rwanda for the same year (OECD/ATAF/AUC, 2017). The satisfactory figures found in tax collection for the 16 countries listed above are different when all the 54 African countries are considered. In fact, our calculations based on data from ICTD-GRD (Prichard et al, 2014) indicate that, the average tax revenue to GDP ratio was 16.4 % in 2015 whereas it was 18.01% in 2014 in Africa. These latter statistics provide an indication that on average, African countries have poorly performed

in terms of tax revenue collection between the year 2014 and 2015. Among others factors, declines in oil and gas prices which started in 2014 could potentially explain this fall in tax revenue. Anyway, despite recent progresses in tax collection for some African countries, taxation experts estimate that the tax potential of African countries is not fully exploited (Brun, Chambas, and Mansour, 2015). There are still possibilities to increase tax collection in these countries for properly financing sustainable development goals (SDG) and other development objectives in Africa (Coulibaly, 2018).

Relevance of increasing non-resource tax revenue mobilization.

Regarding the possibilities to increase domestic tax revenue, experts and international development institutions warn from higher dependence on natural resource revenue and particularly encourage governments to enhance domestic non-resource tax revenue mobilization for protecting their economies from the collapse of commodity prices (Coulibaly, 2018).

Actually, recent declines, instability and the downward trends in oil, gas and uranium prices (since 2014) provide signal for a major overhaul of government revenue mobilization strategy by implementing and strengthening an efficient tax system based on non-resource taxes for reducing the exposure to harmful effects from external shocks related to the volatility of natural resources' global prices. Fjeldstad et al. (2015) supports the idea of building an efficient tax system focused on non-resource taxes for government revenue mobilization, since natural resources from which resource taxes are collected may deplete.

Furthermore, the current global tendency towards a low carbon economy through a shift from non-renewable energy sources to renewable energy sources for reducing the global temperature is likely to mitigate the importance of oil and gas as major sources of energy and thereby reduces the demand for these resources as well as their value (Cust et al, 2017; Manley et al, 2017). The shift from hydrocarbon energy sources to renewable sources could render

commercially unattractive hydrocarbon resources extraction (Manley et al, 2017). Thus, an efficient and robust non-resource tax system could be therefore relevant for government revenue mobilization in a context of climate change with its corollary of energy transition which may negatively affect petroleum resources exploitation.

Another reason to pay greater attention to non-resource tax revenue lies on the fact that the resource taxes component of total tax revenue is somewhat outside the reach of economic policy (Gnangnon and Brun, 2017). Furthermore, non-resource tax revenue is more relatively homogeneous between countries than total tax revenues (Brun et al., 2015, p.206) because of differences in each country's endowment in natural resources.

In sum, increasing non-resource tax revenue mobilization is important and strategic for African countries. However, non-resource tax revenue collection in Africa is facing enormous challenges ranging from low administrative capacity of tax administrations, enormous tax incentives, to the political and social environment in which taxes are collected.

To sum up, given the huge financing needs of Africa, the instability and uncertainties around ODA and constraints on public indebtedness, it is imperative for African countries to increase domestic tax revenue mobilization, especially non-resource tax revenue for financing their development agendas. Nonetheless, in short and medium term, some African countries, especially low income countries may still need minimum external financial inflows (external debt, ODA, portfolio investments, remittances, Foreign direct investments) for financing a portion of their budgets.

While the external financing sources could not be strictly excluded even if domestic revenue mobilization is strongly encouraged, we should however keep in mind that a minimum level of domestic revenue will be required to support the implementation of projects financed by ODA for instance. In addition, to ensure the productivity of foreign direct investments (FDI) and fully benefit from these investments, the host country should promote and finance policies that

will facilitate domestic linkages and spillovers effects of FDI in the host economy. Thus, these realities bring back us to the idea that domestic revenue collection should be prioritizing in Africa for enabling harnessing the economic development potential of external financing inflows and ensure sustainable financing of development in the continent.

Contribution of this thesis

This thesis aims to contribute to the economic literature on development financing in Africa through several strategic orientations which we develop in the following paragraphs. In contrast to most of previous work on tax effort which focused on tax revenue mobilization, the present thesis emphasized that non-resource tax revenue collection (tax revenue excluding resource taxes namely tax revenue from natural resources) should be further considered. As already discussed, this orientation is motivated by the fact that, during these last years, the instability and the downward trends in oil and gas prices call for a major overhaul of public revenue mobilization strategy by implementing and strengthening an efficient tax system focused on non-resource taxes for reducing the over-reliance on natural resources in order to reduce macroeconomic vulnerabilities of African countries to external shocks related to the volatility of natural resources' global prices.[3] Indeed, given that resource taxes are generated from non-renewable natural resources that will eventually be depleted, clearly, an efficient and resilient tax system focused on non-resource taxes will be critical for tax revenue mobilization after resource depletion (Fjeldstad et al., 2015). From policy perspective, another reason to pay particular attention to non-resource tax revenue rather than total tax revenue lie on the fact that the resource taxes component of total tax revenue is largely outside the reach of economic policy (Gnangnon and Brun, 2017) because it mainly depends on global commodity prices and

[3] Morrissey et al. (2016) provide more details on tax revenue performances' vulnerability to external shocks in developing countries.

geology. Furthermore, the adaptation to climate change, suggesting a shift from carbon intensive energy source to low carbon economy will put downwards pressure on the value of fossil resources and therefore call for building a tax mobilization strategy mainly based on non-resources tax bases for African hydrocarbons producing countries.

Concerning administrative capacities and institutional challenges related to tax mobilization in Africa, it should be noted that because of large tax incentives and weak administrative capacity and institutional weaknesses to name few, African countries often failed to secure and capture a fair share of their natural resources wealth for increasing government revenue. Moreover, because of weaknesses in institutions and administrative capacities, most of African countries cannot successfully use resource revenue to support the growth of non-resource sectors activities for greater tax collection from these sectors. That said, the economic literature is still less abundant in studies investigating on the factors that explain why natural resources wealth do not contribute to increase and even often crowd out non-resource tax revenue mobilization in Africa. Indeed, some African countries are well endowed in natural resources which if well managed could contribute to finance productive investments, strengthen the quality of institutions for stimulating economic activities from the non-resource sector and thereby better tax revenue collection from these sectors. Better institutions and economic diversification-oriented policies could play a critical role in converting natural resources revenue towards non-resource sectors development and therefore more non-resource tax revenue collection. This thesis contributes to the literature on the relationship between natural resources revenue and non-resource revenue by analyzing the impact of natural resource rents on non-resource tax revenue depending on the quality of institutions and the level on diversification for African economies. The second contribution of this thesis comes up on this point. Actually, to our knowledge, this is the first study which tests the conditional impact of natural resource revenue

on non-resource tax revenue depending on the country's economic diversification and institutions.

Having analyzed how natural resources wealth could contribute to stimulate non-resource tax revenue mobilization, we investigate on the role of social environment in non-resource tax collection in Africa. In fact, the social environment in which tax collection is conducted could play a significant role in tax mobilization performances. Indeed, this environment is a strong determinant of tax compliance, a crucial dimension of tax collection. More precisely, we analyze the impact of income inequality and poverty on non-resource tax revenue in Sub-Saharan Africa.

To our knowledge, this is the first study that estimates the impact of income inequality and poverty on non-resource tax revenue in Sub-Saharan Africa. Previous studies on inequality-tax effort nexus in developing countries have not looked at the impact of inequality on tax revenue mobilization at regional level. The analysis in these studies is conducted at the level of the entire panel of developing countries whereas the depth of income inequality is not strictly the same across regions of developing countries (World Bank, 2016, p3). This thesis takes into account this consideration by examining the relationship between income inequality and non-resource tax revenue for the Sub-Saharan African countries in order to provide more specific results and policy implications. This thesis also attempts to add value to the existing literature on the topic by exploring the possible channels through which inequality could affect non-resource tax revenue in Africa.

Furthermore, this thesis shed light on external environment considerations in tax revenue mobilization. In fact, as already emphasized, increasing domestic tax revenue mobilization will be imperative for counterbalancing ODA declines and constraints on indebtedness for ensuring the funding of development in a sustainable manner. In this respect, African governments have undertaken reforms to strengthen tax systems, broaden domestic tax bases to enhance tax

revenue collection. However, these domestic tax revenues would not be immediately sufficient to cover the continent huge financing needs. Accordingly, external financing source like remittances and FDI could be interesting alternatives for complementing domestic revenue for financing national budgets. However, because remittances to Africa are not primarily oriented towards productive investments in contrast to FDI, we will focus on FDI attractiveness as external resource for complementing domestic revenue mobilization for financing development in Africa. In fact, more FDI inflows would appear as an important complement of domestic tax revenue for financing development in Africa. FDI is an important source of finance for African countries. For a host country, FDI can significantly contribute to jobs creation, facilitate the transfer and the diffusion of technology and therefore stimulate economic growth and sustainable development. In the aftermath of the worldwide economic recession of 2009, FDI inflows to Africa raised by 22% from 2010 to 2014 mainly due to high economic growth rate and political and macroeconomic stability (AfDB, 2017). The champions of attracting FDI over this 5-year period were the resource rich countries notably in Algeria and Egypt in North Africa, Ghana and Nigeria in West Africa, Chad and the Republic of the Congo in Central Africa, and Angola, Mozambique and South Africa in Southern Africa (AfDB, 2017). In 2016, FDI inflows to Africa represented 11.5% of global FDI (AfDB 2017). Although FDI declined by 8% in 2015, Africa has experienced an increase in its FDI inflows in 2016, by over 10% for an amount of USD 56.5 billion and projections show that FDI inflows in Africa will remain around USD 57.5 billion in 2017 (AfDB, 2017).

The economic benefits of FDI inflows (jobs creation, transfer of technology, competitiveness) could motivate governments to grant tax incentives to foreign investors for attracting FDI. From this perspective, it is commonly thought that African countries are making competition among themselves for attracting foreign capitals. However, to our knowledge, there is no empirical study that has already tested that prediction for African economies. In fact, for

attracting foreign investments, countries may have strong motivations to engage in tax competition through the lowering of their corporate tax burden. For OECD countries, Devereux et al. (2008) explain the fall in corporate tax rate by corporate income tax (CIT) rate competition between these countries. Recently, Chen et al. (2014) test and find the existence of CIT rate competition among South Asian countries. But for African countries, except the paper of Klemm and Van Parys (2012) there is no study that has investigated on corporate tax rate interaction among African economies. Yet, the inspection of corporate income tax rate data from IMF, fiscal affairs department indicates that, 32 out of 36 selected African countries (for which data are fully available) have reduced their statutory corporate tax rate from the year 1995 to 2013. Only Zambia, Uganda, Cameroon and Guinea have not modified their statutory corporate income tax rate from 1995 to 2013.

However, the analysis of Klemm and Van Parys (2012) test corporate tax rate competition in Africa using a panel data including Latin America and Caribbean (LAC) and African countries. They capture African countries through the weighting matrix attributing the value 1 for economies belonging to Africa and 0 otherwise. This approach is likely to exacerbate the heterogeneity problems and one would wonder whether the results obtained for African economies are not driven by the presence of LAC countries in the panel. Furthermore, the sample these authors used includes 22 African economies while our sample includes 36 African countries. Clearly, it is preferable to include as much as possible a large number of countries for getting a robust and general conclusion regarding corporate tax rate interactions between African economies. Beyond these potential limitations, the question of corporate tax rate interactions in Africa is so far important for being limited only on empirical evidence from one research paper. The present thesis aims to advance understanding about CIT rate interactions between African economies. In other words, we will test the existence of corporate tax rate competition among African economies in order to guide tax policy on CIT cutting for attracting

foreign capitals. In the same dynamic, we extend the analysis to the interactions between corporate tax bases between African economies. We investigate on interactions between corporate tax rates, corporate tax bases, and between corporate tax bases among African national tax jurisdictions. This is to take onboard the reality that corporate tax rates interactions have corporate tax base implications and countries may interact/compete through tools which affect the tax base other than tax rates. Again, in our knowledge this is the first study that estimates how national corporate tax rate and corporate tax bases react to changes in international corporate tax policy for African economies.

Corporate tax policy discussions go in pair with FDI considerations. In fact, the potential development benefits from FDI could lead governments to offer various incentives including tax incentive such as reduced corporate tax rate in order to attract them. However, the debate around the effectiveness of tax incentives in attracting FDI is a relatively old and unsettled. Opponents argue that tax incentives negatively affect economic growth and development by depriving developing countries from tax resources that are much needed to finance investments in infrastructure, education or health; in addition to the fact that those incentives are not effective in attracting FDI (Oates, 1972; IMF, 2014; World Bank, 2005). In contrast, proponents of tax incentives suggest these incentives leads to a more effective use of public resources and limits rent seeking activities (Tiebout, 1956). Tax incentives are also granted to foreign investors for compensating the relatively poor investment climate in developing countries (political instability, inadequate public infrastructure or corruption). Moreover, revenue losses from tax incentives could be justified by the fact that the positive FDI effects are expected to boost the economy and, in fine, increase the income tax base (OECD, 2008).

The contribution of this thesis to the literature on the impact of tax policy on FDI is twofold. First, we fill a void in empirical evidence between FDI attraction and cuts in CIT rate focusing on Africa. To the best of our knowledge, this is the first study to do so. Previous studies have

concentrated on developed countries or developing countries. In the latter case, only three studies have examined the link between taxation and FDI in developing countries using samples that include African countries (Abbas and Klemm, 2013; Cleeve, 2008; Klemm and Van Parys, 2012). Second, previous studies have typically used gravity models that assume bilateral exchanges of FDI between the countries (see Bénassy-Quéré et al., 2005). But, for most of African countries, FDI flows are predominantly oneway: from developed and transition countries to Africa. Moreover, as pointed out by Blonigen et al (2007), these previous studies have ignored spillover effects of FDI between countries, whereby the increase in FDI in one country can have positive or negative spillover effects on the level of FDI in neighboring countries. This thesis addresses such a shortcoming by taking spillover and neighborhood effects into account, using a spatial econometrics approach.

Outline of this thesis

In a nutshell, this thesis aims to advance knowledge on domestic tax revenue mobilization, revenue implication of tax competition and FDI attractiveness in a prospect of sustainable development financing in African countries. To do so, the first part of this thesis deals with non-resource tax revenue mobilization. We examine the role played by natural resources and social environment in tax revenue collection. More specifically, we are interested in the relationship between natural resources wealth and non-resource tax revenue mobilization as well as the relationship between income inequality, poverty and non-resource tax revenue in Africa. Consequently, the first chapter of this part analyses the impact of natural resources rents on non-resource tax revenue (chapter 1). We deep the analysis by examining whether the impact of natural resources rents on non-resource tax revenue depends on the quality of institutions and the level of diversification. The second chapter (chapter 2) is questioning whether income inequality and poverty affect non-resource tax revenue performance in Sub-Saharan Africa.

The second part of this study is devoted to external financing sources of development. While we have outlined the importance for African countries to increase domestic tax revenue mobilization, we are not saying that external financing sources should be strictly excluded. These countries could continue to finance a portion of their development through external financial flows like FDI. Regarding FDI, the experience on the ground tends to show that African countries are offering too many tax incentives for attracting investors. As each African country is offering tax incentives for attracting FDI, there is a sentiment that these countries are competing among themselves for attracting FDI and that this competition leads to tax revenue losses for these countries. Thus, the first chapter of this part will look at the national and cross border impacts of corporate tax policy in Africa. Concretely, this chapter tests the existence of CIT rate competition between African economies. It also examines the base spillover effects between African economies in corporate taxation (chapter 3) and discusses the revenue implications from these spillover effects. The second chapter of this part (last chapter of this thesis) which is in close relationship with the chapter 3 analyzes the effectiveness of cuts in CIT rates in attracting FDI inflows in Africa (chapter 4).

Part 1: Natural Resources Wealth, Social Indicators and Non-resource Tax Revenue Mobilization in Africa.

Chapter 1: Natural Resource Wealth and Non-Resource Tax Revenue Mobilization in Africa: Do Institutions and Economic Diversification Matter?

Abstract

While natural resources exploitation represents a real opportunity to increase resource taxes mobilization, its impact on non-resource tax revenue collection is however ambiguous. This chapter analyses the impact of natural resources rents on non-resource tax revenue mobilization. Regressions are carried out using the Panel Smooth Transition Regression model for 29 African countries over the period 1995-2012. The empirical results indicate that while the impact of natural resources rents on non-resource tax revenue is negative, the quality of institutions and the level of economic diversification modulate this impact. Natural resource rents enhance non-resource tax revenue collection in countries with good institutional environment and in countries with diversified economies. In terms of policy recommendations, these research findings urge African governments to allocate natural resources revenues towards diversifying the economy and strengthening the quality of institutions for enhancing non-resource tax revenue mobilization.

Keywords: Natural resources rents, non-resource tax revenue, Institutions, Diversification, Africa.

1. Introduction

With the drop in global Official Development Assistance and FDI flows in the aftermath of the recent global recession, domestic resource revenue mobilization became imperative for African countries. In this regard, identifying the opportunities and specific conditions for stimulating tax revenue collection is of crucial importance for policymakers in African countries. Natural resources wealth represents a real opportunity for the government to increase its tax revenue collection through the taxation of natural resources (Crivelli and Gupta, 2014; Eltony, 2002; Ossowski and Gonzales, 2012; Stotsky and WoldeMariam, 1997; Tanzi, 1989; Thomas and Trevino, 2013). While natural resources exploitation may increase resource taxes mobilization, its effect on tax collection from non-resource sectors is however unclear. Indeed, on the one hand, natural resource exploitation and the resource revenue it generates can serve as a catalyst for stimulating the activities of the non-resource sectors and therefore enabling more non-resource tax collection. But, on the other hand, the governments that collect a large share of their budget revenue from natural resources may have incentives to lessen efforts in collecting taxes from non-resource tax bases.

Against this background, an emerging literature on the topic indicates that the effect of natural resource revenue on non-resource tax revenue is non-linear and depends on the quality of institutions (Belinga et al., 2017). The studies from this literature document that natural resource rents increase non-resource tax revenue in countries with good institutions and decrease non-resource tax revenue mobilization in countries with weak institutions. The present chapter extends this line in the literature by showing that in addition to the quality of institutions, the effect of natural resource rent on non-resource tax revenue also depends on the level of economic diversification.

In fact, economic diversification favors the broadening of the non-resource tax base by stimulating the activities of tradable sectors suggesting that natural resources may stimulate non-resource tax revenues in countries that are more diversified while they are negatively associated with non-resource tax revenues in less diversified countries. In other words, countries which allocate an important share of their resource revenue to promote the economic diversification may experience better non-resource tax revenue than those which do not act in this direction. Within this context, this study puts forward that in addition to the quality of institutions, the level of economic diversification also matters in the relationship between natural resource revenue and tax effort. More specifically, this chapter estimates the direct impact of natural resource rents on non-resource tax revenue and the conditional effect of natural resources rents on non-resource tax revenue depending on the level of economic diversification and the quality of institutions for African economies. The contribution of our study to the existing literature on the topic is threefold.

First, for analyzing the effect of natural resource wealth on non-resource tax collection, instead of focusing only on hydrocarbons as Belinga et al (2017) and Bornhorst et al. (2009), we consider all the natural resources (hydrocarbons, minerals, fisheries and forests) to take into account the diversity of natural resources endowment in Africa[4].

Second, in contrast to most of previous studies on the subject which have considered as dependent variable total tax revenue (Botlhole et al, 2012), we rather consider non-resource tax revenue to come up with policy-oriented recommendations for facing current tax mobilization challenges in Africa. The rationale behind focusing on non-resource tax revenue instead total

[4]In fact, around 30% of the global mineral resources are located in Africa and the continent's proven oil reserves represent 8% of the global stock of oil reserves. Africa also hosts 7% of the world's stock of natural gas (ANRC, 2016a). Africa's forests and woodlands of Africa are estimated to cover 650 million ha, or 21.8 percent of the continent's land area (FAO, 2003).

tax revenue is mainly is motivated by the strategic substitution role that non-resource tax system could play in mobilizing revenue for African countries in a context of downwards trends in natural resource international prices. Indeed, the recent downwards trend and instabilities in oil and gas prices suggest redefinition of the strategy of domestic revenue mobilization towards an efficient tax system focused on non-resource taxes. This will help reducing the reliance on natural resources as government's major source of revenue in order to reduce the macroeconomic vulnerabilities of African countries to external shocks related to the volatility of natural resources' global prices[5]. Moreover, given that some natural resource rents are generated from non-renewable resources that will eventually be depleted, an efficient tax system focused on non-resource taxes will be crucial for sustainable domestic revenues mobilization after resource depletion (Fjeldstad et al., 2015).

Finally, to our knowledge this is the first study that on the one hand develops theoretical arguments to show that economic diversification and institutional quality modulate the impact of non-resource tax revenue on non-resource tax revenue and on the other hand, the first study which empirically tests the conditional effect of natural resource rents on non-resource tax revenue depending on the level of economic diversification for African economies. Furthermore, to our knowledge, this is also the first study that uses panel smooth transition regression (PSTR) model to estimate the conditional impact of natural resource revenue on tax revenue. In fact, in contrast to previous studies which generally draw upon on linear models with interaction term between natural resource rents and institutions which suggests a linear interaction between resource revenue and institutions in generating non-resource tax revenue to estimate the conditional effect of natural resource on non-resource tax revenue, the present study relies on non-linear model (PSTR) to estimate the conditional effect of natural resources

[5]Morrissey et al. (2016) provide details discussions on tax revenue performances' vulnerability to external shocks in developing countries.

on non-resource tax revenue depending on economic diversification and institutions[6]. The PSTR model has the advantage to take into consideration heterogeneities in the relationship between natural resources rents and non-resource tax revenue since given the heterogeneities in natural resources endowments and the dependence on natural resource across African countries; one cannot guaranty the homogeneity of the relationship between natural resource revenue and non-resource tax revenue in Africa. Moreover, the economic diversification and improvement in the quality of institutions are not abrupt but rather progressive processes because it takes time to observe significant changes in the level of economic diversification and the quality of institutions for a given country. The PSTR model takes onboard these considerations since this model assumes smoothness in the conditional effect.

The remainder of the chapter is organized as follows: In section 2, we discuss the mechanisms through which natural resources could affect non-resource tax collection. Section 3 analyses the theoretical impact of resource revenue on non-resource tax revenue depending on institutions and economic diversification. Section 4 reviews the empirical literature on the relationship between natural resources revenue and non-resource tax revenue in developing countries. Then, section 5 motivates and describes in greater details the econometric model, the specification tests and the estimation method utilized to test the impact of natural resources wealth and non-resource tax revenue. Section 6 is dedicated to the presentation of data. Section 7 presents and analyses the estimation results and comes up with policy recommendations that could be drawn from the study, while the section 8 concludes the study.

[6]However, we run linear regressions with interaction term between natural resource rents and the institutional quality indicator when the relevance of the PSTR model is not accepted by econometrics tests.

2. How do natural resources revenues affect non-resource tax revenue mobilization?

Government could use natural resources revenue to finance basic infrastructure for stimulating the whole economic activity, increasing productivity and therefore enhancing tax collection from non-resource sectors. Moreover, a country engaged in natural resources projects could invest in capacity building programs for the relevant tax administrations officials in order to harness a fair value of its natural resources. For instance, the African Natural Resources Center (ANRC) of the African Development Bank and OpenOil are supporting capacity building in financial modelling for the extractive sector in some African countries for strengthening domestic resource mobilization. Financial modeling realizes projections of what should have been paid by companies to the government under the existing tax regime and compares it to what have been really paid to the government for detecting potential discrepancies around natural resources tax revenue collection. In such circumstances, there could therefore be a positive spillover effect from building capacity for improving resource taxes collection to stimulating non-resource tax revenue mobilization performance.

In the same vein, some African countries are developing strategies to increase domestic linkages of natural resources sector. For example, Guinea has recently requested the assistance of the ANRC to undertake a study that should put light on efficient strategies for linking mining exploitation to agriculture and energy sectors such that mining sector activities stimulate agriculture and energy sectors. In 2017, Zambia in collaboration with the ANRC has undertaken and validated a study on local content policies aiming at stimulating local activities through mining exploitation. The goal of these strategies is to reinforce the link between natural resources activities to the rest of the economy so that natural resources sector act as an engine for the other sectors in the economy. In such a context, growth in natural resources activities implicitly suggesting an increase in natural resources revenue will boost non-resource sector activities and thus more non-resource tax revenue for the government.

For countries which are experiencing an increase in the level of natural resource revenue, it is possible that the demand for transfers and redistribution from the citizens also increase[7]. Thus, if the raise of the demand for transfers and public goods is more proportional than the increase in resource revenue, the government could turn towards the possibility to increase non-resource tax revenue effort in order to satisfy the surplus demand of transfers and public goods and services. From this perspective, natural resources revenues act as a catalyst for increasing efforts towards non-resource tax revenue mobilization.

However, there is evidence that natural resource wealth can crowd out non-resource tax revenue effort. This seems to be the case for African countries where Ndikumana and Abderrahim (2010) reveal that these countries have been unable to take advantage of their natural resources endowment for raising government revenue collection. Indeed, as stressed by Brun et al, (2015), governments that collect a large share of tax revenue from natural resources have less incentive to increase efforts in mobilizing tax revenues from non-resource tax bases (crowding out effect of resource revenues on non-resource revenue). Furthermore, in order to minimize demand for accountability and demand for public goods and services from the citizens and the taxpayers, governments with large natural resource revenue may lower the tax burden on their taxpayers.

[7]Burkina Faso is in phase to face this situation. In fact, in 2008 it produced just 5.5 tons of gold from two large-scale projects. Five years after, in 2013, the country has multiplied by 6 its gold production to 33 tones. During 2018, Burkina Faso expects to produce 55 tons of gold, a two-thirds increase on five years ago (2013). But at the same time, the government is facing growing pressure for increasing salaries and transfers. In Côte d'Ivoire, the tax revenues generated by the mining companies totaled FCFA 56, 4 billion in 2017, an increase of 39.8% between the year 2016 and 2017. During the same period, the public sector workers unions have successfully put pressure on the government to pay back unpaid premiums and raise wages in some cases.

The situation of Dutch disease[8] that may occur in natural abundance countries is detrimental to non-resource tax mobilization as there is a shift of economic activities from non-resource sectors to the natural resource sector. Furthermore, the macroeconomic challenges that follow natural resources exploitation may significantly threaten the growth of the non-resource economy. In fact, an increase in natural resource activities can provoke the appreciation of the real exchange rate, thereby disturbing the competitiveness and the productivity growth of the non-resource sectors (Arezki et al., 2012) and negatively affect tax revenues collected from these sectors. The appreciation of the national currency due to significant revenues from natural resources exports can exacerbate inflation and therefore impedes non-resource tax collection as suggested by the Oliveira-Tanzi effect (negative effect of inflation on tax revenue).

3. The conditional effect of resource revenue on non-resource tax revenue depending on institutions and economic diversification.

In this section, we analyze how natural resource revenue can affect non-resource tax revenue depending on the quality of institutions and the level of economic diversification. Governments in countries with good institutions have more capacity and are more likely to use resource rent for investing in establishing an efficient non-resource taxation system that could support and allow government revenue mobilization during bad conjuncture on commodities markets and when the resource will deplete. Furthermore, resource rich countries with good institutions are more capable to apply resource rents towards productive public investments for supporting production and economic activities in the non-resource sectors and thereby more revenue collection from these sectors.

[8] Natural resources exports lead to foreign currency inflows in the exporting country which increases the demand for national currency and the price of non-tradable goods. This leads to an appreciation of the exchange rate of the national currency with respect to foreign currencies and thereby reducing the country's' price competitiveness of other products on the international market.

Basically, citizens expect the government to use resource revenue for improving their living standards (building basic infrastructure, schools and hospitals). Thus, when citizens and taxpayers feel that the government is poorly managing natural resources revenue because of weaknesses in institutions, they will be motivated to reject taxes. In fact, taxpayers could anticipate that similarly to resource revenue, the taxes they pay to the government will not serve for financing the public needs but rather the ones of the ruling elites and politicians. Clearly, as resource revenues increase, non-resource tax revenue compliance will tend to decrease if institutions are not functioning well. Accordingly, countries with strong institutions may exhibit greater non-resource tax revenue mobilization performance than their peers with relatively weak institutions. Furthermore, in countries with weak checks and balances, the ruling government could easily use natural resource rents for unproductive purposes rather than strengthening the development of non-resource sectors. This will result in less non-resource tax revenue collection.

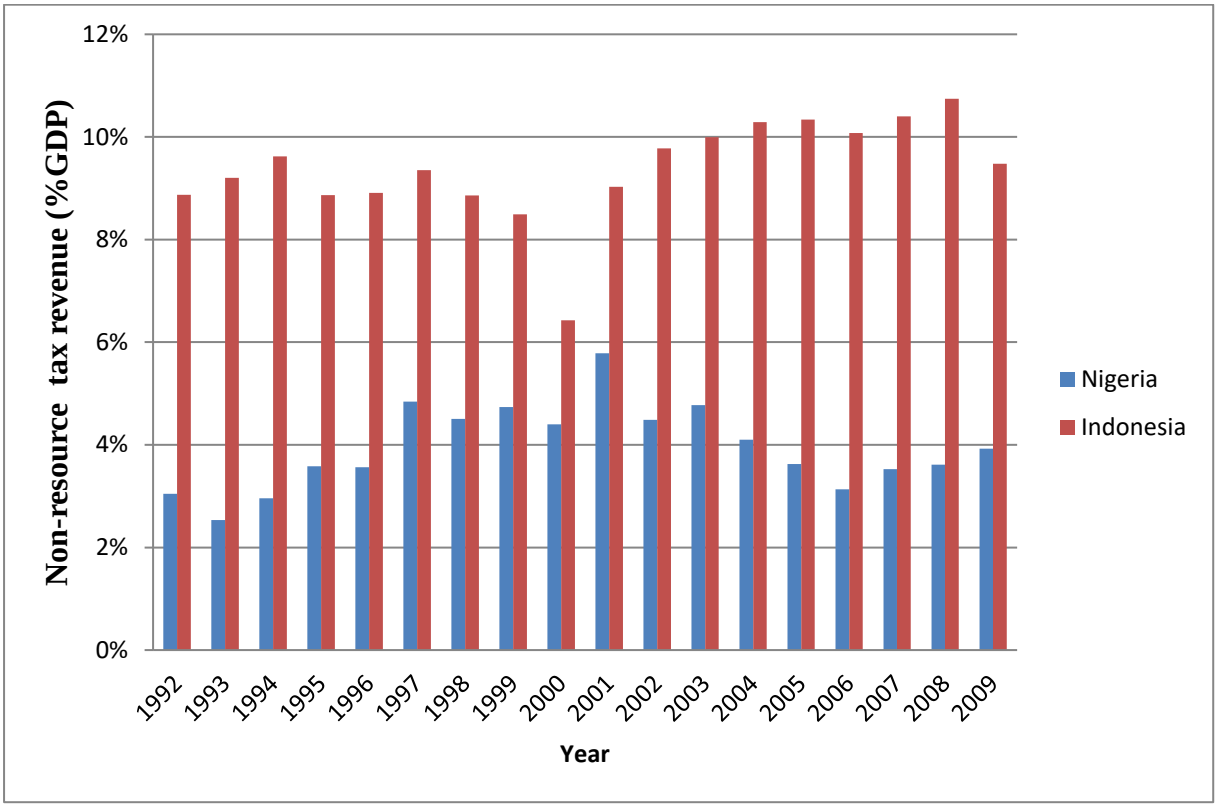
Economic diversification refers to the actions undertaken for the structural transformation of the economy by investing in education, health, basic infrastructure and all other productive investments and therefore reduces the higher dependence of the country to one sector, especially the extractives sector. Typically, economic diversification suggests diversification of exports and output away from greater dependence on commodities and change towards broadly based exports and output (Gylfason, 2017), the economic diversification favors the broadening of the non-resource tax base by stimulating the activities of tradable sectors. Accordingly, countries which use natural resource revenues to support economic diversification are likely to collect more non-resource tax revenues.

We illustrate this point by comparing the experiences of Nigeria and Indonesia in diversifying their economies in a context of oil exploitation. A study undertaken by the AfDB in collaboration with Bill and Melinda Gates foundation in 2015 reported that Nigeria and

Indonesia have experienced oil booms at almost the same period (in the year 1970s). While Indonesia managed to diversify its economy by using oil revenue to accelerate investments in basic infrastructure (schools, roads, and irrigation) and to subsidize fertilizers for boosting agricultural productivity and jobs creation, Nigeria has been affected by the Dutch disease (AfDB and Bill and Melinda Gates, 2015). This has putted down the competitiveness of the agriculture sector and its contribution to the national income. The loss of competitiveness of the agriculture sector has increased the dependency of the government revenue to oil and gas exploitation[9] and slowed down the country's economic diversification (Anyaehie and Areji, 2015). We examine the non-resource tax performance in proportion of GDP for Nigeria and Indonesia over the years where data are jointly available for the two countries. Figure 1 below shows that Indonesia collected much more non-resource tax revenue in proportion of GDP than Nigeria over the period 1992-2009. Nonetheless, the satisfactory point for Nigeria is that it has experienced an increase in non-resource tax revenue from 1993 to 2001. This trend could be traced to efforts made by the Nigerian government for diversifying the economy over this period. However, from the year 2001 to 2009, there is an overall downward trend in Nigeria's non-resource tax revenue. The non-resource tax revenue decreases probably because the government might have relaxed its efforts in collecting non-resource tax revenue following the increasing oil prices after the year 2000. This trend could also be attributed to potential inefficiencies and challenges encountered by government policies in diversifying the economy. These challenges range from poor policies, weaknesses in economic institutions and governance, and corruption, leading the diversification index for the country to fall from 0.4 to 0.3 from the period 1991-2000 to the period 2001-2009 (Anyaehie and Areji, 2015).

Figure 1: Nigeria and Indonesia Non-resource tax revenue performances

[9] In Nigeria, petroleum revenue accounts for around 80% of government revenue (Anyaehie and Areji, 2015).



Source: Author's construction using Government revenue database from ICTD/UNU-WIDER (2017)

With this background, we speculate that natural resources stimulate non-resource tax revenues in countries that are more diversified while they are negatively associated with non-resource tax revenues in less diversified countries. Similarly, we expect natural resources boost non-resource tax revenue in countries with good institutions while they are negatively associated with non-resource tax performance in countries with institutional weaknesses.

4. Literature review

The impact of natural resources revenues on tax revenue mobilization tends to be ambiguous in the tax effort literature (Botlhole et al. 2012; Gupta, 2007). For 46 sub-Saharan Africa (SSA) Stotsky and WoldeMariam (1997) find a negative impact of mining to GDP on tax revenues countries over the period 1990-1995. Drummond et al. (2012) confirm the result of Stotsky and WoldeMariam (1997). They find negative association between mining and tax revenues for 28

SSA countries over the period 1990-2010. In the same region, Thomas and Trevino (2013) find that resource revenues have negative impact on non-resource revenue. Based on a sample of 30 oil-producing countries over the period 1992-2005, Bornhorst et al. (2009) find that revenue from hydrocarbon exploitation negatively affects non-resource government revenue. Using panel data for 35 resource-rich countries including 16 African countries over the period 1992-2009, Crivelli and Gupta (2014) find that resource revenues negatively influence non-resource revenue. Ossowski and Gonzales (2012) confirm the eviction effect of resource revenue on non-resource revenue for 15 Latin American countries over the period 1994-2010. Using data for 31 resources depending developing countries, Brun and Diakité (2016) run ordinary least squares regressions and find that while natural resource rents positively affect total tax revenues; they are negatively associated with non-resource tax revenues.

The studies that found negative impact of natural resource revenue on tax revenues explained this result by the fact that the situation of Dutch disease caused by a greater dependence of the economy to the mining and petroleum sector to the detriment of other sectors does not contribute to broaden the non-resource tax base (Brun et al, 2015). In addition, resource-rich countries have strong incentives to relax efforts in mobilizing revenues from non-resource tax bases leading to a lower tax collection effort. Furthermore, for minimizing demand for accountability regarding the management of resource revenue and demand for transfers from the population, governments which collect large natural resource revenue may lower the non-resource tax burden on its taxpayers (McGuirk, 2013; Ross, 2001)

Since natural resources are after all an important source of revenues for the government, they may substantially contribute to increase tax revenue. For SSA, Tanzi (1989) finds that the mineral exports in proportion of GDP have a positive impact on tax revenue. Again, in SSA, Ghura (1998) also finds a positive impact of mining shares in % of GDP on tax ratio. Keen and

Mansour (2010) find that in SSA, over the period 1980-2005, resource-rich countries have performed well than non-resource rich countries in terms of revenue mobilization.

More recently, for 22 oil producing countries around the world, Knebelmann (2017) finds that during the 2000s oil price boom, oil revenue did not crowd out non-oil taxes except for two countries (Equatorial Guinea and Timor-Leste), where there are signs of an eviction effect between oil revenue and non-oil sector.

However, few studies have attempted to find out the factor behind the heterogeneous effect of natural resource revenues on non-resource tax collection. Botlhole et al. (2012) bring preliminary insights on that particular point. For 45 Sub-Saharan African countries over the period 1990-2007, these authors find that the impact of natural resources rents on non-resource tax revenue is driven by the quality of institutions. More precisely, they find that natural resource rents increase tax revenue in countries with good institutions and decrease tax revenue mobilization in countries with weak institutions. Botlhole et al. (2012) document that countries with good institutions are more likely to set strong apparatus for tax revenue collection through further investment in education, health and public infrastructures. While in countries with bad institutions, natural resources generate rent-seeking behaviors from policy makers and raise the probability of the country to suffer from resource curve situation which is detrimental to tax revenue mobilization. In the same vein, for 60 countries over the period 1975-2011, Klomp and de Haan (2016) reveal that the ruling government uses resource rents for reducing taxes for re-elections objectives, in countries with limited political checks and balances, and a presidential system.

Belinga et al (2017) extend this line of empirical research. Using 30 resource rich countries over the period 1992-2012, they find that hydrocarbon revenues are likely to have an eviction effect on non-resource revenues. Moreover, these authors underline that the crowding out effect

of natural resource revenue on non-resource revenue could be mitigated or reversed with an improvement in the quality of institutions.

5. Econometric methodology

This section develops the empirical model used to estimate the impact of natural resource wealth on non-resource tax revenue and presents in greater details the specification tests as well as the control variables.

5.1 Empirical specification

Because of heterogeneity in natural resources endowment between African countries, the impact of natural resource wealth may not be homogeneous across countries. Moreover, the efficiency in improving the quality of institutions, diversifying the economy away from natural resource sectors and managing natural resources may change gradually over time within each country. Accordingly, the impact of natural resource rents on non-resource tax collection depending on the level of economic diversification and the quality of institutions may change over time within each economy. The Panel Smooth Transition Regression (hereafter PSTR) model developed by Gonzales et al (2005) and Fok et al (2005) is well suited to account for heterogeneity and time variability in the relationship between natural resources revenue and non-resource tax revenues depending on institutions. With the PSTR model, the impact of natural resource revenue on non-resource tax revenues takes different values across countries depending on the state of economic diversification and institutions (regimes). The PSTR assumes that the transition from one regime to another regime is smooth. This is particularly interesting in a context of African countries where most of the time, transition or changes in institutional quality take time. Clearly, economic diversification in Africa appears as a progressive process rather than brutal. In fact, Ghana which is sometimes cited as a good

student in terms of governance and institutional quality in Africa has taken time to stabilize, stop the series of coup d'états and improve the quality of institutions. On the other hand, Cote d'Ivoire which was relatively stable since its independence in 1960 has seen her stability and institutions deteriorate over time after the death of the first president from the independence in 1993 with the eruption of a rebellion in 2002 and a post electoral conflict in 2011. To summarize, changes in the quality of institutions and the level of economic diversification takes time, they are not systematic.

The PSTR model allows countries to change gradually over time between the group of "bad institutions" (more diversified) countries and "good institutions" (less diversified) countries depending on the level of institutional quality (economic diversification). The PSTR model is therefore viewed as a regime-switching model allowing for few extreme regimes. It is a generalization of the Panel Threshold Regression (PTR hereafter) of Hansen (1999) in which coefficients of some explanatory variables take different values depending on the value of another variable called the transition variable. The PTR model assumes a sharp shift from a regime to another while the PSTR model allows the coefficients to change smoothly.

Taking d_{it}, an economic diversification index as the transition variable, the PSTR model is given as follows:

$$\boldsymbol{NRT_{it} = \mu_i + \beta_0 NRR_{it} + \beta_1 NRR_{it}\, g(d_{it}, \gamma, c) + \alpha X_{it} + \varepsilon_{it}} \quad \textbf{(1)}$$

where NRT_{it} is non-resource tax revenues and $NRR_{it}$is natural resource rents in country i at time t, for i = 1,..., N, and t = 1,. . . ,T.

The non-resource tax revenue (excluding social contribution) encompasses all the taxes collected from non-resource sectors using tax instruments available in the economy. Data on

non-resource tax revenue in proportion of GDP are collected from the International Center for Taxation and Development (ICTD) Government revenue data base (Prichard et al, 2014).

Natural resource rent represents the revenue from the export of natural resource (oil, natural gas, coal, mineral and forest) netted from costs generated during its production process. Total natural resources rents are the sum of oil rents, natural gas rents, coal rents, mineral rents, and forest rents as indicated in the statistical notes from the World Development Indicators database of the World Bank.

In equation (1), μ_i represents an individual fixed effect and ε_{it} the usual independent and identically distributed error term. X_{it} represents the vector of traditional determinants of tax revenue. $g(d_{it}, \gamma, c)$ is the transition function. It is a continuous function of the transition variable d_{it}, and bounded between 0 and 1, defining the two extreme regimes. When d_{it} equals 0, the impact of natural resources rents (NRR) on non-resource tax revenues (NRT) is β_0 and when it equals 1, the impact of NRR on NRT is $\beta_0 + \beta_1$.

Following Granger and Teräsvirta (1993) and González et al. (2005) the transition function is specified as the following logistic function: $g(d_{it}, \gamma, c) = \left[1 + \exp(-\gamma \prod_{j=1}^{m}(d_{it} - c_j))\right]^{-1}$ (2) with γ the slope of the transition function (smoothness parameter) and c = (c_1; c_2,…; c_m) an m-dimensional vector of threshold /location parameters. For m = 1 (the case we will focus on here in this study) there is one threshold of economic diversification/institutional quality around which the impact of NRR on NRT is non-linear. This non-linear impact is represented by a continuum of parameters between the two extreme regimes early mentioned ($g(d_{it}, \gamma, c)$ =0 and $g(d_{it}, \gamma, c)$ =1). The first extreme regime which is associated with low values of the transition variable d_{it} corresponds to the case where the transition function is null ($g(d_{it}, \gamma, c)$ =0) while the second extreme regime corresponds to the case where the transition function takes the value 1. This latter regime is associated with high values of the transition

variable d_{it}. Between these extreme regimes, the marginal effect of NRR on NRT is given as follows:

$\frac{\partial NRT_{it}}{\partial NRR_{it}} = \beta_0 + \beta_1 g(d_{it}, \gamma, c)$ (3).

The relation (3) suggests that the effect of NRR on NRT is country and time specific as the transition variable d_{it} varies over countries and time. It is worth noting that when the smoothness parameter γ tends toward zero ($\gamma \to 0$), the PSTR model reduces to a simple linear panel fixed effects model. As γ tends to infinity ($\gamma \to \infty$) the PSTR model reduces to a threshold model with two regimes[10]

5.2 Control variables

Following the literature on tax effort, we include GDP per capita, trade openness, inflation, and agricultural value added as control variables (Crivelli and Gupta, 2014; Eltony, 2002; Ossowski and Gonzales, 2012; Stotsky and WoldeMariam, 1997; Tanzi, 1989; Thomas and Trevino, 2013).

Agriculture value added

Agriculture value added as proportion of GDP is used as a proxy of the sectoral composition of the economy. In Africa, the Agriculture sector in developing sector is dominated by a large number of small farmers who produce for self-consumption or sell their output in informal markets[11] or exchange theirs output for other goods[12]. In addition, most farmers in African countries do not keep modern accountings for the management of their farms. All these aforementioned factors contribute to the complexity of the agricultural sector's taxation in Africa (Fox and Gurley, 2005**;** Stotsky and WoldeMariam, 1997; Gupta, 2007**).** We therefore

[10] It reduces to Hansen's (1999) two-regime panel threshold regression for m=1.
[11] Agriculture is often used as a proxy of the informal sector (see Mahdavi, 2008)
[12] It is typically subsistence agriculture (Drummond et al, 2012).

expected negative impact of agriculture value added on non-resource tax revenues in our estimations.

GDP per capita

GDP per capita measures the level of development. High level of development tends to be correlated with a higher capacity to pay and collect taxes. Moreover, high level of development goes together with high demand for public goods and services (Wagner's law). The impact of GDP per capita is therefore expected to be positive.

Trade openness

Trade openness expressed as the sum of exports and imports as a percentage of GDP is expected to increase non-resource tax mobilization as trade openness stimulates trade volume and therefore trade taxes. However, in Africa, trade liberalization policies have been implementing by cuts in tariffs. These measures have resulted in losses in tax revenues for some countries (Baunsgaard and Keen[13] , 2010) while others have compensated losses in tariffs by domestic taxes (Bird and Gendron, 2007; Cnossen, 2015) rending thereby difficult the prediction of the impact of trade openness on non-resource tax revenue.

Inflation

Inflation is proxied by the percentage change in average consumer prices. Its effect on non-resource tax-to-GDP ratio, the so called "Oliveira-Tanzi effect" is assumed to be negative because of lags in tax collection. Indeed, with high inflation rate, the real value of taxes is likely to decrease between the date of implementation and the effective date when tax is collected. However, because of climb in sales in nominal terms due to inflation, the turnover of firms

[13] These authors reveal that low income countries have recovered at most 30 cents per dollar lost in tariffs reduction.

might exceed the threshold of value added tax (VAT) liability making these firms now liable to VAT and then lead to increase VAT revenue if there is no explicit VAT threshold adjustment (ATAF[14], 2017). This latter consideration complicates the prediction of the effect of inflation on non-resource tax revenue.

5.3 Specification tests and Estimation method

Before estimating equation (1), we need to perform some specifications tests. The first batch of tests is the linearity test. It tests the homogeneity of the coefficient for the relationship between natural resource rents and non-resource tax revenue conditional to the transition variable. In other words, the linearity test indicates whether the PSTR model is preferable than a linear model to estimate the impact of natural resource rents on non-resources tax revenues. The rejection of the null hypothesis (H0: Linear fixed effects panel) against the alternative (H1: PSTR with *m* regimes) suggests that the PSTR model is suited to estimate equation (1).

The homogeneity test in the PSTR model is performing by testing: H0: $\gamma = 0$

or H0: $\beta 1 = 0$ against the alternative H1: $\gamma \neq 0$ or $\beta 1 \neq 0$. However, these tests are nonstandard since the PSTR model contains unidentified nuisance parameters under the null hypothesis (Hansen, 1996, Gonzales et al, 2005). This identification problem is solved by replacing the transition function g(d_{it}; γ; c) by its first-order Taylor expansion around $\gamma = 0$ and to test with an equivalent hypothesis based on the following auxiliary regression:

$$NRT_{it} = \mu_i + \beta_0^* NRR_{it} + \beta_1^* NRR_{it} d_{it} + \alpha^* X_{it} + \cdots + \beta_m^* NRR_{it} q_{it}^m \varepsilon_{it} + \varepsilon_{it}^* \quad (4)$$

where β_0^*, β_1^* and β_m^* are multiple of γ and ε_{it}^* is the usual error term plus the remainder of the Taylor development $\varepsilon_{it}^* = \varepsilon_{it} + R(\text{d\_it}; \gamma; c)$. Accordingly, testing linearity against the PSTR model becomes testing H0: $\beta_0^* = \beta_1^* = \beta_m^* = 0$ in the auxiliary equation which is linear.

[14] African Tax Administration Forum (ATAF)

Following Colletaz and Hurlin (2006), the test decision relies on the LM, F-version LM, and pseudo-LR tests and their statistics are given as follows:

LM = TN (SSR0−SSR1)/SSR0 ((follows Chi2 (mk))

LMF = [(SSR0−SSR1) /mK] / [SSR0/ (TN−N−m(K + 1))] ~ F(mk; TN –N-m(k+ 1))

LR = −2 [log(SSR1)− log(SSR0)]. LR follows Chi2 with mk degree of freedom, LR∼Chi2 (mk).

with SSR0 the panel sum of squared residuals under H0 (linear panel model with individual effects), SSR1 the panel sum of squared residuals under H1 (PSTR model with two regimes), and K the number of explanatory variables.

After the linearity/homogeneity test, the second specification test is the number of regimes test. This test seeks to determine the appropriate number of transition functions (m), implicitly the number of regimes (r+1) in the PSTR model.

The null hypothesis of the test of number of regimes is H0: the PSTR model has one transition function (m = 1) while the alternative hypothesis is H1: the PSTR model has at least two transition functions (m = 2). The decision of the test is based on the statistics of *LMw* and *LMf*. If the coefficients are statistically significant at the 5%, the null hypothesis is rejected suggesting that there are at least two transition functions for the PSTR model. In this case, a two-regime PSTR model is then estimated. If the two regimes model is also rejected, a three regimes model is estimated. The testing procedure continues like that until the non-rejection of the null hypothesis of no remaining heterogeneity.

The non-rejection of H0 suggests that the model has one transition function, two regimes. The estimation method of the PSTR consists of eliminating the individual fixed effects μ_i by

removing country specific means and then applying non-linear least squares to the transformed model (Gonzalez et al, 2005).

6. Data

Regressions are carried out using a sample of 29 African countries[15] over the period 1995-2012. We extract natural resource rents data from the World Development Indicator (WDI), the World Bank database. Natural resource rents are defined as the revenue from the export of natural resources (oil, natural gas, coal, mineral and forest) netted from their production costs.

We measure institutional quality by the government stability index[16] from international Country Risk Guide (ICRG). The higher the index, the better institutions. Government stability is crucial for converting natural resources revenue towards non-resource sectors development. In fact, when the members of the ruling government feel that the uncertainties are increasing about the future of their stay in power, they may be motivated to adopt rent seeking behaviors before the possible end of their regime. Practically, they will ignore the implementation of broaden based policies that promote the development of non-resource sectors activities while grabbing resource revenue to finance their supporters and buying opponents for organizing resistance. They could also lessen the tax burden on groups of taxpayers for getting their support in order to resist and stay in power.

The dependent variable, non-resource tax revenue is directly extracted from the Government Revenue Database (GRD) of the International Centre for Tax and Development (Prichard et al, 2014). Non-resource tax revenue encompasses all the taxes collected from tax base other than natural resources. The control variables including trade openness, inflation, agriculture value

[15] The list of countries is given in appendix.

[16] The government stability index from ICRG indicates the ability of the government to stay in office and to implement its program. Government unity, legislative strength and popular support are the three components used to construct the government stability indicator (see ICRG methodology).

added and GDP per capita are taken from the World Development Indicators database, the World Bank.

We measure economic diversification by the share of manufactures exports in the total exports of merchandise. This indicator provides an interesting picture about the structure of exports and could therefore reflects an acceptable measure of economic diversification. Data on manufactures exports in percent of merchandise exports are extracted from WDI, the World Bank database. As indicated in the statistical notes of the WDI database, manufactures include chemicals, basic manufactures, machinery and transport equipment, and miscellaneous manufactured goods, and exclude non-ferrous metals. The three linearity tests validate the preference for the PSTR model with manufactures as transition variable comparatively to the linear model

Given that large countries with relatively vast internal market may not export much to the rest of the world, exports diversification index may show partial picture of the state of diversification. However, since African countries tend to be more outward oriented because of the relatively small size of their internal markets, we think that an exports-based diversification index is suitable and acceptable as an economic diversification index for African economies (Alsharif et al, 2017). Descriptive statistics on all these variables are provided in table 1 below. For our sample, on average the non-resource tax revenue is 15.5% of GDP while natural resource rents account for 12% of GDP (table 1). On average, manufactures exports account for 30% of total merchandise exports for the countries under investigation in this study (table 1).

Table 1: Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Non resource tax revenue	506	15.512	8.652	3.205	62.828
Natural resource rents	505	12.120	15.073	.0037	77.054
Government stability	432	8.911	1.643	4	11.083
GDP per capita	522	2535.6	2742.25	168.931	12633.8
Trade openness	522	77.473	39.846	17.434	261.529
Inflation	522	8.001	10.988	-18.222	132.823
Agriculture value added	518	21.113	13.214	1.953	51.848
Export diversification index	400	3.982	1.090	1.784	6.063
Manufactures exports (% merchandise exports	458	29.857	26.272	0.0242	94.875

Source: Author's calculations from ICTD-GRD (Prichard et al, 2014); WDI, ICRG and IMF (2017).

7. Impact of natural resource rents on non-resource tax revenue: specification tests and Estimation results

This section first presents results from specification tests and those obtained from the estimation of the impact of natural resources rents on non-resource tax revenue depending on institutions and diversification. Then, results from various robustness analyses are presented and finally, the section comes up with policy implications which could be drawn from the study.

7.1 Linearity and unit root tests

The linearity tests results are reported in table 2 below. The three linearity tests reject the null hypothesis of linearity of the relationship between natural resource rents and non-resource tax revenue conditional to the level of economic diversification suggesting that the impact of natural resources rents on non-resource tax revenue depends on the country's economic diversification. The PSTR model is therefore appropriate for our case.

Table 2: Linearity tests

Threshold variables	Wald LM test	Fisher test	Pseudo LRT test
IMF Export Diversification index	3.116* (0.07)	2.866* (0.09)	3.130* (0.07)
L.(IMF Export Diversification index)	4.343** (0.03)	3.985** (0.04)	4.372** (0.03)
Government stability	1.342	1.235	1.344
Polity2	47.665*** (0.000)	9.843*** (0.000)	50.27*** (0.000)
Manufactures exports (% merchandise exports)	16.692*** (0.005)	3.197*** (0.008)	17.029*** (0.004)

Note: P-values are in parenthesis.

Before carrying out regressions, we run panel unit root test to see whether the variables under consideration are stationary as the time dimension of our panel is relatively long. We apply Maddala and Wu (1999) (Fisher type test) to take into account the heterogeneity of our panel data (in terms of natural resources rents, non-resource tax collection and economic diversification) and the fact that the panel data is unbalanced. Results from Fisher test reported in Table 3 below indicates that for all the variables the null hypothesis of non-stationarity is rejected.

Table 3: Fisher type unit root test

Variables	Maddala and Wu ADF-Fisher, inverse chi2
Non resource tax revenue	133.498 (0.000)
Natural resource rents	151.121 (0.000)
GDP per capita	79.407 (0.032)
Trade openness	122.319 (0.000)
Inflation	242.760 (0.000)
Agriculture value added	172.062 (0.000)
Government stability	177.601 (0.000)

Note: P-values are in parenthesis.

7.2 PSTR estimation of the impact of resource rents on non-resource tax revenue depending on diversification.

This sub-section analyses and discusses the main results obtained from the estimation of the empirical model.

7.2.1 Main results

Table 4 displays the results obtained from the estimation of the PSTR model. The direct impact of natural resources rent on non-resource tax revenue (measured by βo) is negative and statistically significant at 5% (table 4). This result is in line with those found in previous work

indicating that natural resources revenue undermines the governments' effort to properly tax non-resource sector (Brun et al, 2015, Crivelli and Gupta, 2014). While the direct effect of natural resources rents on non-resource tax revenue is negative, the effect of its interaction with economic diversification (nonlinear effect) is positive. In other words, this result reveals that natural resource rents contribute to non-resource tax revenue mobilization in more diversified economies while they slow down non-resource tax collection only in less diversified economies.

The location parameter for this regression C=32.990 is higher than the average manufacturing exports (the threshold variable) equals to is 29.857, suggesting that countries with manufacturing exports level below the threshold value 29.857 need additional efforts towards improving economic diversification to reverse the crowding out effect of natural resource rents on non-resource tax revenue collection.

We plotted in figure 2 the elasticity of non-resource tax revenue with respect to resource rents, depending on the values of manufacturing exports. From the lower to higher regimes, the elasticity of resource rents with respect to non-resource tax revenues smoothly increases as manufacturing exports (the threshold variable) increase. Accordingly, any improvement in diversifying the economy (higher manufacturing exports) will result in a gradual increase in the non-resource tax revenue effect of resource rents (from -0.063 to 0.754)

Figure 2: Elasticities of non-resource tax revenue with respect to resource rents conditional on manufacturing exports.

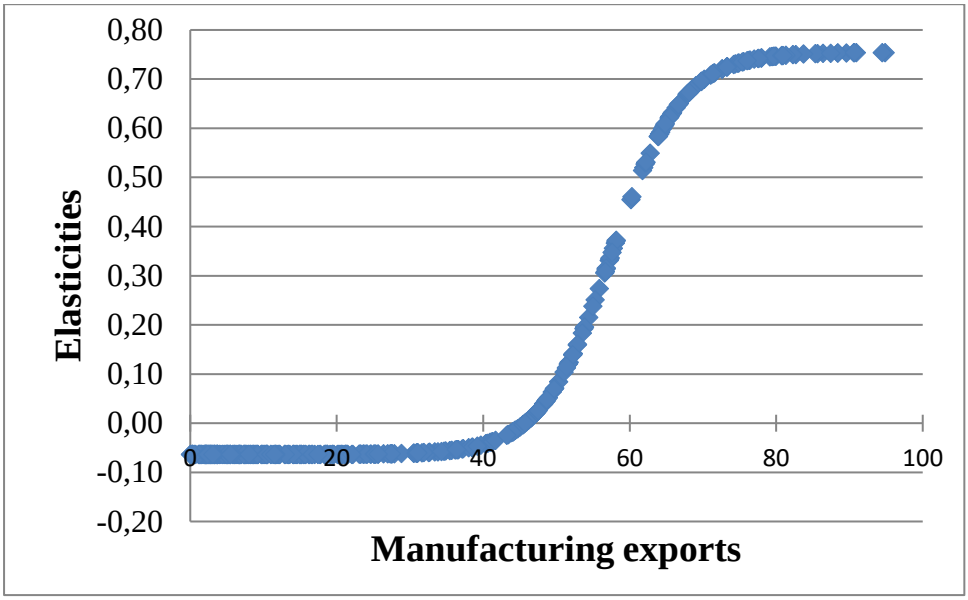


Table 4: Impact of Natural resources rents on Non-resource tax revenue depending on diversification

Dependent variable: Non-resource tax revenue (% GDP)	
Transition variable	**Manufactures exports (% merchandise exports)**
Natural resource rents (βo)	-0.201*** (0.013)
Natural resource rents (β1)	0.331 *** (0.0682)
GDP per capita	0.0002** (0.000)
Trade openness	0.017** (0.005)
Inflation	-0.048*** (0.012)
Agriculture value added	-0.204*** (0.025)
Gamma (γ)	0.160
C	57.528
AIC criterion	1.291
BIC criterion	1.380
Observations	345

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

7.2.2 Further analysis: overview on country-specific cases.

For few number of countries, the economic diversification indicator over the period 1995-2012 have been generally above or below the threshold value identified in the estimation. More precisely, countries such as Botswana, Lesotho, Morocco, Mauritius, Swaziland, Tunisia and South Africa have always had the maximum impact of resource rents on non-resource tax revenue (higher regime) as their manufactures exports in percentage of total merchandise

exports were most of time above the threshold. This result suggests that these countries have been efficient in using resource rents towards stimulating non-resource tax revenue mobilisation through diversification. In other words, these countries did not experience any crowding out effect of resource rents on non-resource tax collection because of their relatively advanced level of economic diversification.

The presence of Botswana among the group of countries where resource rents do not crowd out non-resource tax revenue collection is not surprising. In fact, Botswana has received praise and has gained a worldwide reputation for its management of extractive resources wealth. The success of Botswana, among other factors is related to the fact that the country has placed a attention to the development of non-mining sector.

Indeed, from the beginning of mining exploitation in the country (1970s), the authorities have always kept in mind that the role of extractives in the economy will eventually decline. Accordingly, the government used revenue from extractives resources as a platform to boost the diversification of the economy. In fact, the policy in Botswana aimed at utilising revenues collected from minerals to finance investments in other sectors in order to create a strong basis for revenue generation that can eventually replace mineral revenue. Accordingly, almost the entire mineral wealth was used to finance investments in education, healthcare and physical capital. For instance, during the period 1983-1984 to 2014-2015, the total mineral revenues amounted to BWP406bn (US$39bn, €33bn) at 2012 prices, and these revenues were almost entirely invested in physical and human capital (ANRC, 2016b). This policy has spurred the development of the private sector and has reduced the importance of the mining sector in the economy. In fact, from 2004 to 2014, the non-mining private sector grew by 128 percent, while the mining sector collapsed by 13 percent (ANRC, 2016b). The ANRC (2016b) argues that these developments (faster growth of the non-mining sector compared to the mining sector) provide an indication that economic diversification policies in Botswana have to some extent

succeeded. The tendency towards diversifying the economy away from mining sector has fostered the development of non-mining sectors and has therefore sustained greater tax revenue collection from these sectors. As early mentioned, in addition to Botswana, some countries like Swaziland, Morocco and Tunisia also record positive impact of resource rents on non-resource tax revenue collection. In spite of the potential institutional deficiencies in these countries, resource rents favour the mobilisation of non-resource tax revenue because of the relatively more advanced state of economic diversification in these countries compared with their peers. This result suggests that beyond institutions, economic diversification could reverse the crowding-out effect of resource revenue on non-resource tax collection.

In contrast, for countries like Algeria, Cameroon, Nigeria, Sudan, Republic of Congo, Gabon Mali, Burkina Faso, Malawi, Côte d'Ivoire, Ghana and Tanzania, resource rents have experienced a crowding out effect of resource rents on non-resource tax revenue mobilisation because of weak economic diversification level, such that higher resource rents, not only relax government efforts in collecting taxes from non-resource sectors, but also in some extent, shrink the development of these sectors.

Nonetheless, for some countries like Togo, there is change in the impact of resource rents on non-resource tax revenue. For this country, the impact of resource rents on non-resource tax revenue shifted from negative values (low regime: -0.063) to positive value (high regime: 0.61). Togo achieved in 2003 the critical threshold of manufactures exports in percent of total merchandise exports for which the crowding out effect of resource rent on non-resource tax revenue is reversed. In fact, over the last two decades, in Togo, efforts have been made to diversify the economy away from phosphate and cotton in order to develop the industrial sector and to attract foreign direct investments, especially with the creation of a free trade zone for exports processing and the construction of roads infrastructures. The country has also strengthened and has modernized the equipments and the capacities of the port of Lomé in

order to revitalize the country's transit function in the West African Economic and monetary Union (WAEMU) region, mainly for the landlocked countries (Mali, Burkina and Niger). As a result, based on the IMF Theil diversification index, in its 2017 report on international trade, the Central Bank of West African Countries remarked that Togo is one the WAEMU countries which has recorded the highest performance in improving the economic diversification over the period 2006-2017.

Adversely for countries such as Senegal, the degradation of the business environment since the year 2000s which has slowed down economic diversification has ultimately (ceteris paribus) negatively affected the elasticity of non-resource tax revenue to resource rents (transition from high non-resource tax revenue regime to low regime). Indeed, as explained in Jude and Levieuge (2016), Senegal has implemented a package of policy reforms aiming at improving the country's business climate. These reforms contribute to the emergence and the development of indigenous enterprises. However, during the 2000s, frequent government change with its corollary of concentration of executive power, and sometimes high state interference in the economy. This has reduced the activities of foreign investors in the country and finally slowed down the diversification of the economy and thereby negatively affect non-resource tax collection. This result could serve as a lesson for Senegal which is expected to start oil production in 2021. The country may consider paying particular attention to factors that sustain economic diversification such that the country does not suffer from the crowding out effect of oil exploitation on non-resource tax collection.

Finally, we find that the elasticity of non-resource tax revenue to resource rents has been volatile for a certain number of countries where the economic diversification indicators fluctuate. Namibia and Madagascar are among these countries.

Although Namibia has achieved significant development outcome (the country's GDP per capita was USD 5 227,18 USD in 2017, WDI) thanks to mining exploitation, the country's level of economic diversification is still relatively low mainly because of weak backward and forward linkages between mining sector and non-mining sectors. Nonetheless, over the past two decades efforts have been made towards the diversification of the economy. The manufacturing sector's contribution to GDP increased from 5.3 percent in 1990 to 11.3 percent in 2012, mainly due to the quick development of fish and meat processing and some mineral beneficiation. As a result, over the periods 2000-2002 and 2004-2006, the country even exhibits positive elasticity of non-resource tax revenue with respect to resource rents. However, from 2010 to 2012 the country's elasticity of non-resource tax revenue to resource rents was negative while it was positive for the year 2009.

Basically, one of the real challenges with Namibian economic diversification is the fact that the manufacturing sector is concentrated on mineral processing activities, such that the manufacturing exports and therefore economic diversification is vulnerable to fluctuations of mineral prices. Consequently, the country could not enjoy better non-resource tax collection both in periods of mining booms (because of relaxing effort in collecting taxes from other non-mining sectors) and mining busts (because of weak tax potential from non-mining sectors due to a potential slowdown in the mineral processing manufacturing activities). The country therefore could consider scaling up its diversification level by strengthening the productivity of the agro-industry sector for instance.

7.3 Estimation results of non-resource tax revenue elasticity to resource rents depending on institutions

We now turn to the estimation of the effect of natural resources rents on non-resource tax revenue depending on the quality of institutions. Government stability is used as measure of

institutional quality and therefore as the transition variable in the PSTR model. However, the three linearity tests carried out using government stability as the transition variable fail to reject the linearity hypothesis (table 2 in appendix) suggesting that the PSTR model is not suitable to test for the non-linear effect of natural resource rents on non-resource tax revenue depending on government stability[17]. Accordingly, as Botlhole et al (2012), we estimate a simple panel data model by including the interaction term between natural resource rents and government stability as an explanatory variable to test for the non-linear effect of natural resources rents on non-resource tax revenue depending on the institutions. The estimation results from the fixed effects panel data model are reported in table 5. In column (1) of table 5, we both introduce natural resource rents and government stability as explanatory variables, but we do not include their interaction term as control variable. Column (2) reports results obtained from panel fixed effects estimator with Driscoll Kray (DK-FE) autocorrelation and heteroskedasticity standard errors correction. The results show that natural resource rents negatively affect non-resource tax revenue while government stability fosters non-resource tax collection. In column (2) of table 5, we introduce the interaction term of natural resource rents and government stability. The interaction term is positive and statistically significant at the 5% level suggesting that as the quality of institutions improves, natural resources revenue becomes an important engine of non-resource tax revenue. Natural resource rents still negatively affect non-resource tax revenue and government stability is always positively associated with better non-resource tax mobilization. In summary, our estimation results show that natural resource rents slow down non-resource tax revenue in countries with weak institutions while they stimulate non-resource tax ratio in countries with better institutions.

[17] Similar results were found when we use an alternative indicator of institutional quality, namely political rights, civil liberties and bureaucracy quality.

Table 5: Non-linear effect of natural resource rents on non-resource tax revenue: fixed effects model with interaction term.

Non-resource tax revenue	(1) FE-DK	(2) FE-DK
Natural resource rents (Rents)	-0.044**	-0.046*
	(0.019)	(0.025)
Government Stability	0.161***	0.157**
	(0.047)	(0.059)
Rents*Government Stability		0.0002**
		(0.002)
GDP per capita	0.002***	0.002***
	(0.000)	(0.000)
Trade openness	0.039***	0.039***
	(0.011)	(0.011)
Inflation	-0.01	-0.01
	(0.00845)	(0.00827)
Agriculture value added	-0.033***	-0.033***
	(0.010)	(0.008)
Constant	7.091***	7.116***
	(1.454)	(1.395)
Observations	398	398
Number of countries	24	24

(Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1)

7.4 Robustness analysis

In this subsection, we analyze whether the main results obtained from the estimation of the baseline equation (equation 1) remain unchanged under some circumstances.

7.4.1 Alternative indicators of economic diversification and the quality of institutions.

Alternative indicator of institutions

We test whether our results resist to a change in the indicator of institutional quality. Since institutions are likely to work better in democratic regimes than autocratic ones, we use as institutional variable the indicator Polity from polity IV database (Marshall et al., 2014). In addition to the fact that it covers many countries over long period, Acemoglu et al (2003) argue that this indicator "*is conceptually attractive since it measures institutional and other*

constraints that are placed on presidents and dictators (or monarchies)" (p.52). The indicator polity ranges from -10 (autocratic) to +10 (democratic) regimes. The linearity tests validate the PSTR model with polity as the transition variable (table 2). The PSTR estimation results using polity as threshold variable are reported in table 6. The main findings of the chapter remain qualitatively unchanged. Natural resources rents are negatively associated to non-resource tax revenue. However, with better institutions, natural resources rents foster non-resource tax collection in Sub-Saharan Africa (table 6, column 2) suggesting that the baseline results of this study are robust to the use of alternative indicator of institutions.

The threshold variable C=6.116 while the average polity index for the countries under consideration is equal to 1.4 suggesting that African countries should significant increase effort to improve institutions such that natural resource rents contribute to enhance non-resource tax revenue. Indeed, countries such as Botswana, Namibia, South Africa and Mauritius well known for their relative political stability and for their relatively well functioning institutions have always had the maximum elasticity of non-resource tax revenue with respect to resource rents depending on the quality of institutions.

More interestingly, countries such as Ghana, Kenya and Lesotho shift from negative elasticity of non-resource tax revenue with respect to resource rents conditional on the institutions to positive elasticities. The critical threshold of the indicator of institutions quality (polity2) has been achieved in Ghana in 2001. For Ghana, it was the period of government instability with the series of coups d'etats from 1966 (ten years after its independence) to 2000 which has led to a negative effect of resource rents on non-resource tax revenue. In fact, since 2000, efforts made by Ghana in moving away from political instability and establishing democratic institutions have contributed, all things being equal, to reverse the crowding out effect of resource revenue on non-resource tax revenue mobilization. Indeed, in 2000, under the provision of the fourth republic, Jerry Rawlings, the ruling president was prohibited by term

limits provision for running for a third presidential mandate. The opposition party's candidate, John Kufour won the presidential elections that year. This orderly transition between parties was an important signal of the political stability of Ghana. The president John Kufour focused his actions in developing Ghana's economy and enhancing the countrys' international reputation. As a result, he was reelected in 2004. However, in 2008, after two mandates, Kufour can not run for a third presidential mandate. Thus, in 2008, John Atta Mills, Rawlings' former Vice-President who had lost to Kufour in the 2000 elections, won the election and therefore replaced Kufour. In 2012, the president John Atta Mills passed away in office and his Vice-President, John Dramani Mahama, temporarily replaced him. After this peaceful and smooth transition of power to Dramani Mahama, in 2012, subsequent presidential elections were organised in the same year as provided by the constitution. John Dramani Mahama won that election. In 2016, Nana Akufo Addo defeated Mahama in a single round during general elections. This was the first time that a ruling president failed to win a second presidential term in Ghana. Despite that, the transition of power from Dramani Mahama to Akufo Addo was on overall peaceful.

Alternative indicator of diversification

While manufactures exports in percent of merchandise exports measures the structure of exports across products categories, this measure however does not capture the number of exported products, which, yet reflects the diversity of exported products. The economic diversification indicator (export diversification index) developed by the International Monetary Fund[18] (IMF) takes into account this consideration. Indeed, this index considers both extensive export diversification (reflecting change in the number of export products) and intensive export diversification (reflecting change in the shares of export volumes across export products such

[18] Data on this index are available at https://www.imf.org/external/np/res/dfidimf/diversification.htm

that a country is considered less diversified when only a few sectors are driving export revenue, even if the country is exporting many different goods). Higher values of the index indicate lower exports diversification. For robustness check, we alternatively use the IMF export diversification index as the economic diversification indicator. To facilitate the interpretation of results, we inverse the diversification index in our regressions so that higher values of this index reflects higher economic diversification of in the country's under investigation.

Table 6: PSTR estimation of the conditional impact of natural resources rents on non-resource tax revenue depending on economic diversification.: Alternatives measures of diversifications and institutions

Dependent variable: Non-resource tax revenue	(1)	(2)
Transition variable :	**IMF export diversification index**	**Polity2**
Natural resource rents (βo)	-0.063 (0.021)	-0.074 (0.016)
Natural resource rents (β1)	0.818*** (0.182)	0.254** (0.129)
GDP per capita	0.001*** (0.000)	0.002*** (0.000)
Trade openness	0.046 (0.034)	0.054*** (0.018)
Inflation	-0.073 (0.163)	-0.098 (0.062)
Agriculture value added	-0.220 (0.107)	--0.145 (0.038)
Gamma (γ)	0.209	1.627
C	0.2	6.363
AIC criterion	1.489	1.597
BIC criterion	1.587	1.695

Observations	270	270

(Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1)

7.4.2 Alternative measure of natural resource wealth

So far, natural resource rents have been used as an indicator of natural resource wealth. The variable natural resource rents extracted from the WDI, the World Bank database has the advantage to cover a wide range of African countries over long periods thereby allowing reducing the risk of sample selection bias. Moreover, it could mitigate the endogeneity problem resulting from reverse causality between non-resource tax revenue and natural resources wealth. In fact, it is unlikely that non-resource tax revenue at the current period in a given country will affect resource rents because the latter largely depend on the country's endowment in natural resources and world commodity prices which are exogenous to African countries. Despite these qualities, uncertainties around production costs for natural resources extraction could cast doubt on the accuracy and relevance of natural resource rents data. Since, the confidence about production costs could be challenged; one should take with caution the measures of natural resources wealth which include production costs in their calculations. In addition, the World Bank's natural resources data refer to rents captured both by the private and the public sector (Klomp and de Haan, 2016). Even if in most countries African, governments attempt to capture the largest share of rents, given the purpose of this study, it should be desirable to isolate rents received by public sector. We take into account all these considerations above by replacing natural resource rents by resource taxes in the baseline specification. Resource taxes are tax revenues collected from natural resources sector (resource taxes). Data on resource taxes are directly taken from the ICTD-GRD database (Prichard et al, 2014). PSTR Regressions are therefore carried using as interest variable resources taxes instead of resource rents. Estimation results are reported in table 7. We find that resources taxes exert negative impact though not statistically significant on non-resource tax revenue. However, the

impact of resource taxes on non-resources taxes depending on the level of economic diversification and the quality of institutions are positive and statistically significant at 5% level (table 7). These results suggest that the main results of this study qualitatively remain to the use of alternative measure of resource wealth. The conditional impact of resource wealth on non-resource tax revenue (depending on institutions and diversification) is positive while the direct impact of resource wealth on non-resource tax revenue is negative.

Table 7: Conditional impact of resources taxes on non-resource tax revenue depending on economic diversification and institutions.

Dependent variable : Non-resource tax revenue	**Transition variable : IMF Diversification index**	**Transition variable : Government stability**
Resource taxes (βo)	- 1.403 (0.198)	- 0.519 (0.062)
Resource taxes (β1)	1.589*** (0.412)	0.11** (0.051)
GDP per capita	0.0004 (0.000)	0.001*** (0.0003)
Trade openness	0.068*** (0.014)	0.054*** (0.014)
Inflation	-0.010 (0.016)	-0.008 (0.015)
Agriculture value added	-0.196 (0.032)	-0.021 (0.021)
Gamma (γ)	0.967	588.11
C	0.227	7.124
AIC criterion	0.371	0.604
BIC criterion	0.469	0.702
Observations	270	270
Wald test, pvalue	0.000	0.06
LRT,pvalue	0.000	0.056
Fisher Test, pvalue	0.000	0.079

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

7.4.3 Discussing and mitigating the potential endogeneity issue of the explanatory variables.

Our estimations may suffer from a potential endogeneity bias that needs to be addressed. Endogeneity can arise from reverse causality between natural resource rents and non-resource taxes. On the one hand, natural resources can weaken government efforts to mobilize non-resource tax revenues. On the other hand, a government could rely on natural resources exploitation because of the narrowness of the non-resource tax base or because non-resource tax revenues are no longer enough to cover its financing needs. In fact, recent developments on oil, gas and mining projects in Africa corroborate the desire of African governments to increase domestic revenue mobilization. More precisely, over the recent years, African countries, especially East African countries have invested more in natural resources projects to increase domestic revenue collection. As outcome, to our knowledge, all of the African countries have undertaken oil exploration activities except Swaziland. In 2015 and 2016, nine of the worldwide top 20 discoveries were made in Africa (PWC, 2016). These discoveries are mostly gas and they account for 57% of the reserves discovered. Up to date almost all the African countries are involved in at least one petroleum project. Clearly, the tendency towards exploiting natural resources across all the countries in the African continent provides indications that the difficulty and inability to collect more non- resource taxes and the narrowness of non- resource tax bases may stimulate natural resources exploitation and therefore affect natural resource rents. This consideration suggests that the variable natural resource rents is potentially endogenous in the baseline equation (1).

The instrumental variable (IV) technique is usually used to address the endogeneity issue in the estimation of econometric models. However, IV methods have not yet been developed in a PSTR context. Thus, instead of current values, we include one-year lag values of natural resource rents, GDP per capita, Trade openness, Inflation and Agriculture value added to

mitigate the reverse causality problems. This approach[19] is acceptable in our case since resources collected from natural resources previously influences the government current behavior regarding non-resource tax revenues mobilization whereas current level of non-resource tax revenue cannot affect natural resources rents that have already been collected. We also lagged the transition variable to mitigate the issue of reverse causality since if economic diversification is a vehicle for increasing non-resource tax mobilization; countries with high tax revenue are more likely to diversify their economies. As indicated in table 8, even using one-year lagged value of diversification as the transition variable, the three linearity tests suggest that the PSTR model is still suitable to estimate the effect of natural resource rents on non-resource tax revenue depending on the level of economic diversification. Estimation results are displayed in table 8 Results are qualitatively the same as those reported in table suggesting that the main findings of this study are robust to potential endogeneity of control variables. The direct effect of natural resources rents on non-resource tax revenue is negative. The non-linear effect of non-resource tax revenue depending economic diversification, measured by $\beta 1$ is positive.

[19] Jude and Levieuge (2016) adopt the same approch to address the endogeneity problem in their PSTR estimation of the conditional effect of foreign direct investments on economic growth depending on the quality of institutions.

Table 8: Natural resource rents and non-resource tax revenue: mitigating the potential endogeneity issue of explanatory variables.

Dependent variable: Non-resource tax revenue	
Transition variable :	**L.Diversification (manufactures export in % merchandise exports)**
Natural resource rents (βo)	**-0.262*** (0.030)**
Natural resource rents (β1)	**0.359*** (0.102)**
GDP per capita	**0.0003** (0.0001)**
Trade openness	**0.023*** (0.005)**
Inflation	**-0.042*** (0.012)**
Agriculture value added	**-0.143*** (0.021)**
Gamma (γ)	**0.063*** (0.017)**
C	**24.513*** (5.510)**
AIC criterion	**1.276**
BIC criterion	**1.369**
Observations	**323**

(Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1)

7.4.4 Control for path dependence in non-resource tax revenue.

Previous studies on tax effort have revealed persistence in tax revenue performance suggesting that tax revenue-collected at the current date depends on the tax revenue collected at previous periods (Agbeyegbe et al., 2006; Gnangnon and Brun, 2017; Gupta, 2007; Baunsgaard and Keen, 2010; Leuthold, 1991). Indeed, government finances current tax revenue collection with tax revenue previously collected. To take onboard this consideration, we follow the approach adopted in the literature by including one-year lagged value of non-resource tax revenue among the explanatory variables, leading to specify a dynamic model. Since the PSTR model is static by nature (see Gonzales et al, 2005), we estimate a dynamic panel fixed effect model to control for inertia in non-resource tax revenue. The specification of the dynamic model allows correcting for the serial correlation of the error term (Gupta, 2007) and it helps preventing from econometrics problem related with omitted variable bias (Bond, 2002). The estimation of dynamic model with fixed effects estimator would lead to inconsistent estimates because of the dynamic panel bias (known as Nickell bias) caused by the correlation between the lagged dependent variable and the error term.

Nonetheless, the dynamic panel data bias tends to zero as the time length of the panel data tends to infinity (Nickell, 1981). More practically, Hurlin and Venet (2001) consider that for a time dimension of 31 the dynamic panel bias could be neglected. But our panel dimension which is equal to 18 (T=18) is not sufficiently high in the sense of Hurlin and Venet (2001) to consider that the Nickell (1981) bias is negligible with fixed effect estimator. Following the literature on the estimation of dynamic panel data model, we therefore rely on system GMM estimator to estimate the dynamic specification of equation 1 in order to obtain consistent and efficient estimates. More interestingly, in addition to the correction of the panel data bias, the system GMM estimator corrects for potential endogeneity bias of the other explanatory variables. This feature of system GMM makes this estimator suitable and relevant in our case

as some of the structural determinants of non-resources tax revenue we included in our specification may be endogenous like the GDP per capita. In fact, GDP per capita affect non-resource tax revenue through an increase in the taxable income. However, countries with higher non-resource tax revenue are more likely to finance broad-based economic growth policies for improving the GDP per capita.

There are two categories of GMM estimator: the first-difference GMM estimator (Arellano and Bond, 1991), and the GMM system estimator (Blundell and Bond, 1998). The first-difference GMM estimator eliminates individual unobserved fixed-effects by first difference and uses previous level values of the lagged differenced variables as instrumental variables (see Blundell and Bond, 1998). The system GMM estimator combines the equation in differences with the equation in levels and uses lagged first differences as instrumental variables for the levels equation and lagged levels are used as instrumental variables for the first-difference variables. The system GMM estimator performs better than the first GMM difference estimator in the presence of high persistence in the variables under consideration (Blundell and Bond, 1998) and when cross-sectional variability dominates time variability. The validity of the instrumental variables in system GMM regressions is checked through the Hansen test of over-identifying restrictions and the Arellano and Bond's autocorrelation tests. Arellano-Bond (AB) tests of autocorrelation determine whether there is first-order serial correlation in the error term [AR (1)] and no second-order autocorrelation in the residuals [AR (2)]. 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, 2009). We divided the time span of the panel data in three-year non-overlapping intervals to obtain six-year panel data (1995/1997; 1998/2000; 2001/2003; 2004/2006; 2007/2009; 2010/2012). This transformation eliminates cyclical fluctuations thus, enabling to focus on long term relationships. It also enables reducing the length of the time dimension (T)

of the panel as GMM estimator is more efficient for panel data with small T and large individual dimension (N). The estimation results from the system GMM (two-step) are displayed in table 9. These results are qualitatively the same with those found with the PSTR estimation. We find that government stability, the institutional variable used here has positive effect non-resource tax revenue, suggesting that improving institutions would enhance non-resource tax revenue mobilization in Africa. Once again, the results indicate that natural resources rents have negative effect on non-resource tax revenue (table 9). However, the interaction term between natural resource rents and government stability (Rents*Government stability) is positively related to non-resource tax ratio (table 9) suggesting that with better institutions, natural resource rents positively contribute to non-resource tax revenue mobilization in Africa. From a policy implication perspective, these results provide an additional motivation to policy makers for improving the quality of institutions and diversifying the economy for better non-resource tax revenue mobilization. In other words, our findings suggest that African countries may experience more non-resource tax revenue if they use revenue from natural resources to support the economic diversification and to improve the quality of institutions.

Table 9: Non-linear effect of Natural resource rents on resource tax revenue: accounting for inertia in non-resource tax revenue.

Non-resource tax revenue	
	Sys GMM
L.Non-resource tax revenue	0.700***
	(0.078)
Natural resource rents (Rents)	-0.374***
	(0.140)
Government Stability	-0.454***
	(0.150)
Rents*Government Stability	0.029**
	(0.014)
GDP per capita	0.0004***
	(0.000)
Trade openness	0.023***
	(0.008)
Inflation	0.035
	(0.024)
Agriculture value added	-0.01
	(0.033)
Constant	7.753***
	(2.487)
Observations	112
Number of countries	24
ar1, pvalue	0.036
Hansen,pvalue	0.228
Number of instruments	18
ar2, pvalue	0.153

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

7.4 Policy implications of key findings from the analysis of the impact of natural resource wealth on non-resource tax revenue.

This chapter comes up with policy recommendations for African countries indicating that resource revenue should be invested towards economic diversification and building better institutions such that natural resources exploitation enhance non-resource tax collection in the continent. In this respect, policy makers could consider the following suggestions:

Education is crucial for a success of economic diversification policies. A good education spurs entrepreneurial initiative and facilitates the construction and the implementation of bankable investment projects.

Sound macroeconomic management towards avoiding overvaluation of the real exchange rate. In fact, an overvalued currency disadvantages the industries specialized in manufacturing exports and services. An independent central bank could play a crucial role in this respect by controlling the evolution of the exchange rate such that the currency does not appreciate above its appropriate level.

Efforts should be increased towards improving the business climate in the country. Government should facilitate the process and procedure of delivering construction permits, register property, pay taxes, export products, and enforce contracts. An emphasis should be also put in the protection of investors against abuse and expropriation risks from authorities and any other entity (land holders).

A clear and well-planned industrial policy should be set by the government. The construction of economic and social infrastructures (roads, access to internet, hospitals) could improve productivity and encourage the creation of firms. The government could work in collaboration with banks and financial institution to ease the get of credit for projects holders. Institutions should be designed such that supervisory authorities conduct regular effective checks and balances.

8. Conclusion

This chapter analyses the effect of natural resources rents on non-resource tax revenue conditional on the level of economic diversification and the quality of institutions for 29 African countries over the period 1995-2012. The main methodology used is the panel smooth transition regression technique to account for heterogeneities and non-linearity in natural

resources and non-resource tax relationship and the gradualism of the process towards diversification and better institutions in African countries. The results show that economic diversification and institutional quality modulate the effect of natural resources on non-resource tax revenue. The direct effect of natural resources rents on non-resource tax revenue is negative. However, natural resources rents tend to positively affect non-resource tax revenue for higher levels of economic diversification and better institutions. In terms of policy recommendations, our research findings suggest that African government invest more in economic diversification and improve the quality of institutions so that natural resources revenue strengthens non-resource tax revenue mobilization performance in African countries.

Appendix

List of countries

Algeria, Botswana, Burkina Faso, Cameroon, Comoros, Republic of Congo, Côte d'Ivoire, Egypt, Gabon, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, Seychelles, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda.

Chapter 2: Do Income Inequality and Poverty affect Non-Resource Tax Revenue Performance? Empirical Evidence from Sub-Saharan Africa.

Abstract

This chapter analyses the impacts of income inequality and poverty on non-resource tax revenue collection in Sub-Saharan Africa. Using panel data for 35 Sub-Saharan African countries over the period 1980–2013, we estimate dynamic panel data models with the system GMM estimator to deal with the potential endogeneity problems of the Gini coefficient, the poverty ratio and the dynamic panel data bias. Results show that an aggravation of income inequality and poverty leads to lower non-resource tax revenue collection in Sub-Saharan Africa. These results are robust to alternative measures of income inequality and poverty. Moreover, results provide evidence that the impact of inequality on non-resource tax revenue works through lower tax compliance and higher corruption. In terms of policy implications, these results help inform policymakers that reducing income inequality and poverty is not only a crucial dimension of development and social justice, but also a pathway to better non-resource tax revenue mobilization in Sub-Saharan Africa.

Keywords: *Non-resource tax revenue, Income inequality, Poverty, System Generalized Method of Moments estimator, Sub-Saharan Africa*.

1. Introduction

Since the Addis Ababa's 3rd international conference on financing for development in 2015, Sub-Saharan African countries pay more attention to domestic tax revenue collection for financing public goods and services. In fact, despite progresses, the average tax revenue in proportion of GDP is still relatively lower in Sub-Saharan Africa (15% GDP) comparatively to developing regions like Latin America and the Middle East and Northern Africa region (18% GDP) (Mascagni et al, 2014; OECD/ATAF/AUC, 2017). Indeed, Sub-Saharan African countries collect less tax revenue in relation to their tax potential suggesting that there is room for increasing tax revenue mobilization for financing development in these countries (Brun et al, 2015, Coulibaly, 2018).

In this regard, several empirical studies have been conducted to try to identify the key determinants of tax revenue mobilization in Sub-Saharan Africa countries. The literature on tax revenue mobilization shows that the level of development; trade openness (Crivelli and Gupta, 2014; Stotsky and WoldeMariam, 1997; Drummond et al. 2012; Hinrichs, 1965) and the quality of institutions (Bird et al., 2014; Bourgain and Bertinelli, 2016) are key drivers of tax revenue mobilization in Sub-Saharan African countries while, agriculture value added; inflation (Agbeyegbe et al, 2006; Ghura, 1998) and natural resources rents (Brun et al, 2015; Drummond et al. 2012) tend to depress tax revenue collection in these countries.

However, the role income inequality and poverty play in tax revenue mobilization performances in Sub-Saharan Africa has received very little attention, whereas higher within-country income inequality and poverty persist and are still key challenges for the region. In fact, Sub-Saharan Africa records the second highest level of income inequality in the world after Latin America and Caribbean (Woo et al., 2013) as depicted by figure 1. Furthermore, a recent study conducted by UNDP (2017) reveals that 10 of the 19 most unequal countries in

the world belong to the Sub-Saharan Africa region and this study stresses that inequality causes more losses in human development for Sub-Saharan Africa than for all other regions in the World. A study of the World Bank (2016, p.4) on poverty and shared prosperity reveals that Sub-Saharan Africa hosts the largest number of the poor in the World[20] These developments raise the debate as to whether income inequality and poverty are among the factors responsible of low tax collection in Sub-Saharan Africa (Chambas, 2005; Fenochietto and Pessino, 2013; Bird et al., 2014) which thereby translates into significant losses of human development. Basically, the relationship between income inequality and tax revenue collection is theoretically unclear. Indeed, by affecting sociopolitical stability and tax compliance, income inequality and poverty could impede tax collection. However, high level of income inequality and poverty may lead the government to increase tax revenue mobilization for financing redistributive policies.

The contribution of this paper to the literature examining the impact of income inequality on tax revenue collection is threefold. First, since the depth of income inequality is heterogeneous across regions of developing countries (World Bank, 2016, p3) it is prudent to analyze the impact of inequality on tax collection for a panel of countries belonging to the same region of the developing world with relatively homogeneous characteristics (tax structures, tax administrations capacities). To our knowledge, this is the first study that estimates the impact of income inequality on tax collection for a panel of only Sub-Saharan African economies. The consideration of panel data for only Sub-Saharan African economies allow the formulation of more specific and reliable policy recommendations for these economies, out of the potential influence of the presence of other economies in the data.

Second, previous studies on the relationship between inequality and tax revenue in developing countries did not attempt to empirically explore the mechanisms through which income

[20] Typiccally, 389 million of poor among the 767 million of poor individuals who were living with less than US $1.90 a day globally in 2013 were in Sub-saharan Africa.

inequality may affect tax revenue collection (Chambas, 2005; Fenochietto and Pessino, 2013; Bird et al., 2014). To our knowledge, this is the first study that estimates the impact of income inequality on tax mobilization for Sub-Saharan African countries by testing the channels through which inequality affects tax collection. The identification of transmission channels of income inequality to tax revenue is essential to enrich and guide policy discussions on the topic.

Finally, while previous studies focused on the effect of income inequality on total tax revenue (Bird et al., 2014; Chambas, 2005), the present study rather focuses on the effect of inequality and poverty on non-resource tax revenue (total tax revenue excluding resource taxes, that is tax revenue from natural resources) in order to deliver relevant and updated policy recommendations taking into account the current fiscal policy context in these countries. Basically, this orientation is motivated by the fact that, since 2014, the instability and the downward trends in oil and gas prices call for a major overhaul of public revenue mobilization strategy by implementing and strengthening an efficient tax system focused on non-resource taxes for reducing the over-reliance on natural resources in order to reduce macroeconomic vulnerabilities of developing countries to external shocks related to the volatility of natural resources' global prices (Coulibaly, 2018).[21]. Indeed, given that resource taxes are generated from non-renewable natural resources that will eventually be depleted, an efficient tax system focused on non-resource taxes will be crucial for government revenue mobilization after resource depletion (Fjeldstad et al., 2015).

Moreover, the current global tendency towards a low carbon economy through a shift from non-renewable energy sources to renewable energy sources for reducing the global temperature is likely to mitigate the importance of oil and gas as major sources of energy and thereby reduces the demand for these resources as well as their value (Cust et al, 2017). The shift from

[21] See Morrissey et al. (2016) for details on tax revenue performances' vulnerability to external shocks in developing countries.

hydrocarbon energy sources to renewable sources could render commercially unattractive hydrocarbon resources extraction (Manley et al, 2017). Within this background, an efficient and robust non-resource tax system could be therefore relevant for government revenue mobilization in response to probable contraction in petroleum resources exploitation due to considerations related to climate change.

Another reason to pay attention to non-resource tax revenue rather than total tax revenue lie on the fact that the resource taxes component of total tax revenue is somewhat outside the reach of economic policy (Gnangnon and Brun, 2017) because it mainly depends on global commodity prices and geology. Furthermore, non-resource tax revenue is more relatively homogeneous between countries than total tax revenues (Brun, Chambas, and Mansour, 2015, p.206) because of differences in each country's endowment in natural resources.

The remainder of this chapter is organized as follows: Section 2 reviews the impact of inequality and poverty on tax revenue. Section 3 specifies the empirical model and discusses the estimation method used to estimate the impact of inequality on non-resource tax revenue. Section 4 describes the data in greater details. Section 5 presents and analyses the results from the estimation of the impact of inequality on non-resource tax revenue as well as the robustness check of the main findings. Section 6 is entirely dedicated to the impact of poverty on non-resource tax revenue while section 7 concludes the chapter and gives the main policy recommendations drawn from the study.

2. Review of the theoretical and empirical evidence on the effect of inequality and poverty on non-resource tax revenue.

This section reviews previous empirical and theoretical studies on the impact of income inequality and poverty on tax revenue.

2.1 Review of the theoretical framework

This subsection analyses the transmission mechanisms through which the variations in income inequality may affect tax revenue. We start the discussion on how income inequality affects tax revenue through corruption. In most of low income countries, because of their close relationship to politicians and some tax administration officials, rich individuals often manage to make full or part of their income avoiding taxes by corrupting tax administrations staffs. In such context, income inequality through corruption may weaken the capacity of government to implement tax reform aiming at broadening the tax base since rich individuals may lobby against such reform that will ultimately increase income and property taxes when it passes into force. In the same vein, high income inequality may give incentive to practice corruption attitudes in tax administration. In fact, income gap could be used as morale excuse by some tax administration staffs to participate in corruption activities aiming at collecting less or not at all taxes from some taxpayers against financial or in-kind compensation from these taxpayers.

Moreover, high income inequality can fragilize the social cohesion and discourage tax compliance. In fact, individuals may interpret high income inequality as a result of insufficient supply of public goods and services thus leading them not to comply with tax payment and not support higher taxes (Boustan et al., 2013) since tax compliance tends to increase with the availability of public goods and services (Alm et al., 1992). Income inequality can undermine the social fabric and fuel political instability and therefore lead to disturb tax collection since low income groups may employ undemocratic means for improving their social position (Alesina and Perotti, 1996).

The median voter model could also be mobilized to explain the mechanism for the relationship between income inequality and taxes. This model predicts that as income distribution becomes more unequal (rising the mean income relatively to the median income), with universal suffrage

and majority rule, the majority of voters along with the median voter support higher taxes on relatively higher incomes for financing redistribution policies (Meltzer and Richard, 1981). However, voters whose income is higher than the median income vote for lower taxes. Nonetheless, Persson (1995) shows that if pre-tax wage inequality is low, all individuals will accept a tax on labor income, such that taxes will tend to be higher in countries with low pre-tax wage inequality.

In developing countries, since high income households tend to spend fewer proportion of their income on purchasing goods and services relative to lower income households, growing income inequality is likely to slow down the growth rate of both consumption taxes and income tax revenue given that consumption from an economic agent represents an income for another economic agent.

Except the median voter model, the theoretical framework we have reviewed up to now tends to indicate that the relationship between income inequality and tax revenues is negative. However, there is a possibility that inequality stimulates tax mobilization. As the government may decide to increase non-resource taxes for financing redistribution policies, income inequality is likely to boost non-resource tax revenue mobilization (Alesina and Rodrik, 1994). Since theory provides inconclusive guidance on the effect of inequality on tax revenue, we turn to empirical studies that analyzed the impact of income inequality on tax revenue mobilization. Growing income inequality and poverty are likely to slow down the growth rate of tax revenue. In fact, since high income households tend to spend fewer proportion of their income on purchasing goods and services relative to lower income households. This reduces the growth rates of consumption taxes and income tax bills since consumption from one person represent an income for another person. Furthermore, as poverty reduces the households' demand of goods and services, it may affect the tax revenues collected from consumption taxes. Clearly,

tax mobilization from a tax base composed by a large number of low income individuals will probably result in lower non-resource tax revenue collection. In line with this prediction, Fjeldstad et al. (2015) report a survey which reveals that people in Tanzania argue that they do not pay taxes because they do not have a reliable income.

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

In this section, we first review the literature on the effect of income inequality on tax revenue and then, we move to the discussion on how income inequality can affect tax revenue performances.

The economic literature has focused on investigating how tax revenue can be used to reduce income inequality (Bastagli et al, 2012; Sokoloff and Zolt, 2005). Few studies have analyzed the impact that income inequality can have on tax revenue of a given tax jurisdiction. Furthermore, the handful of existing studies on the topic focuses on developed countries. For example, Islam et al (2018) find that income inequality has negative impact on the income tax-to-GDP ratio for 21 OECD countries over the period 1870-2011. For US municipalities and school districts, Boustan et al (2013) conclude that income inequality increases taxes over the period 1970 - 2000.

In contrast to the studies we reviewed so far which have focused on the effect of inequality on tax revenue, the study of Adam et al (2014) has rather estimated the impact of inequality on tax rates using cross country data for 75 developed and developing countries for the year 2004. They find that inequality has positive impact on capital tax rate and negative impact on labor tax rate as well as negative impact on the ratio of labor tax rate to capital tax rate. These authors conclude that more unequal countries tend to rely more on labor taxation relatively to capital taxation.

Pickering and Rajput (2018) estimate the relationship between income inequality and tax composition. They find that income inequality is positively associated to income taxes whilst it negatively affects taxes on goods and services. Moreover, Pickering and Rajput (2018) find positive relationship between inequality and the ratio of income taxes to consumption taxes.

For developing countries, Chambas (2005) emphasizes the importance of analyzing the relationship between income inequality and tax mobilization, arguing that reducing inequality is one of the conditions for better tax revenue mobilization in these countries. This author shows that an increase of 10 percent in Gini coefficient is associated with lower total tax revenues of 5.6 percent of GDP in developing countries. Aizenman and Jinjarak (2012) find the same result for 50 countries showing that income inequality is negatively associated with the tax base. They find that one point increase of the Gini coefficient reduces the tax base by 2 percent of the GDP. For 96 non-natural resources dependent countries over the period 1991-2012, Fenochietto and Pessino (2013) find that the Gini index is negatively correlated to tax revenue. Bird et al (2014) estimate the impact of income inequality on tax effort in developing countries and find that higher income inequality lead to lower tax revenue collection. These authors therefore suggest taking into account societal factors in addition to supply side factors for enhancing tax effort in developing countries.

Beyond empirical and theoretical considerations, based on the experience of Latin American countries characterized by high inequalities and low tax revenues, Moore (2013) emphasizes that it is intuitively plausible to argue that income inequality is associated with low tax revenues.

Nonetheless, as emphasized by the literature review, the theoretical impact of income inequality on tax revenue is ambiguous and the handful empirical studies on the topic show mixed results about the impact of income inequality on tax revenue.

Accordingly, an, econometric analysis is therefore crucial to determine the impact of income inequality on non-resource tax revenue collection for Sub-Saharan African economies.

3. Econometric analysis

This section discusses the specification of the empirical model for estimating the impact of income inequality on non-resource tax revenue as well as the estimation method employed to estimate that empirical model.

3.1 Empirical Model specification

Because of inertia in tax structure in developing countries and given that the country's current fiscal capacity depends on its fiscal capacity inherited from the past (Besley and Persson, 2013)[22]., previous studies on tax effort argue that the current level of tax revenues for a given country is affected by its past values (Gnangnon and Brun, 2017; Gupta, 2007; Leuthold, 1991; Yogo and Njib, 2018). We take onboard this consideration and specify a dynamic panel data model for estimating the impact of income inequality on non-resource tax revenues. More precisely, the estimated model is specified as follows:

$$Log(\ Tax^{NR})_{it} = \alpha + \delta Log(Tax_i^{NR})_{it-1} + \beta Log(Gini)_{it} + \theta X_{it} + \vartheta_i + \mu_t + \varepsilon_{it} \qquad (1)$$

where $(\ Tax^{NR})_{it}$ is the non-resource tax revenues in proportion of GDP for country i in year t while $(Tax_i^{NR})_{it-1}$ is its value in year t-1 . $(Gini)_{it}$ is the Gini net coefficient in country i in year t, X_{it} stands for other determinants of non-resource tax revenue identified by previous studies on tax revenue mobilization in developing countries. These determinants include, GDP per

[22] In fact, tax revenue previously collected is used to finance tax revenue collection at the current date.

capita, inflation, trade openness, agriculture value added (Drummond et al, 2012; Gupta, 2007) and resource taxes.

GDP per capita is included to control for the level of development of the country, while inflation control for the effect of macroeconomic management on tax revenue collection. Trade openness controls for the effect of the exposure to international trade on tax ratio. We also include the agriculture value added among the explanatory variable as a proxy for the sectoral composition of the economy.

An emerging literature on revenue mobilization shows that resource revenue is a strong determinant of non-resource tax revenue collection (Bornhorst et al., 2009; Brun et al., 2015; Crivelli and Gupta, 2014; Drummond et al. 2012). In fact, abundance of resource revenue may lead the government to relax its effort in increasing non-resource taxes collection. Governments which collect large share of tax revenue through natural resources exploitation may deliberately relax tax burden on its taxpayers operating in non-resource sectors in order to reducing their accountability vis à vis taxpayers and citizens. We therefore follow these recent developments on tax effort literature by including resource taxes as a determinant of non-resource tax revenue in the baseline specification (equation 1).

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 non-resource tax revenues and u_t to control for time-varying shocks and economic fluctuations that affect all African countries.

3.2 Identification strategy

We need to address some econometric problems that may arise in the estimation of the baseline specification (equation 1). In fact, the Gini coefficient is likely to be endogenous, due to reverse causality from non-resource tax revenues to income inequality. Indeed, governments may

choose to increase their non-resource tax revenues for financing redistributive policies in line with one the fundamental function of public finances that is income redistribution (Larch, 2012). Accordingly, the Gini index could be correlated to the error term. Moreover, endogeneity may also arise due to measurement error in Gini coefficient (attenuation bias) since the Gini data we used in this study are estimated parameters (See Solt, 2014)[23].

Moreover, the presence of lagged dependent variable among the right hand side variables creates dynamic panel bias (Nickell, 1981) because of correlation between the lagged dependent variable and the error term. This bias is especially significant for panel dataset with short time dimension (T = 7 for our panel dataset). In this case, applying a panel fixed effects estimator would not be appropriate (Roodman, 2006).

To address these endogeneity issues, following the literature in the estimation of dynamic panel data, we use the system-GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998)[24]. Islam et al (2018) adopt the same approach by using system GMM for estimating the impact of Gini coefficient in tax revenue for 10-year panel data of 21 OECD countries over 1870-2011.

In system GMM estimator, equation (1) in level and in differences are combined as a system and the variables in levels are instrumented by their lagged differences, and the differenced variables are instrumented by the lagged variables in levels. This leads to increase the efficiency of system GMM estimator with respect to GMM difference estimator because the system GMM simultaneously exploits the time series dimension and the cross sectional variations of the data. In fact, the difference-GMM estimator (Arellano and Bond, 1991) uses first differences to remove unobserved country fixed effects in equation (1). This solves the

[23] We use Gini coefficient from SWIID database, some values of the Gini coefficient from SWIID database are estimated parameters (Solt, 2014).

[24] A brief mathematical description of system GMM estimator is provided at the end of the paper in appendix.

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 variables in level. However, the problem with the difference GMM estimator is that lagged levels of variables may be poor instruments (weak instrument problem) if those variables follow a random walk process as lagged values of the variables in level provide less information about future changes (Blundell Bond, 1998). Furthermore, because of inertia in within-country income inequality, Berg et al (2018) indicate that it may not be appropriate to remove cross sectional variation as does by the difference GMM estimator. Therefore, in this study, our preferred estimator is the system-GMM (Arellano and Bover, 1995; Blundell and Bond, 1998). The validity of the instruments in system GMM estimation is checked with the Hansen test of over-identifying restrictions, which tests the validity of the instrumental variables used in the regressions and the Arellano and Bond's autocorrelation tests[25]. 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, 2009).

4. Data

To achieve the objectives of the present study, we construct an unbalanced panel dataset of 34 sub-Saharan African countries, for the period 1980-2013. The choice of the sample and the time span is dictated by the availability of data. Since, non-resource tax and Gini coefficient data are not available for most of the African countries before 1980 and after the year 2013, we therefore retain the period from 1980 to 2013 as the analysis period for this study.

[25] Arellano-Bond (AB) tests of autocorrelation determine whether there is first-order serial correlation in the error term [AR (1)] and no second-order autocorrelation in the residuals [AR (2).]

4.1 Dependent variable: Non-resource tax revenue

The non-resource tax revenue (excluding social contribution) in percent of GDP is obtained from the International Center for Taxation and Development (ICTD) Government revenue data base (Prichard et al, 2014). Non-resource tax revenue includes all the taxes collected from non-resource sectors using several tax instruments.

4.2 The main explanatory variable: Gini coefficient

Our measure of income inequality for the 34 countries is the Gini net coefficient, the Gini coefficient for disposable income (income after taxes and transfers). Annual data for Gini coefficient are extracted from the Standardized World Income Inequality Database (SWIID), version 5.0 (Solt, 2014). The Gini coefficient measures the distribution of income among individuals in the society. It varies between 0 (equal distribution of income) and 1 (unequal distribution of income). (Solt, 2014) uses several survey data on income distribution and utilizes regression-based methods (imputation, interpolation) to create net inequality Gini values over long periods for many countries. One could nonetheless argue that Gini coefficient from the SWIID database (version 5.0) is not perfect because its values depend on the imputation model employed (Jenkins, 2015), but it is the best available and acceptable for the purpose of this study: the only database with annual net inequality values, comparable among countries, for large number of Sub-Saharan countries over many years. The version 5.0 of SWIID database covers 174 countries around the World over the period 1960-2014.

Similarly to the empirical economic growth literature and following Islam et al (2018), we divide, the time span of the panel data in five-year non-overlapping intervals to obtain seven-period panel data except the last sub-period which is four-year panel data: 1980-1984; 1985-1989; 1990-1994; 1995-1999; 2000-2004; 2005-2009; 2010-2013. This transformation eliminates cyclical fluctuations from the data (Pickering and Rajput, 2018; Yogo and Njib,

2018) and mitigates the problem of measurement errors (Yogo and Njib, 2018) and therefore enables to focus on long term relationships. This transformation is in harmony with Gini data frequencies for Sub-Saharan African countries where households' surveys from which Gini coefficients are calculated happen each five years.

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, the real GDP per capita, the trade openness measured by the sum of exports and imports as the share of GDP, the inflation measured by the annual percent change of the consumer price index. These variables were obtained from the World Development Indicators database (WDI), the World Bank. Let's discuss now the expected effect of control variables on non-resource tax revenue.

Inflation

Following Sarel (1996), we mitigate the effects of moderate hyperinflation episodes[26] that are likely to distort our regression results, we define π' as the new inflation rate calculated following the semi logarithmic transformation: $\pi' = \begin{cases} \pi - 1, \ if \ \pi \leq 1 \\ ln\, \pi - 1, \ if \ \pi > 0 \end{cases}$

[26] Hyperinflation episodes are observed for Zimbabwe from 2002 with an inflation rate of 140% to 2007 with an inflation rate of 24411%. Zambia recorded higher inflation rate from 1989 with a rate of 123% to 183% in 1993.

The effect of inflation on non-resource tax-to-GDP ratio, the so called “Oliveira-Tanzi effect" assumes a negative impact of inflation on tax revenue because of lags in tax collection. Indeed, with high inflation rate, the real value of taxes is likely to decrease between the date of implementation and the date that the tax is effectively collected. Nevertheless, through its upward effect on prices, wages and income, pure inflation increases tax revenue and nominal GDP by the same proportion suggesting that the tax revenue to GDP ratio will remain constant with inflation episodes. The effect of inflation on non-resource tax revenue is therefore a priori difficult to predict.

Resource taxes

The resource taxes in proportion of GDP, also used as explanatory variable in this study is extracted from the recent ICTD’s Government revenue dataset. Natural resources taxes might weaken the incentives and the efforts of the government to collect non-resource taxes. Therefore, in the estimations, it is expected a negative relationship between resource taxes and non-resource taxes.

Trade openness

Trade openness expressed as the sum of exports and imports as a percentage of GDP is expected to increase non-resource tax mobilization as trade openness stimulates trade volume and therefore trade taxes. However, in developing countries, trade liberalization policies have been implementing through cuts in tariffs. These measures have resulted in loss in tax revenue

Angola has also experienced hyperinflation episodes from over ten years (from 1992 to 2002) with an inflation rate of 1379.4% in 1993, 2671.8% in 1995 and 4145.1% in 1996.

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 non-resource tax revenue is a priori difficult to predict.

Agriculture value added

Agriculture value added as proportion of GDP is employed as a proxy of the structure or sectoral composition of the economy. In Africa, the agriculture sector in developing sector is dominated by a large number of smallholder farmers who produce for self-consumption or sell their output in informal markets or exchange theirs output for other goods[27]. In addition, most of the farmers in African countries do not keep modern accountings for the management of their farms. All these factors aforementioned contribute to make it hard for taxation of the agriculture sector in Africa (Fox and Gurley, 2005**;** Stotsky and WoldeMariam, 1997; Gupta, 2007**).** We therefore expected a negative effect of Agriculture value added on non-resource tax revenues in our estimations although some countries like Togo have lower agriculture value added but relatively high tax revenue-to-GDP ratio and Swaziland with low tax revenue-to-GDP ratio and low agriculture contribution to GDP (ATAF, 2017).

GDP per capita

GDP per capita measures the level of development. High level of development tends to be correlated with a higher capacity to pay and collect taxes. Moreover, high level of development goes together with high demand for public goods and services (Wagner's law). The impact of GDP per capita is therefore expected to be positive.

[27] It is typically subsistence agriculture (Drummond et al, 2012).

Table 1 provides descriptive statistics on averaged five non-overlapping years' data of all the variables from the sample used in the estimation for this study while table 2 in appendix compiles the sources of these variables. The average Gini net coefficient is 45% while the average Gini market is 48%. The average interdecile ratio (D1/D10) is 33.42 (table 1) suggesting that on average, the income of the richest is 33 times higher than that of the poorest in the SSA countries under investigation. The average non-resource tax revenue is equal to 13.32% of GDP, while resource taxes for the sample of countries under investigation account for 1.5% of GDP (table 1). The next section is devoted to the analysis of results obtained from the estimation of the impact of income inequality on non-resource tax revenue.

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gini net	158	44.991	8.444	26.966	67.558
Gini market	158	47.811	8.947	28.814	71.299
Poverty gap $ 1.90 a day	100	23.147	13.572	0.05	58.85
Poverty gap at $ 3.10 a day	100	38.701	15.729	0.270	70.41

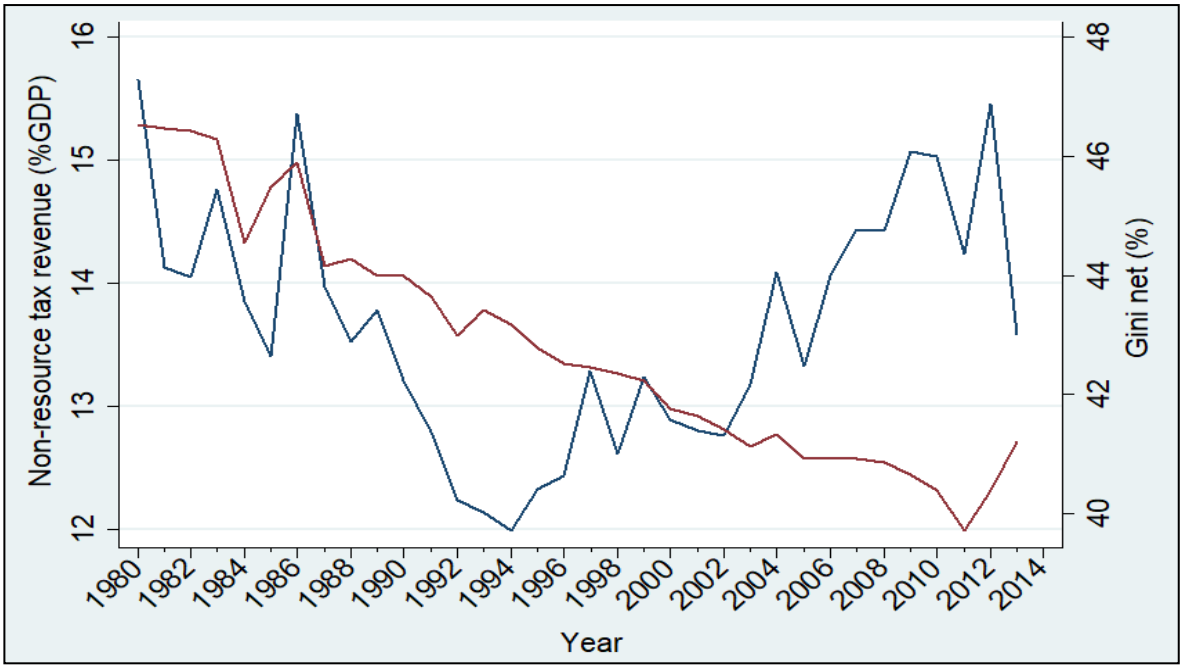
Resource taxes	154	1.507	5.502	0.00	35.555
D10/D1	66	33.418	35.686	6.538	188.970
non-resource tax revenue	154	13.323	7.029	3.157	41.521
Trade openness	158	70.927	35.571	15.855	192.325
Inflation	143	2.001	1.093	-1.639	7.298
Agriculture value added	154	29.622	15.561	2.032	59.480
GDP per capita	158	1020.359	1617.951	126.918	12010.1
Control of corruption	113	-0.541	0.571	-1.433	1.027
Democracy index	156	-1.164	14.518	-83.6	10
Political violence	113	-0.442	0.884	-2.268	1.070

Source: Author's calculation from SWIID5.0 (Solt, 2014), WIID3.0, WDI, ICTD-GRD (Prichard et al, 2014). D10: tenth decile; D1: first decile. GDP: Gross Domestic Product.

4.4 Inequality and Non-resource tax revenue trends

We get a first look at of the nature of the relationship between non-resource taxes and income inequality through a graphical analysis. Figure 2 depicts the relationship between income inequality and non-resource tax revenues in a sample of Sub-Saharan African countries over the period 1980–2013.

Figure 2: Non-resource tax revenue and Gini coefficient, unweighted average of 40 Sub-Saharan African countries, 1980-2013.



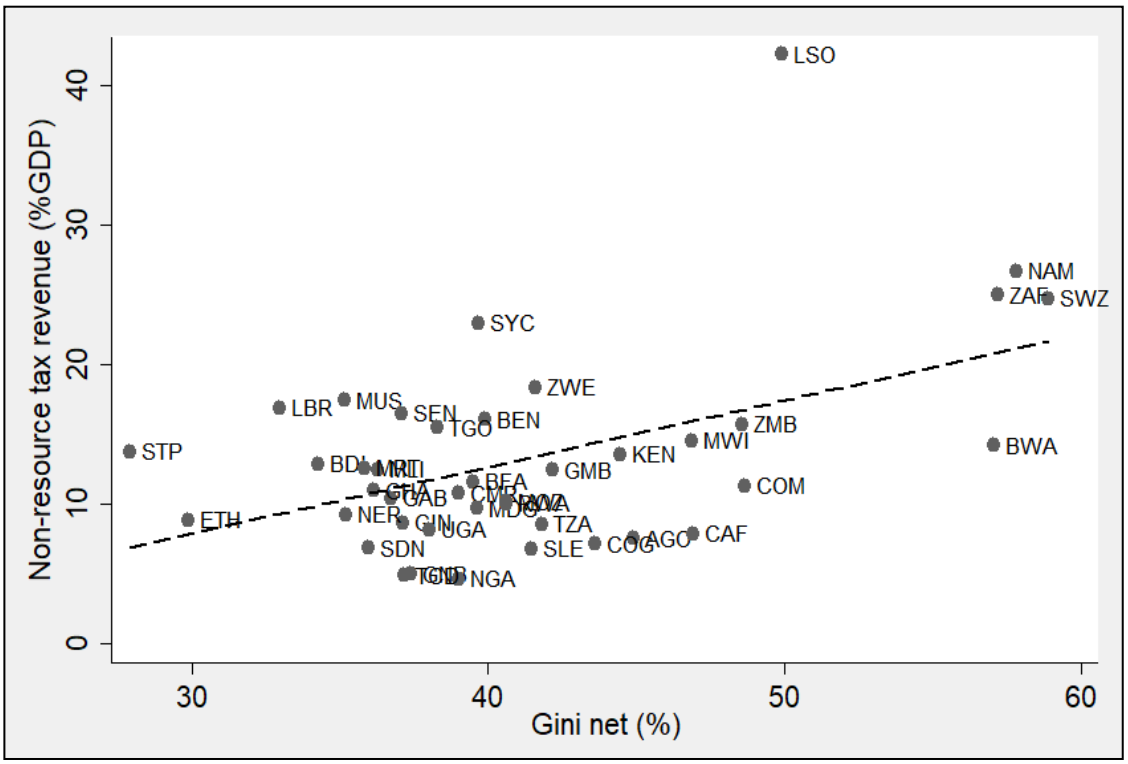
Source: Author's calculation from SWIID 6.2 (Solt, 2016) and ICTD-GRD (Prichard et al, 2014)

Figure 2 shows that while income inequality and non-resource tax collection have followed downward trend from 1980 to 1995, the Gini net coefficient (right axis) and non-resource tax revenue ratio (left axis) trends have diverged over the period 1995-2013. Non-resource tax revenue ratio decreases from 15.5% GDP to 12% GDP in 1994. Low commodity prices combined with economic recession in most of the Sub-Saharan African countries over this period could a factor that has contributed to slow down non-resource tax collection in these countries. However, from 1994-2010, non-resources taxes have drifted upward whereas the Gini index has keep declining over that sub-period. Non-resources taxes grew at 3 percentage point of GDP from 1994 to 2011. The Gini coefficient has declined by around 1.5 percentage point over the same period. However, the overall decline in Gini coefficient may mask individual pictures. UNDP (2017) documents the inequality has risen in most of the Southern and Central resource rich African countries over 1991-2011.

As highlight in figure 3, these countries have the highest average Gini coefficient over 1980-2013. Figure 3 shows that resources rich countries tend to have higher level of income

inequality while their performance in collecting non-resource tax revenue is relatively small than the non-resource rich countries in the continent. This is not to say resource dependence is fueling inequality as already outlined by UNDP (2017), but we have here indications that resource dependence may reduce effort to collect taxes from non-resource tax bases as indicated in the section on non-resource tax determinants. The trend line in figure 3 below shows positive correlation between Gini coefficient and non-resource tax revenue whereas countries like Liberia, Senegal, Mauritius, Togo, Burundi and Sao Tomé and Principle have moderate Gini coefficient but their non-resource tax performances is on average 16% of GDP. The trend line is in fact a correlation, not causality, suggesting that the relationship obtained from the graphical analysis could be biased by econometric problems like reverse causality from taxes to inequality and the existence of other factors that affect the inequality-taxes nexus (Yogo and Njie, 2018). We therefore undertake an econometric analysis to further explore the impact of income inequality on non-resource tax revenue collection.

Figure 3: Correlation between Gini coefficient and non-resource tax ratio, 1980-2013.



Source: Author's calculations from SWIID 6.2 (Solt, 2016) and ICTD-GRD (Prichard et al, 2014). Notes: AGO: Angola; BWA: Botswana; BFA: Burkina faso; BDI: Burundi; BEN: Benin ; COG: Congo; COM: Comoros ; CMR: Cameroon; ETH: Ethiopia; GAB: Gabon; GIN: Guinea; GMB: Gambia; KEN: Kenya; LBR: Liberia; MUS: Mauritius; MWI: Malawi ; NAM: Namibia; NER: Niger; NGA: Nigeria SDN: Sudan; SEN: Senegal; SLE: Sierra Leone; STP: Sao Tome and Principle; SYC: Seychelles; SWZ: Swaziland ; TCD: Chad; TGO: Togo; TZA: Tanzania; UGA: Uganda; ZAF: South Africa; ZWE: Zimbabwe; ZMB: Zambia.

5. Results from the estimation of the impact of inequality on non-resource tax revenue

We present the main results obtained from the estimation of the baseline equation as well as the ones obtained various robustness analyses we undertake to check whether the main results resist under certain circumstances.

5.1 Impact of income inequality on non-resource tax collection: baseline results

Before analyzing and commenting our results, it is important to outline that the regressions carried out with system GMM estimator pass all the standard diagnostic tests. There is no

evidence of second-order residual autocorrelation, and the Hansen test confirms that the set of instrumental variables are exogenous. In addition, for each system GMM regression carried out, the number of instruments does not exceed the number of countries (see bottom lines of tables 3, 4 and 5). Table 3 reports the results obtained from estimating the baseline specification (equation 1). The results show that the impact of Gini net coefficient on non-resource tax ratio is negative and statistically significant at 5%. The estimations indicate that one percentage point increase in the Gini net coefficient will lead to 0.42 percentage point reduction in non-resource tax ratio in Sub-Saharan African countries[28] (column 1 of table 3). This result suggests that income inequality is harmful for non-resource tax mobilization and therefore policy makers may consider reducing income inequality for enhancing non-resource tax revenue collection in Sub-Saharan Africa.

Regarding the standard determinants of tax revenues, in line with the literature on the topic, our results show that resource taxes negatively affect non-resource tax revenues (columns 1, 2 and 4 of table 3). This result could be explained by the fact that public revenues from natural resources may reduce the government's efforts to collect non-resource taxes (Brun et al., 2015; Crivelli and Gupta, 2014).

As expected, we find that agriculture value added is negatively associated to non-resource tax revenues in Subsaharan Africa (columns 1, 2 and 3 of table 3). This result is explained by the difficulty to tax the agriculture sector in developing countries (Fox and Gurley, 2005; Gupta, 2007; Stotsky and WoldeMariam, 1997), sector which is dominated by subsistence farmers in these countries (Drummond et al, 2012).

In line with the idea that trade openness stimulates trade volume, thereby trade taxes, we find that trade openness increases non-resource tax ratio in Sub-Saharan Africa (table 3). Regression

[28] The list of countries is given in appendix.

results indicate the existence of the "Oliveira-Tanzi effect" for Sub-Saharan African countries; inflation negatively affects the non-resource tax ratio in these countries (columns 1, 2 and 3 of table 3).

In contrast to the expectations, the impact of GDP per capita on non-resource tax revenue is negative and statistically significant in most of the regressions results reported in table 3. Similar results are in Gupta et al (2003) as well as in Gnangnon and Brun (2017)[29]. This result would be reflecting the failure of most of Sub-Saharan African countries to collect a large amount of taxes, relatively to their GDP due to the vulnerability of these countries to tax evasion and tax avoidance from individual taxpayers and corporations (Cobham, 2005; GIZ, 2010). In addition to the above-mentioned potential explanation, we think that in some African countries, the fact that growth is often spurred by natural resources sector could explain the negative effect of GDP on Non-resource tax revenue. Indeed, growth in GDP per capita could result from natural resources exploitation which could as well crowd out tax collection from non-resource sectors[30]. In these circumstances, the GDP per capita can increase while non-resource tax collection remains unchanged or even decreased because the increase in GDP per capita is mainly driven by natural resources exploitation rather than non-resource sectors. Clearly, while growth in GDP per capita is important for widening the tax base, it may not mechanically translate into higher tax revenue collection for the government (Besley and Persson, 2014), especially for economies granting significant tax incentives (Piketty and Qian, 2009).

[29]These authors argue that because the GDP of some developing countries are under-evaluated, an appropriate assessment of the GDP of these countries would result to lower tax ratio, explaining therefore the negative association between the income per capita and the tax effort.

[30]Brun et al (2015) and Crivelli and Gupta (2014) discusses some mechanisms through which natural resources exploitation can crowd out non-resource tax mobilization.

Finally, estimation results indicate that the coefficient of the lagged dependent variable is statistically significant at the 5% in all the specifications (columns 1, 2 and 3 of table 3), corroborating the prediction of inertia phenomenon in non-resource tax collection in Sub-Saharan Africa. Having found negative impact of income inequality on non-resource tax revenue, we submit this result to various robustness tests.

5.2. Robustness analysis

We carry various robustness analyses to check whether the negative impact of inequality on non-resource tax revenue found from the empirical analysis resist when some considerations are taken onboard.

5.2.1. Mitigating reverse causality problem: using of Gini market instead of Gini net.

We undertake a wide range of robustness check of our main findings. Persson (1995) indicates that taxes tend to be higher in countries where not only disposable income distribution, but also pre-tax income distribution is equally distributed. We therefore first test whether our results are robust when pre-tax income distribution instead of post-tax income distribution is used as the main explanatory variable. To do so, rather than using Gini net coefficient (Gini for disposable income), we use the Gini market (Gini before taxes and transfers) as the measure of income inequality. This approach has also the advantage to mitigate endogeneity problem due to reverse causality from taxes to Gini net coefficient since Gini market depends on markets forces (labor supply, factor prices) whereas Gini net varies with tax policies (Adam et al, 2015). Before running regressions, we carefully check whether Gini net and Gini market are different or not for the sample of African countries under consideration in this study. In fact, if Gini net and Gini market are the same, it would not be informative to test the two measures alternatively. Figure 3 in annex shows that, overall, Gini net and Gini market are different for all the countries under investigation. Estimation results using Gini market as a measure of inequality is reported

in column 2 of table 3. The elasticity of non-resource tax revenue to Gini coefficient is 0.44 almost equals to the elasticity value obtained when Gini net is used (0.42) as the main independent variable. The main result remains unchanged, income inequality has negative impact on non-resource tax revenue whatever the Gini index (market or disposable) considered as inequality measure.

5.2.2 Alternative source of Gini coefficient

Atkinson and Brandolini (2001) and Jenkins (2015) show that econometric results are likely to be affected by the choice of the database where the Gini coefficient is extracted. They recommend checking the consistency of results using alternative datasets as well as mentioning the potential drawbacks related to the choice of a specific database. In fact, some observations on Gini coefficient from SWIID 6.2 database (Solt, 2016) are generated from multiple imputation method. These data on Gini coefficient from SWIIID depend somewhat on the imputation model used, raising therefore the issue of quality and credibility of these data (Jenkins, 2015). We follow the recommendation of Atkinson and Brandolini (2001) and Jenkins (2015) by checking whether our main result resist to the change of the data source for the Gini index. We alternatively employ Gini coefficient from the World Development Indicators (WDI) of the World Bank instead of the one from SWIID. The Gini coefficients from the World Bank WDI are not obtained from regression-based methods as in SWIID (Solt, 2014; 2016); they have been directly calculated using available data from household surveys collected from government statistical agencies and World Bank country departments (See statistical notes on Gini coefficients from WDI). We do not claim that the Gini coefficient from the World Bank is free from criticism; however, the objective here is to raise the degree of confidence in our estimates by using various secondary data source for the Gini coefficient.

The estimation results when the Gini coefficient from the WDI is used are reported in column 3 of table 3. The observations significantly decrease with respect to the total observations with Gini coefficient from SWIID because of significant missing values in the WDI Gini data. Results show that the Gini coefficient from the WDI has negative and significant impact on non-resources tax revenue, suggesting that our main result remains qualitatively robust to alternative source of the Gini coefficient though quantitatively, the amplitude of the elasticity of non-resource taxes to inequality varies across Gini sources (columns 1, 2 and 3; table 3). We further push the robustness check in the next paragraph by examining whether the negative effect of inequality on non-resource tax revenue survives to alternative measure of income inequality.

5.2.3. Alternative measure of income inequality: interdecile ratio (D10/D1)

Despite its widespread use in empirical studies, the Gini coefficient is not free of criticism (Chitiga et al., 2014). In fact, the Gini coefficient can take the same value for different income distributions. For example, for an economy where 50% of the people have no income and the other half of the people has equal income, the Gini index is 0.5. Also, for an economy where all people have the same income except one wealthy family that hold 50% the country's total income, the Gini index will be 0.5. As highlighted by the example just given, the Gini coefficient is also sensible to outliers, a few very poor or very rich individuals can significantly modify the Gini index even in a large sample. In addition, the Gini coefficient is also criticized for being over sensitive to the income changes of middle income group (Atkinson, 1970) but less sensitive to a variation in the income of the poorest group (Ryu, 2013) and the richest group. Thus, our study takes into account the potential weaknesses of Gini coefficient to properly measure income inequality through the use of an alternative measure of income inequality. Thus, in the baseline specification, we replace the Gini coefficient by an interdecile ratio (the tenth decile (D10) divided by the first decile (D1)) which is a simpler and more

intuitive measure of inequality as indicated by Piketty (2015, p.10). The ratio D10/D1 measures the difference between the income of the 10% poorer individuals and the 10% richest individuals in the country. Income inequality aggravates as the ratio D10/D1 increases. We collect data on deciles (D1 and D10) from the World Income Inequality Database (WIID), version 3.3 of the United Nations University World Institute for Development Economics Research (UNU-WIDER, 2015). Estimation results displayed in column 4 of table 3 suggest that the interdecile ratio D10/D1 is negatively associated to non-resource tax revenue indicating that the main results of the study remain unchanged when an alternative indicator of income inequality is used. The number of observations significantly decreases because of large missing values in the deciles D1 and D10. Though, this may reduce the statistical power of the inferences from the estimation, this result however provides indications that the negative impact of inequality on non-resource tax revenue is not driven by the selected income inequality indicator.

Table 3: Effect of income inequality on non-resource tax revenues

Log(Non-resource tax revenue)	(1) Gini net	(2) Gini market	(3) Gini World Bank	(4) Interdecile ratio
L.log(Non-resource tax revenue)	0.529***	0.532***	0.622***	0.559***
	(0.084)	(0.080)	(0.106)	(0.112)
Log (Agriculture value added)	-0.353***	-0.370***	-0.287***	-0.122
	(0.093)	(0.092)	(0.097)	(0.147)
Resource taxes	-0.012***	-0.012***	-0.008	-0.073**
	(0.002)	(0.002)	(0.004)	(0.030)
Log(GDP per capita)	-0.277***	-0.295***	-0.203***	-0.098
	(0.097)	(0.104)	(0.071)	(0.174)
Log(trade opennes)	0.378***	0.397***	0.288***	0.304***
	(0.068)	(0.071)	(0.093)	(0.093)
Inflation	-0.04**	-0.041**	-0.021	-0.043**
	(0.017)	(0.018)	(0.016)	(0.017)
Log(Gini net)	**-0.420****	**-0.449***	**-0.011****	
	(0.197)	**(0.233)**	**(0.004)**	
D9/D1				**-0.002*****
				(0.000)
Constant	4.208***	4.427***	2.598***	1.034
	(0.918)	(0.929)	(0.776)	(1.064)
Observations	106	106	69	36
Number of countries	35	35	31	19
Hansen, pvalue	0.218	0.172	0.160	0.862
Number of instruments	26	26	24	15
ar2, pvalue	0.246	0.217	0.252	0.507
ar1, pvalue	0.021	0.023	0.099	0.017

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

5.3 Analysis of transmission channels of inequality to non-resource tax revenue.

In section 2, the discussion on the mechanisms through which inequality may affect tax collection highlight that the institutions, political regime, sociopolitical instability and tax compliance are potential transmission channels of inequality to tax revenue. Thus, adding each of these variables as a control in the baseline specification may only lead to a weak impact of inequality. This is the background approach[31] we follow to test for the transmission channels of income inequality to non-resource tax revenue in Sub-Saharan Africa.

Democracy

The median voter model early presented (section 2) highlights that we cannot ignore political regime considerations, especially democracy in the analysis of the effect of inequality on tax effort. In democratic system, policy makers are most likely to consider the median voter aspirations for more redistribution and therefore increase taxes on higher income (Adam et al, 2015). Furthermore, democracy is expected to increase non-resource tax revenues mobilization because this form of government is supposed to take into consideration the social welfare of the majority of the population, which requires larger tax revenue collection (Ehrhart, 2009; Gupta, 2007). We therefore control for the effect of democracy in the baseline specification. We collected data on democratic regime from Polity IV (Marshall et al., 2014) with higher values indicating better values of democracy in the country under consideration. Results show that the impact of democracy on non-resource tax revenue is positive but not significant (column 1, table 4) while the Gini coefficient is still negatively associated to non-resource tax revenue indicating that the impact of inequality on non-resource tax revenue does not transit through the level of democracy.

[31] Berg et al (2018) follow a similar approach to capture channels through which inequality may affect growth.

Tax compliance

As already discussed, higher income inequality can discourage some taxpayers from complying with tax payments as they can estimate that tax revenue are benefiting to few individuals in the society. We therefore need to take into account this consideration by controlling for the effect of tax compliance on non-resource tax revenue in the baseline specification. Because of lack of reliable data on tax compliance for African economies, we use government investment as a proxy of tax compliance since the availability of public goods and services gives strong incentives to taxpayers to comply with tax payments (Alm et al, 1992). Data on general government investment have been taken from the IMF Investment and Capital Stock Dataset (IMF, 2017). Counter intuitively, we find that government investment used as proxy of tax compliance is strongly and negatively associated to non-resource tax revenue (column 3, table 4). The explanation of this result is not straightforward, but if the major share of government investment is realized in natural resources sector, it is possible to observe a negative relationship between government investment expenditure and non-resource tax revenue collection since a focus on natural resource sectors expansion tends to exert a crowd out effect on non-resource tax collection (Brun et al., 2015; Crivelli and Gupta, 2014).

Furthermore, we find that the estimated coefficient for the Gini index (-0.338) is smaller than the one obtained with the estimation of the baseline equation in absolute values (-0.420). This result corroborates the prediction that income inequality may affect non-resource tax collection through tax compliance. This result is quite interesting as it gives a key message to policy makers that in Sub-Saharan African countries taxpayers' may not comply with their tax payment obligations because of existing high income inequalities in the country.

Political instability

In the discussion on how income inequality affects tax revenue mobilization, we indicated that higher income inequality can fuel political instability and significantly disturbs tax collection. We therefore need to control for the effect of political instability to properly isolate the effect of income inequality on non-resource tax ratio. We use the indicator of absence of political violence and terrorism developed by Polity IV (Marshall et al., 2014) to measure political stability in the country with higher values indicating more political stability and absence of violence in the country. Regressions results show more stable countries could collect more non-resource tax revenue (column 3, table IV) even if this effect is not statistically significant at the conventional significance levels in our regressions. This result suggests that the impact of inequality on non-resource tax revenue is not channeled through political instability for the sample of countries under investigation. Nonetheless, here again, our main result remains unchanged; income inequality has negative impact on non-resource tax revenue.

Control of corruption

The level of corruption in the country may affect its tax collection performances. In fact, some taxpayers may erode their tax bases in complicity with tax administration official. We control for the impact of corruption in non-resource tax revenue. To do so, we include the indicator "control of corruption "developed by Polity IV (Marshall et al., 2014) with higher value indicating less corruption. We find that non-resource tax revenue collection goes in pair with the control of corruption (column 4, table IV) suggesting that Sub-Saharan African countries should pursue their efforts in reducing corruption for enhancing non-resource tax revenue mobilization. As usual, the estimated coefficient for the Gini index is negative and statistically different from zero at 5% threshold. Our main result remains robust when we take into account the quality of institutions captured by the country's effort to combat corruption. In absolute value, the estimated coefficient for the Gini index when the variable "control of corruption" is

included in the baseline specification (-0.400) is lower than the one obtained from the estimation of the baseline equation (-0.420). This result suggests that control of corruption is likely to be a channel through which inequality affect non-resource taxes. The corruption channel for the impact of inequality on non-resource tax revenue is understandable and reasonable even if it has not been highlighted in the theoretical discussions on transmission channels. In fact, higher income inequalities in the society could render more vulnerable to corruption some taxpayers and tax administration staff[32] (especially those who may like to reduce the gap between their income and rich individuals' income) and thereby negatively impact tax revenues

[32] In their study of the impact of corruption on inequality, Gupta et al (2002) consider that affect income inequality could affect corruption and thereby use instrumental variable technique to address reverse causality bias from income inequality to corruption.

Table 4: Inequality and non-resource tax revenue: Testing for transmission channels.

Log(Non-resource tax revenue)	(1)	(2)	(3)	(4)
L.log(Non-resource tax revenue)	0.498***	0.379***	0.596***	0.402***
	(0.066)	(0.076)	(0.084)	(0.070)
Log(Agriculture value added)	-0.296***	-0.402***	-0.346***	-0.410***
	(0.0859)	(0.0921)	(0.0550)	(0.0953)
Resource taxes	-0.012***	-0.018***	-0.0004	-0.017***
	(0.002)	(0.002)	(0.004)	(0.002)
Log(GDP per capita)	-0.221**	-0.250**	-0.293***	-0.288***
	(0.084)	(0.091)	(0.034)	(0.104)
Log(Trade openness)	0.365***	0.347***	0.339***	0.365***
	(0.061)	(0.069)	(0.044)	(0.088)
Democracy	0.0004			
	(0.000)			
Inflation	-0.042***	-0.045***	-0.038***	-0.037*
	(0.012)	(0.015)	(0.012)	(0.021)
Log(Gini net)	**-0.306****	**-0.368****	**-0.434***	**-0.400****
	(0.130)	**(0.143)**	**(0.233)**	**(0.163)**
Absence violence and terrorisme (political stability)		-0.029		
		(0.049)		
Government investment (tax compliance)			-0.012***	
			(0.003)	
Control of corruption				0.001***
				(0.000)
Constant	3.387***	4.521***	4.353***	4.759***
	(0.588)	(0.896)	(0.979)	(0.830)
Observations	105	90	106	90
Number of countries	34	35	35	35
Hansen, pvalue	0.466	0.371	0.448	0.194
Number of instruments	31	28	33	25
ar2, pvalue	0.335	0.492	0.863	0.431
ar1, pvalue	0.027	0.036	0.028	0.030

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

6. Poverty and Non-resource tax revenue in Sub-Saharan Africa

The estimation of the impact of inequality on non-resource tax revenue in the first part of this chapter indicates that inequality constrains non-resource tax revenue collection. In this part, we estimate the impact of poverty on non-resource tax revenue for Sub-Saharan African countries. We start by the examination of the empirical model that will be used in this regard.

6.1 Empirical model specification

The empirical model utilized to estimate the impact of poverty on non-resource tax revenue is similar to the one used to estimate the impact of inequality on non-resource tax revenue. We

just replace the Gini net coefficient by a poverty index in the baseline specification (equation 1) to estimate the impact of poverty on non-resource tax revenue. Annual data on poverty rates for sub-Saharan African countries are scarce. To our knowledge, the only database which provides data on poverty rates at national level for African economies is the World Development Indicators (WDI) database of the World Bank. However, missing values on poverty ratio data from WDI are so high for most of the African economies that it is not reliable to carry out regressions including poverty data by using a panel of only sub-Saharan African countries because the total number of observations would be so small that one could cast doubt on the statistical power of the inferences. We therefore run regressions on a large panel of 83 developing countries and capture the specificity of the sample of sub-saharan African countries used for the regressions with the Gini coefficient in the first part of this chapter. Thus, Sub-Saharan African countries are captured through a dummy variable labeled SSA which takes the value 1 if the country belongs to SSA region and 0 otherwise. More precisely, we estimate the following empirical model:

$$Log(Tax^{NR})_{it} = \alpha + \delta Log(Tax_i^{NR})_{it-1} + \beta_1 Log(\mathbf{Pov})_{it} + \beta_1 Log(\mathbf{Pov})_{it} * SSA + \theta X_{it} + \vartheta_i + \mu_t + \varepsilon_{it} \quad (2)$$

where $Tax^{NR}i$, t is the non-resource tax revenues in % of GDP for country i in period t and $Tax^{NR}i,t$-1 is its value in period t-1. θX_{it} stands for other

determinants of tax revenues including GDP per capita, trade openness, inflation, agriculture value added and resource taxes. ϑ_i represents country fixed effects (included to control for unobservable characteristics that are potentially correlated with non-resource tax revenue) and μ_t are time dummies included to control for time-varying shocks that affect all developing countries. Pov_{it} is the poverty indicator in country i in period t. After the specification of the empirical model, we discuss the choice of the poverty indicator.

6.2 Measurement of poverty and data

There is a large literature on the measurement of poverty. Each measure of poverty highlights different aspects of poverty (Atkinson, 1987; Foster et al., 1984; Sen, 1976) since poverty is perceived as a multidimensional concept (Bourguignon and Chakravarty, 2003). Nonetheless, there are two main categories of poverty indicators in the literature namely monetary poverty indicators and nonmonetary poverty indicators. The monetary poverty indicators analyze poverty in terms of insufficient income while nonmonetary poverty indicators suggest the inclusion of the social dimension in the analysis of poverty. Indeed, an individual with a low income can considered himself non-poor when he feels that he is receiving considerations from his peer and he is useful in the life and in the decision-makings of his community. Finding data on non-monetary poverty indicators for a large number of developing countries over long period is a real challenge. Accordingly, the poverty measures used in this study are restricted to monetary poverty indicators. More specifically, we use the international poverty index developed by the World Bank: the poverty gap at $1.90 a day (2011 ppp). It measures the shortfall in income or consumption from the poverty line ($1.90 a day) in the total population (the zero shortfall corresponds to non-poor individuals) expressed in proportion of the poverty line. The poverty gap at $1.90 a day reflects the depth and the incidence of poverty and it is comparable among countries.

The incidence of poverty is measured by the proportion of the population whose income falls under the poverty line while the depth of poverty is the average gap between the poverty line and the income of individuals considered poor. The poverty gap ratio tells us the minimum resources that needed to be transferred to poor individuals to lift them out of poverty. The data on poverty gap at $1.90 a day (2011 ppp) has been extracted from the WDI database.

6.3 Econometric issues and estimation method

After this brief overview on the measurement, we discuss the econometric issues that could rise in the estimation of equation 2.

As already mentioned in the paragraph dealing with the estimation of equation 1, the correlation between the lagged dependent variable (one period lagged value of non-resource tax revenue) and the unobserved country fixed effects raise the well-known problem of panel data bias suggesting that the lagged dependent variable is endogenous and thereby estimating the equation 2 with ordinary least squares estimators would deliver biases estimates for the coefficient of the lagged dependent variable. The second issue is related to the potential endogeneity of the poverty ratio. Indeed, poverty may affect non-resource tax revenue through the decline in the households' consumption of goods and services and the slowdown of economic business in the country as well as in social troubles that it may generate. Inversely, the government may choose to increase non-resource tax revenues to finance poverty reduction programs, resulting in reverse causality between the poverty ratio and the non-resource tax revenues, and therefore the endogeneity of the variable poverty.

These endogeneity problems should be corrected in order to avoid a bias in the estimation of non-resource tax ratio effect of poverty. We use the system GMM estimator (Blundell and Bond, 1998) to correct for the endogeneity problems of the poverty and the lagged dependent variable (one period lagged value of non-resource tax ratio).

6.4 Impact of poverty on non-resource tax revenue: Estimation results

The table 5 reports the results obtained by estimating equation (2) with the system GMM estimator. As indicated in column 1, the coefficient of the poverty index is negative for sub-Saharan African countries and for all the developing countries suggesting that an aggravation of poverty gap at US $1.90 leads to lower non-resource tax revenue collection in SSA. The

estimates indicate that 1% increase in the poverty gap at $1.90 a day results in a decrease of 0.05% in the non-resource tax ratio (column 1, table 5).

In column (2) if table 2, we use an alternative measure of the poverty to test the robustness of our results to a change in the measure of the poverty. We now use as poverty index, the poverty gap at 3.10 US dollar a day directly extracted from WDI database, the World Bank. As suggested by column (2), an increase of 1% in the poverty gap at $3.10 a day will also result in a decrease of 0.05% in the non-resource tax revenues collection.

Table 5: Poverty and non-resource tax revenue in sub-Saharan Africa.

Log (Non-resource tax revenue)	(1) Poverty gap at $1.90/day	(2) Poverty gap at $3.10/day
L. log (non-resource tax revenue)	0.479***	0.418***
	(0.0548)	(0.0703)
Log (agriculture value added)	-0.0677	0.008
	(0.067)	(0.072)
Resource taxes	-0.004	-0.003
	(0.005)	(0.005)
Log (GDP per capita)	-0.057	0.014
	(0.035)	(0.039)
Log (trade openness)	0.049	0.072*
	(0.035)	(0.040)
Inflation	-0.005	-0.014
	(0.009)	(0.012)
Log(poverty gap $1.90/day)	-0.050***	
	(0.010)	
Log(poverty gap $1.90/day)*SSA	-0.051*	
	(0.026)	
Log(poverty gap at $ 3.10 / day)		-0.049***
		(0.017)
Log(poverty gap $3.10 / day)*SSA		-0.052**
		(0.024)
Observations	255	256
Number of countries	83	83
Hansen, pvalue	0.498	0.427
Number of instruments	30	30
ar2,pvalue	0.664	0.736
ar1,pvalue	0.005	0.008

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

7. Conclusion

Non-resource tax revenue mobilization is imperative for responding to the Sub-Saharan African countries' financing needs. This chapter estimates the impacts of income inequality and poverty on non-resource tax revenue. The system GMM estimator is the estimation method used to deal with the endogeneity issues of the Gini coefficient, the poverty ratio and the one-period lagged value of non-resource tax revenue. The estimations are carried out using 5-years averages panel data for 36 Sub-Saharan African countries over the period 1980-2013.

Results indicate that income inequality has negative and statistically significant impact on non-resource tax revenue. This result is robust both for the inclusion of various additional control

variables in the baseline specification, the use of an alternative source of Gini index and an alternative indicator of income inequality. Moreover, our results provide preliminary evidence that inequality seems to affect non-resource tax revenue through lower tax compliance and higher corruption channels. Regarding poverty, we find that poverty gap at $1.90 per day is negatively associated to non-resource tax revenue. This result remains unchanged when poverty gap at $3.10 per day is used as the measure of poverty. In terms of policy implication, our conclusions help inform policymakers that reducing income inequality and poverty could be viewed not only as a crucial dimension of development or a vector of social justice, but also an important lever for non-resource tax revenue mobilization in Sub-Saharan African countries.

Appendix

List of countries:

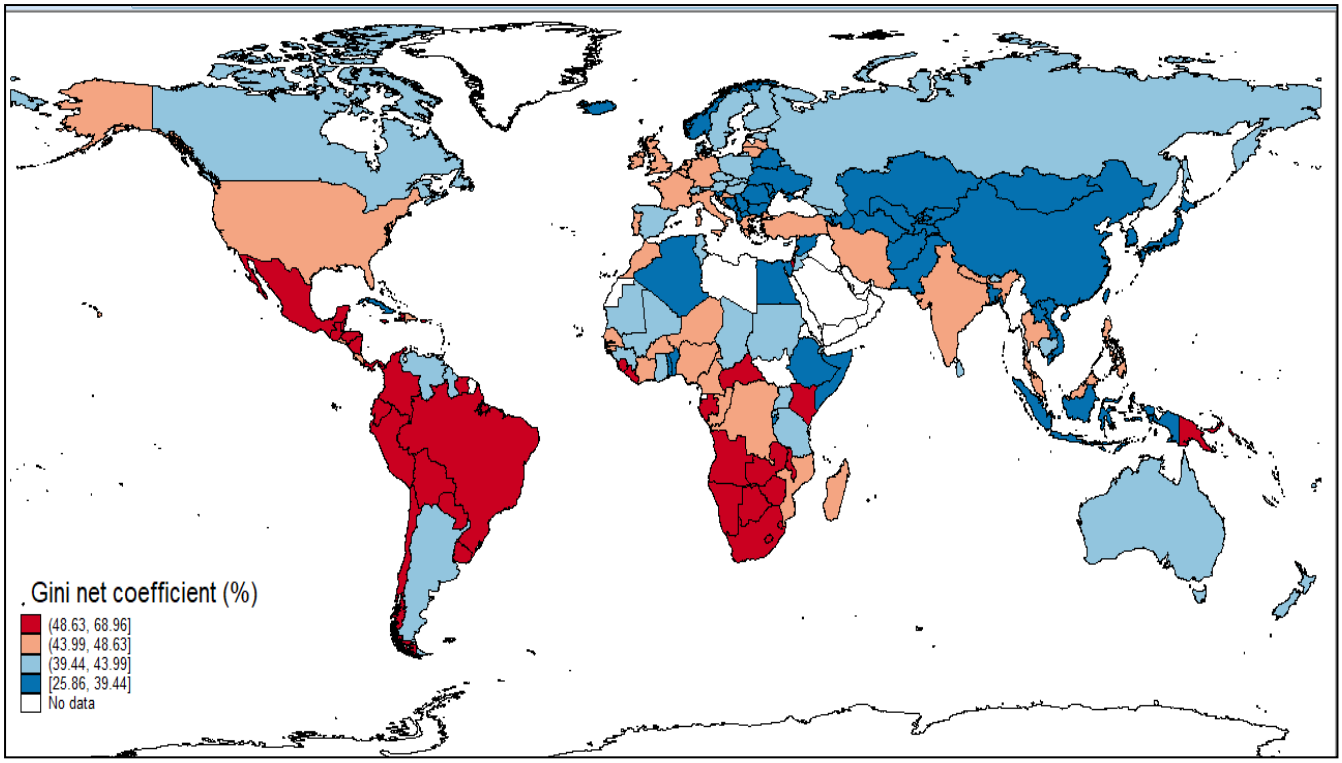
Sub-Saharan African countries

Angola, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Central African Republic, Chad, Comoros, Cote d'Ivoire, Djibouti, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Developing countries

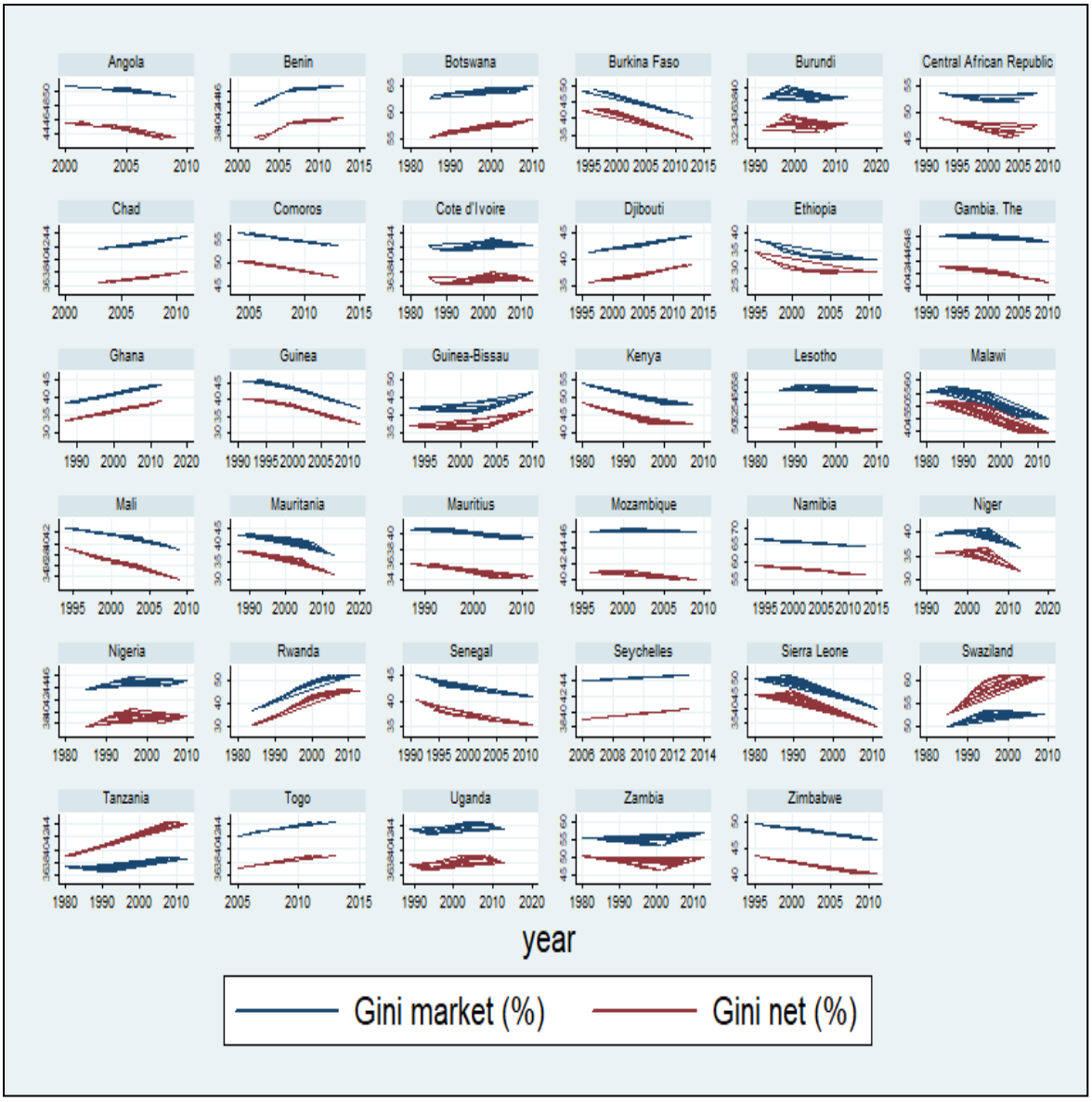
Afghanistan, Albania, Algeria , Armenia, Azerbaijan, Bangladesh, Belarus, Belize , Bhutan Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Cambodia , Chile, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Georgia, Guatemala, Guyana Honduras, India, Indonesia, Jordan, Kazakhstan , Kyrgyz, Lao, Lithuania, Macedonia, Malaysia Maldives, Mauritius, Mexico, Moldova, Mongolia, Morocco, Nicaragua, Pakistan, Panama Papua New Guinea, Paraguay, Peru, Philippines, Serbia , Sri Lanka, St. Lucia, Suriname, Syria Tajikistan, Tunisia, Ukraine Uruguay, Venezuela, Vietnam.

Figure 1: Spatial distribution of Gini coefficient around the world



Source: Authors calculations using Gini coefficient from SWIID 5.0 (Solt, 2014).

Figure 3: Gini net and Gini market in Sub-Saharan Africa, 1980-2013



Source: Author's calculations from SWIID 5.0 (Solt, 2016).

Table 2 : Data sources

Variables	Data sources
Gini net and Gini market coefficients	SWIID, Versions 5.0 and 6.2 (Solt, 2014, 2016)
Non-resource tax revenues (excluding social contribution) in % of GDP	International Center of Taxation and Development (ICTD) (Prichard et al, 2014)
Resource taxes revenues in % of GDP	International Center of Taxation and Development (ICTD) (Prichard et al, 2014)
GDP per capita (constant dollar 2005 US $)	WDI, the World Bank
Trade openness (sum of imports and exports in GDP)	WDI, the World Bank
Agriculture value added in % of GDP	WDI, the World Bank
Poverty gap at 1.90 USD; poverty gap at 3.10 USD	WDI, the World Bank
General government investment	IMF Investment and Capital Stock Dataset (IMF, 2017).
Deciles D1 and D10	WIID, version 3.3, UNU WIDER
Inflation	Our calculations based on consumer index prices from WDI
Democracy index, absence of political violence and terrorism indicator, control of corruption	Polity IV (Marshall, Gur and Jaggers, 2014)

Brief description of the GMM estimation technique.

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

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

Where is $y_{i,t}\ is$ 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 rewriting as:

$$y_{i,t} = \delta y_{i,t-1} + \beta X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (2)$$

The estimation of equation (2) with FE estimator will produce biased estimates due to the fact that the lagged dependent variable is included among the explanatory variables (dynamic model). Two estimation techniques are usually used for estimating dynamic panel data model for which in addition to the lagged dependent variable, other 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 generalized moment:

$$y_{i,t} = \delta y_{i,t-1} + \beta X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t} \quad (3)$$

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

Note that the transformation in 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 level are instrumented by the variables in first differences 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 first difference

$$E\left[y_{i,t-s}.(\varepsilon_{i,t} - \varepsilon_{i,t-1})\right] = 0 \; for \; s \geq 2; t = 3, \ldots., T \; (5)$$

$$E\left[X_{i,t-s}.(\varepsilon_{i,t} - \varepsilon_{i,t-1})\right] = 0 \; for \; s \geq 2; t = 3, \ldots., T \; (6)$$

For the equation in level

$$E\left[(y_{i,t-s} - y_{i,t-s-1}).(\mu_i + \varepsilon_{i,t})\right] = 0 \; for \; s = 1 \; (7)$$

$$E\left[(X_{i,t-s} - X_{i,t-s-1}).(\mu_i + \varepsilon_{i,t})\right] = 0 \; for \; s = 1 \; (8)$$

The conditions (5) to (6) are combined with the generalized method of moments for estimating the coefficients of the model. 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 Africa: The Role of Tax Policy.

Chapter 3: Domestic and Cross Border Spillover Effects of Corporate Tax Policy in Africa from tax revenue perspectives[33]

Abstract

This chapter examines spillover effects in corporate tax policy for African economies. Using a balanced panel data in statutory corporate income tax (CIT) rate for 34 African countries over the period 1995-2013, we find positive interaction between CIT rates in Africa only when common time trend effects are not controlled. We conclude that the evidence of pure corporate tax competition among African countries is weak. These countries' tendency to implement similar fiscal policies under the common intellectual assistance may explain the positive slope reaction between their CIT rates. Regarding corporate tax base spillovers, estimation results indicate that cuts in foreign countries' average corporate tax rate reduce the host country's corporate tax base. If the host country reacts to cut in foreign countries tax rates by cutting its own CIT rate in the same proportion, this could ultimately result in a net erosion of its corporate tax base of 0.4% GDP, representing a loss of corporate tax revenue by 2.3% GDP. Moreover, we find strategic complement responses in corporate tax base policies suggesting that countries react to measure that tend to reduce corporate tax liability (tax incentives) in other countries by also undertaking similar measures.

JEL codes: E62, H25, H77, H87.

Keywords: Tax competition, Corporate income tax, Instrumental variable estimation, System GMM, Africa.

[33]A version of this chapter is under review in the *Review of Development Economics*

1. Introduction

For attracting foreign investments, countries may have strong incentives to engage in tax competition through the lowering of their corporate tax burden. From market economy perspective, competition is desirable as it could stimulate competitiveness. But, competition between countries for attracting foreign investments through special tax treatments could lead these countries to erode each other's tax revenues and thereby reducing their capacities to finance development. Corporate income tax (CIT) competition has particularly important implications for African economies because of the significant role played by the corporate income tax in tax revenue collection in these countries. The fact that corporate tax competition is likely to put downwards pressure into a key revenue source, namely corporate tax revenue is worrisome and therefore needs a particular attention. However, it is argued that tax competition may improve the efficiency of the public sector in the management of government revenue (the "starve the beast" argument). In fact, since the governments know that CIT competition is exerting downward pressures on tax revenues, they will be motivated to efficiently use the limited public revenue to properly respond to the demand of citizens and electors. International tax competition will remain for long at the heart of international taxation issues. This will be exacerbated with growing international mobility of capitals suggesting that multinationals can use transfer prices and other tax avoidance techniques to shift their real investments and profits from high tax jurisdictions to low tax jurisdictions. But they can't shift their real investments and profits out of our planet suggesting that coordination of tax rules among countries could somewhat mitigate tax competition related issues. To better understand this issue, it is important to analyze the cross-border impact of national corporate tax policies and how host governments react to changes in international corporate tax policies.

For OECD countries, Devereux et al. (2008) explain the fall in corporate tax rate by corporate income tax (CIT) rate competition between these countries. Casette and Paty (2008) find the

existence of tax interdependence within Western European countries. These authors also find tax interactions between Western and Eastern European countries. Recently, Chen et al. (2014) test and find the existence of CIT rate competition among South Asian countries.

Except the paper of Klemm and Van Parys (2012), there is no study that has investigated on corporate tax rate interaction among African economies[34]. However, the analysis of Klemm and Van Parys (2012) relies on uniform weight matrix to test interdependencies among African CIT rates whereas this connection matrix is usually used to test for the existence of common policy environment which steers tax rates in the same direction not for testing the existence of pure tax competition (Caldeira et al., 2015; Casette and Paty, 2008). Furthermore, these authors test corporate tax rate competition in Africa using a panel data including Latin America and Caribbean (LAC) countries. They capture African countries through the weighting matrix attributing the value 1 for economies belonging to Africa and 0 otherwise. This approach is likely to exacerbate the heterogeneity problems and one would wonder whether the results obtained for African economies are not driven by the presence of LAC countries in the panel. Furthermore, the sample which these authors used includes 22 African economies while our regressions are carried out on 34 African countries since it is better to include as much as possible a large number of countries for getting a robust and general conclusion regarding corporate tax rate interactions between African economies. Furthermore, the extension of the sample size reduces the risk of conducting the analysis with mainly cooperative tax jurisdictions or non-cooperative fiscal jurisdictions. For instance, Tunisia and Seychelles which are often been under radar as tax havens (see Jones and Temouri, 2016) are not in the sample used by Klemm and Parys (2012) for their analysis of tax competition in Africa.

[34]Yet, as shown in figure 1 (Appendix), 34 over 36 African countries have reduced their statutory corporate tax rate from the year 1995 to 2013.

Furthermore, Klemm and Van Parys (2012) have estimated two reaction functions to analyze strategic interactions in setting tax holidays and investments allowances. However, this approach does not capture the possibility for a country to react on changes in tax holidays in competing countries by changing its investments allowances rules while keeping unchanged its tax holidays and vice versa. Our study takes onboard this consideration by estimating interaction between the overall corporate tax base rather than interactions between each specific tax instrument which affects the corporate tax base. The present chapter therefore aims to advance the literature on tax competition through the analysis of the tax base effects of changes in foreign corporate tax rates and tax bases in Africa. In fact, tax competition could occur through interactions between tax bases on the one hand and between tax rates and tax bases of the competing tax jurisdictions on the other hand. To our knowledge, the first study that empirically tests the existence of tax competition by considering both strategic spillovers through interaction between tax rates and tax base on the one hand and between corporate tax bases among tax jurisdictions for African economies[35]. We emphasized that such spillovers have tax revenue implications for African countries.

The rest of the chapter is structured as follows: Section 2 provides theoretical framework of a simple tax competition model. Section 3 develops the econometric methodology used to test CIT rate competition in Africa. Section 4 presents the data and discusses the choice of the tax rate variable used as tax competition tool. The section 5 presents and analyses the results obtained from the estimation of tax rates reaction function. In section 6, we turn to the analysis of corporate tax base spillover effects in Africa and the section 7 concludes the study.

[35] Experts consider that corporate income tax bases interactions are more critical than corporate income tax rate interactions between tax jurisdictions.

2. A simple theoretical framework of corporate tax competition

In a context of tax competition, a country i chooses its tax rate (τ_i) on capital to maximize its objective function (S_i).

The objective function (S_i) depends on the capital stock in country i (k_i).

The utility function of country i is derived from tax revenues collected in this country (Rota Graziosi, 2018) and a representative citizen's welfare in country i.

$S_i = U [C_i (k_i), G_i, X_i] + \tau_i \, k_i$

With $C_i = [f_i (k_i) – k_i \, f'(k_i)] + \theta_i \, \delta K$ the consumption of the representative citizen.

fi(k) is the production function of the private good. $f_i (k_i) – k_i \, f'(k_i)$ is the income (remuneration of labor) with $f'(k_i)$ the marginal product of capital in country i.

$\theta_i \, \delta K$ is the revenue from capital.

θ_i is the share of capital stock held by the representative citizen of country i.

G_i is the consumption of public goods and services. As government finances its expenditure using taxes, G_i is a function of tax rate and capital stock $G_i (\tau_i, k_i)$.

X_i represents socio economic characteristics of country i (consumer preferences, production technology) affecting its capital taxation setting.

In a globalized world with high mobility of factors, firms are looking for the place where the after-tax return is higher to locate their productive investments.

At the equilibrium, the after-tax return from investments (r) is the same in all the countries. If we consider two countries i and j, this implies that $r_i = f'(k_i) - \tau_i = r_j = f'(k_j) - \tau_j$.

The first derivative of after-tax return with respect to tax rate yields:

$$\frac{\partial r_i}{\partial \tau_i} = f^i_{kk} \cdot \frac{\partial k_i}{\partial \tau_i} - 1$$

$\frac{\partial r_i}{\partial \tau_i} = 0$ implies that $f^i_{kk} \cdot \frac{\partial k_i}{\partial \tau_i} = 1$ and therefore, $\frac{\partial k_i}{\partial \tau_i} = 1 / f^i_{kk} < 0$ since the second derivative of the production function f^i_{kk} is negative (decreasing marginal productivity law).

The relation $\frac{\partial k_i}{\partial \tau_i}$ =1/ f^i_{kk} < 0 suggests that the stock of capital in country i negatively react to an increase in capital taxation in country i.

Accordingly, as the global stock of capital (Kw) is assumed to be fixed at each given unit of time, the capital stock in country j will increase (everything is equal else) as capital taxation in country i increases.

We get $K_w = K_i + K_j$ implies that $K_j = K_w - K_i$. A reduction in K_i may increase K_j.

In sum, the capital stock in a particular country i appear as a function of corporate tax rate in this country (τ_i) and the corporate tax rate in other countries (τ_j).

$K_i = k(\tau_i , \tau_j.)$

The substitution of K_i in the utility function of the country i gives:

$S_i = U[C_i (k(\tau_i , \tau_j.)), G(\tau_i, k(\tau_i , \tau_j.).), X_i] + \tau_i\ k(\tau_i , \tau_j.)$.

$\tau_i = h(\tau_j., X_i)$.

As capital inflows increase with a decrease in corporate tax rate, each country will react to cuts in other countries tax rate by cutting its own rate to avoid the flight of capital. The slope of the tax reaction function is therefore assumed to be positive (Wildasin, 1991, pp.399-400).

3. Empirical analysis on the existence of CIT rate competition among African economies

To achieve this study's objective, we specify a Nash tax reaction function (Chen et al., 2014; Devereux et al., 2008; Klemm and Van Parys, 2012) in which country's i CIT rate reacts to a change in its neighboring countries j CIT rates and a set of explanatory variables that are likely to affect its setting. Our empirical model is aligned with the model used in tax competition studies classified as "Second-Generation Direct Studies" by Leibrecht and Hochgatterer (2012) in their literature survey in tax competition. Second-generation direct studies use tax reaction functions for explicitly modeling strategic interaction in CIT rate settings between independent tax jurisdictions. There is strategic interaction when an action on the tax policy of country i for

attracting capital influences country j capital stock. Consequently, country j may react by modifying its tax policy toward capital attractiveness suggesting that in addition to the domestic environment that govern tax policy setting, the optimal corporate tax rate choice of country i depends on country j's corporate tax rate and vice versa (Franzese and Hays, 2009). More specifically, cut in the CIT rate of country i would lead country j to also reduce its CIT rate (Devereux et al., 2008; Franzese and Hays, 2009).

Nash games and Stackelberg games are the theoretical framework used to model strategic interactions in tax rate settings. Nash tax reaction functions type consider simultaneous tax setting strategies while Stackelberg tax reaction functions are founded on the idea that other countries (followers) react to a change in the tax rate setting of a "leader" tax jurisdiction (Altshuler and Goodspeed, 2002).

Empirically, for modeling strategic interactions, Nash game framework included among the determinant of CIT rate in country i, (τ_{it}), the weighted average CIT rate of all countries in competition except i ($W\tau_{jt}$). The Stackelberg game framework included the 'leader's' lagged tax rate, among the explanatory variables of the host country's i CIT rate. The lagged tax rate is included to consider the fact that the Stackelberg leader is the first to modify its CIT rate in the tax competition game (Altshuler and Goodspeed, 2002). It should be noted that when the lagged tax rate for the host country i and the weighted average tax rate for the competing countries except the country i are simultaneously included among the set of explanatory variables of a tax reaction function, this result to an empirical model called 'mixed Nash and Stackelberg models').

Algebraically, the empirical model used to test the existence of CIT rate competition between African countries is as follows: $\tau_{it} = \rho(W\tau_{jt}) + \beta_1 X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$ (1)

Where τ_{it} is the statutory CIT rate in country i at the year t. $W\tau_{jt}$ corresponds to other countries' CIT rates τ_{jt} multiplied by the spatial weighting matrix W[36]. ρ , is the spatial autocorrelation coefficient. X_{it} represents macroeconomic variables that are likely to affect CIT rate setting. These control variables include GDP per capita, trade openness, government consumption and population (Klemm and Van Parys, 2012). A government may lower the corporate tax burden while trying to maintain the tax revenues at a constant level to ensure the provision of public goods and services. Tax revenues is, therefore, a relevant control variable. μ_i is the country fixed effects to control for unobserved country heterogeneity, while λ_t is country specific time trend included to control for common shocks affecting African economies each year. ε_{it} is the independent and identically distributed error term.

Because countries may influence each other in setting CIT rate, $W\tau_{jt}$ is potentially endogenous in equation (1). If the endogeneity issue of the spatially lagged dependent variable is not addressed in the estimation of equation 1, it would lead to overestimate the interaction term ρ.We use an instrumental variable (IV) technique to address this endogeneity issue. We included some controls to explain the host country's CIT rate. This suggests that the same controls variables for abroad countries also impact the CIT rate in these countries (the endogenous variable). Accordingly, the impact of these variables on the host countries corporate tax rate will transit via the average CIT rate in foreign countries. In such setting, the control variables in other countries could be used as instrumental variables for the average CIT rate in foreign countries. We therefore follow the literature on tax competition and use as instruments for the average CIT rate in foreign countries, the average weighted of the control variables excepted tax revenues[37] in abroad countries (Chen et al., 2014; Devereux et al., 2008; Klemm and Van Parys, 2012; Overesch and Rincke, 2011). For each control variable $x_{it,}$ the

[37]Because of missing observations in this variable, the weighted average tax revenue in the others countries cannot be computed.

weighted average for others countries is calculated as follows: $\bar{x}_{it} = \sum_{j \neq i} w_{ij}\, x_{jt}$, with w_{ij} the connection matrix[38] between the control variable in hand in the host country i (x_{it}) and in others countries (x_{jt}).

Control variables

In order to properly isolate the effect of tax competition on the host country's CIT rate, we need to control for the effect of key drivers of changes in CIT rate. Following the literature on corporate tax competition among countries, we include as control variables: trade openness, GDP per capita, total population, government consumption (Chen et al, 2014; Devereux et al, 2008; Hufe, 2014; Klemm and Van Parys, 2012).

Trade openness

Trade openness is employed as a proxy of economic openness to control for the impact of the exposure of the country to trade and competition for foreign capitals. We use imports, exports and GDP data from PWT9.0 to calculate trade openness as the sum of imports and exports in proportion of GDP. The relationship between trade openness and CIT rate is expected to be negative since preferences for international trade may put downwards pressure on CIT rates for stimulating the country's competitiveness. Nonetheless, as trade liberalization policies often induce cuts in tariffs and thereby losses in trade taxes revenues (Baunsgraad and Keen, 2010), Government may try to compensate for these losses in trade taxes by increasing corporate income tax revenue, through an increase in the CIT rate. To sum up, the impact of trade openness on CIT rate is a priori unknown.

GDP per capita

[38] We multiply the control variable by the same weighting matrix used for the spatially lagged dependent variable.

GDP per capita is used to measure the state level of development. An increase in the level of GDP per capita can be an attractive factor for foreign investors and therefore puts the government into strong position for increasing or maintaining unchanged its CIT rate. Moreover, countries with higher level of GDP per capita are more able to construct infrastructures and set up other non-tax factors that are key drivers of FDI such that these countries do not need to cut their CIT rate for attracting FDI. However, if the higher level of GDP per capita is mainly driven by few sectors in the economy like in some natural resources and raw materials dependent African countries, the government can cut corporate tax rate for attempting to attract foreign investment in the less developed sectors in order to boost their contribution to the national income. These considerations make somewhat difficult the prediction of the nature of the relationship between GDP per capita and CIT rate.

Total population

Total population is used as proxy of the size of the country for considering the fact that larger countries have less incentive to engage in tax competition since they are potentially the losers of cuts in CIT rates (IMF, 2014). Clearly, the increase of demand in public goods and services that follows a raise in the population size is likely to lead government to increase the corporate tax rate for responding to the growing demand for public goods and services. Moreover, governments of countries with large population size are in power position to insist on the level of CIT rate they judge acceptable to be applied to market seeking FDI (Durst, 2018). We therefore expect that CIT rate will be positively related to the population.

Government consumption

Government consumption expenditure is included to control for the effect of the government financing needs. The sign of the effect of government consumption expenditure on CIT rate is difficult to predict because government may satisfy its revenue needs by increasing taxes. However, with high demand for revenues, the government may choose to reduce CIT rate to attract tax base.

Time fixed effects

In econometric model, time dummies are usually included to control for shocks that affect all countries in each year. However, including time dummies in our specification is equivalent to include the average corporate tax rate of all countries (Klemm and Van Parys, 2012)

Accordingly, the following equation would be estimated: $CIT_{it} = \rho WCIT_{it} + CIT_t + X\beta + \varepsilon$, with CIT_{it} the corporate tax rate for country i at the year t; and $WCIT_{it}$ the weighted average tax rate of all the other countries (except the host country i) in year t and CIT_t the average tax rate of all countries in year t. One cannot doubt on the fact that $WCIT_{it}$ and CIT_t are highly correlate making therefore hard the identification of the true impact of each of these two variables. To circumvent this problem, the literature suggested using linear time trend instead of including time dummies (see Klemm Van Parys 2012; Devereux et al, 2008). We therefore include time trend to control for potential common trend followed by the African countries in corporate taxation.

4. Data and Sample

We extract statutory CIT rates data from the Tax Rate Database of the International Monetary Fund, Fiscal Affairs Department (IMF-FAD). Data on GDP per capita are directly collected from the World Development Indicators (WDI) database of the World Bank. Data on Trade openness (calculated as the sum of imports and exports in proportion of GDP), government consumption and population are taken from the database Penn World Table, version 9.0

(PWT9.0) (Feenstra et al., 2015). Total tax revenue data are extracted from the Government Revenue Database of the International Conference on Taxation and Development-(ICTD-GRD) (Prichard et al., 2014). Finally, we obtain a balanced panel data in CIT rate for 36 countries[39] over the period 1995-2013[40]. The construction of balanced panel data for CIT rate is motivated by the fact that an unbalanced panel would cause year to year variations of the main explanatory, namely the average of CIT rate variables in other countries because of a change in the sample composition. In order to make sure that all variability in the weighted average tax rate is the result of tax policy, not sample composition, we base the calculation of the weighted averages tax rate only on a fully balanced panel in terms of the tax rate variables. Descriptive statistics on all the variables are displayed in table 1 below. The average CIT rate in Africa is 33.4% with a minimum rate of 15% and a maximum rate of 60% (the maximum tax rate is observed in Sudan).

[39] The list of countries is given in appendix.
[40] According to the experts, this period corresponds to the time when most of the corporate tax rate changes took place in Africa.

Table 1: Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
CIT rate	646	33.404	6.650	15	60
PIT rate	477	35.716	10.884	10	78
CIT base	332	11.245	13.623	.0124	102.025
GDP per capita	646	2384.448	2633.004	168.931	13160.21
Agriculture value added	628	21.270	13.218	1.954	57.723
Trade openness	646	78.584	37.590	14.772	225.043
Natural resources rents	629	13.776	16.008	.002	77.054
Inflation	646	62.518	980.179	-18.222	24411.03
FDI net inflows	646	4.138	5.795	-8.589	43.329
Government consumption	646	17.694	14.514	.634	109.008

Source: Author's calculations from IMF-FAD, ICTD-GRD, PWT9.0 and WDI.

4.1 The relevant tax rate competition instrument

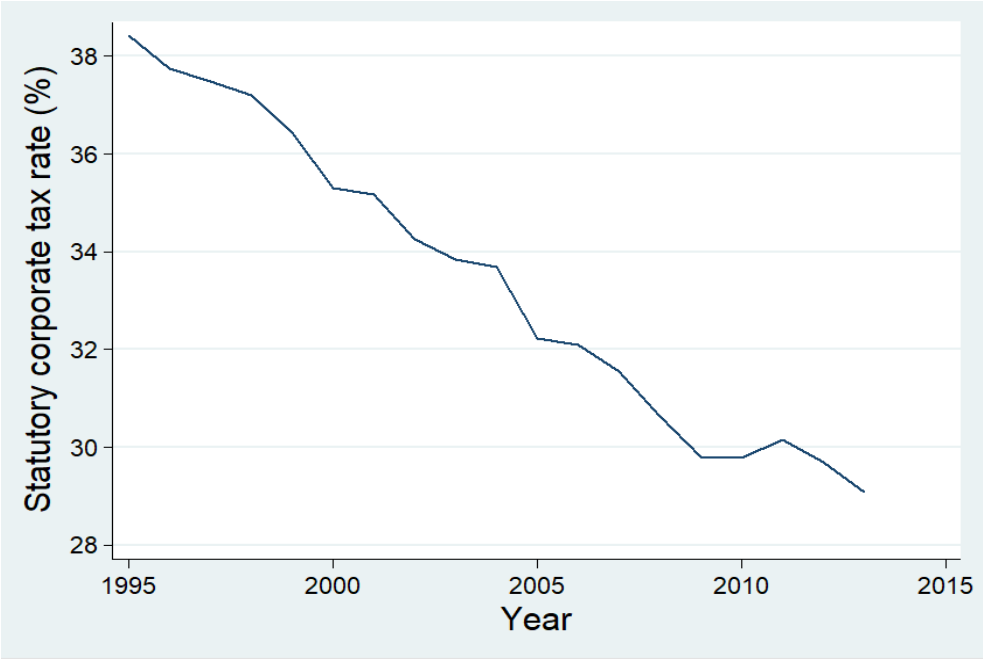
The statutory corporate tax rate (STR), the effective average corporate tax rate (EATR) and the effective marginal corporate tax rate (EMTR) are three potential candidates for being tax competition tool. The effective average corporate tax rate proxied by the ratio of corporate tax revenues to GDP is not a perfect measure because it is affected by all the factors that influence the GDP and therefore some factors outside the control of the government (Devereux et al., 2008).

For African economies, the required data (interest rate, allowances rules) to calculate EMTR, the tax rate applied to marginal investment, are quite difficult to collect over long periods. Alternatively, our choice falls on the STR. The STR is a highly visible and simple indicator comparable across countries of a corporate income tax structure (Keen and Mansour, 2010),

and it reflects the intent of decisions makers (Chen et al., 2014). Moreover, the STR is most relevant for profits shifting behaviors across tax jurisdictions (Keen and Mansour, 2010). Furthermore, because of the high correlation between statutory CIT rate, effective rates and special regimes (IMF, 2014, Keen and Mansour, 2010), we believe that our approach is acceptable and suitable for the purpose of the present study.

In figure 2, we present time series for the corporate income tax rate in the sample of African countries under investigation over the period 1995-2013. Figure 2 shows a tendency towards lower corporate income tax rates in Africa. Overall, the average corporate income tax rate declined from 38. 4% in 1995 to 29.1% in 2013.

Figure 2: Trends in statutory corporate income tax rates



Source: Author's calculations from IMF-FAD.

For the same sample of African economies under investigation, we count the number of occurrences of cuts in corporate tax rate from the year 1995 to 2013. As reported in table 2, the countries under consideration in this study have recorded 76 reductions of CIT rate over the period 1995-2013. The largest number of cuts in CIT rate is observed for Madagascar (8 times)

followed by the Republic of Congo (6) and then by South Africa, Sudan, Ethiopia and Zimbabwe which have reduce for times their CIT from 1995 to 2013.

Table 2: Occurrences of changes in CIT rate for African economies, 1995-2013.

Country	Occurrence of cuts in CIT rate	Occurrence of an Increase in CIT rate	Occurrence of changes in CIT rate
Algeria	2	0	2
Angola	1	0	1
Botswana	1	0	1
Burkina faso	4	1	5
Cabo verde	3	0	3
Cameroon	0	0	0
Comoros	2	0	2
Congo	6	0	6
Côte d'Ivoire	2	0	2
Egypt	1	2	3
Ethiopia	4	1	5
Gabon	2	0	2
Ghana	2	0	2
Guinea	0	0	0
Kenya	2	0	2
Lesotho	2	0	2
Madagascar	8	1	9
Malawi	2	1	3
Mali	1	0	1
Mauritania	2	0	2
Mauritius	2	1	3
Morocco	1	0	1
Mozambique	2	0	2
Namibia	2	0	2
Nigeria	1	0	1
Senegal	2	1	3
Seychelles	1	0	1
South Africa	4	1	5
Sudan	4	1	5
Swaziland	1	0	1
Tanzania	1	0	1
Togo	3	1	4
Tunisia	1	0	1
Uganda	0	0	0
Zambia	0	0	0
Zimbabwe	4	1	5
Total	76	12	88

Source: Author's calculations using data on CIT rate from IMF-FAD.

4.2 The choice of the spatial weighting matrix

We discuss in this paragraph the choice of the connectivity matrix for exploring CIT rate interaction between countries.

The contiguity matrix could be used as the spatial weighting matrix. The elements of the contiguity matrix are equals to 1 if the two spatial units share a common border and 0 otherwise. However, we do not use contiguity matrix as the spatial weighting matrix in our analysis for several reasons. First, with contiguity matrix, islands would have no neighbors. Second, because our dataset is not complete some countries may have no neighbors. Furthermore, basically, tax competition for attracting foreign investments is not restricted between first-order neighbors suggesting that contiguity matrix is not the appropriate weighting matrix to test for CIT rate interactions between tax jurisdictions (Klemm and Van Parys, 2012).

Previous studies on tax competition use geographic distance weighting matrix (Chen et al., 2014; Klemm and Van Parys, 2012; Overesch and Rincke, 2011) and economic distance weighting scheme. The rationale behind the use of geographic distance weighting matrix is related to the fact that geographically close countries are more relevant tax competitors since productive capitals are highly mobile between geographically close countries due to the relative lower cost of transport and information. This is in line with the first law of geography: "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970: 236) explaining the wide use of geographical inverse distance in spatial econometrics for measuring connectivity.

Algebraically, after standardisation, the weights w_{ij} of the geographic distance weighting matrix are given as follows:

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

With d_{ij} the Euclidian distance between the capital of country i and country j for $i \neq j$.

The economic distance weight matrix (Devereux et al., 2008; Casette and Paty, 2008) is used to reflect the idea that countries with the same economic patterns are more likely to engage in competition with each other for attracting corporate tax bases. After standardisation, the weights w_{ij} of economic distance weighting matrix defined as the inverse of the difference between GDP per capita of country i ($GDPpc_i$) and country j ($GDPpc_j$) are given as follows:

$$w_{ij} = \begin{cases} \frac{(\left|GDPpc_i - GDPpc_j\right|)^{-1}}{\sum_j (\left|GDPpc_i - GDPpc_j\right|)^{-1}}, & for\ i \neq j \\ 0, & for\ i = j \end{cases}$$

In contrast to most previous studies, ours' considers a spatial weight matrix that combines both geographic and economic distance. The underlining idea is the fact that tax competition can take place between both geographically and economically close countries (Martinez-Vasquez and Liu, 2014). Following Martinez-Vasquez and Liu (2014), the elements w_{ij} of this mixed weight matrix are computed as follows:

$$w_{ij} = \begin{cases} \frac{e_{ij} d_{ij}}{\sum_{j=1}^{N} e_{ij}\, d_{ij}}, & for\ i \neq j \\ 0, & for\ i = j \end{cases}$$

Where e_{ij} is the inverse of the absolute value of the difference in GDP per capita between countries i and j; d_{ij} is the inverse of the Euclidian distance between the capital cities of countries i and j. For robustness check, we separately use each of the weighting matrices e_{ij}

and $d_{ij.}$ Accordingly, to our knowledge, this is the first study that tests for tax competition using geographic or/and economic neighborhood matrices.

5. CIT rate interactions in Africa: Baseline results

Prior to regressions, we run Maddala and Wu (1999) unit root test to check the stationarity of the variables. The results are displayed in table 3. Results show that the null hypothesis that all the panels contain a unit root is rejected for all the variables, except for population, for which we use the first-difference.

Table 3: Unit root test

Variables	Maddala and Wu ADF-Fisher, inverse chi2
CIT rate	115.718 (0.000)
WecoCIT rate	136.256 (0.000)
WgeoCIT rate	177.388 (0.000)
GDP per capita growth	268.448 (0.000)
Trade openness	158.829 (0.000)
Tax revenue	154.515 (0.000)
Gov consumption	199.936 (0.000)
Population	50.205 (0.976)

Note: P-values are in parenthesis.

Tables 4 and 5 presents the results obtained from IV estimation of equation (1). First step regressions from the instrumental variables estimations are reported in table 4 below. The results show that all the instrumental variables we retained[41] for each regression are

[41] For each regression, in the set of potential instrumental variables, we keep only those that significantly affect the endogenous variable in the first step regression to avoid the problem of weak instruments

significantly correlated to the endogenous variable (table 4), suggesting that the set of instrumental variables are not weak instruments.

Table 4: Instrumental variable estimation of CIT rate interactions in Africa: first step regressions

W(CIT rate)	(1)	(2)	(3)	(4)	(5)	(6)
Weighting schemes	Benchmark weights	Benchmark weights	Inverse distance	Inverse distance	GDP weights	GDP weights
W(Gov. consumption)[42]	0.419***	0.426***				0.523***
	(0.058)	(0.056)				(0.059)
W(Trade openness)	-0.12***	-0.082***	-0.097***		-0.06**	-0.126***
	(0.014)	(0.014)	(0.008)		(0.027)	(0.016)
W(Population)	-0.622***	-0.249***	-0.807***	-0.018**	-1.098***	-0.113
	(0.046)	(0.071)	(0.037)	(0.007)	(0.115)	(0.081)
GDP per capita	-0.001***	-0.003	-0.004***	-0.002**	-0.004	-0.001**
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness	-0.009*	-0.004	-0.007***	-0.005***	-0.012*	-0.01
	(0.005)	(0.005)	(0.002)	(0.001)	(0.006)	(0.005)
Gov. consumption	-0.020	-0.012	-0.031***	0.001	-0.036	-0.011
	(0.023)	(0.022)	(0.009)	(0.007)	(0.030)	(0.026)
Population	-0.008	0.029	-0.010	-0.005	-0.001	0.012
	(0.025)	(0.025)	(0.011)	(0.008)	(0.034)	(0.030)
Tax revenue	-0.011	-0.001	-0.001	0.002	-0.008	0.035
	(0.022)	(0.021)	(0.009)	(0.007)	(0.029)	(0.024)
Time trend		-0.331***		-0.608***		-0.340***
		(0.049)		(0.017)		(0.057)
W(GDP per capita)			0.001**	0.003***	0.002*	
			(0.000)	(0.000)	(0.001)	
Constant	51.984***	41.322***	58.080***	35.559***	59.033***	40.438***
	(1.287)	(2.008)	(0.425)	(0.833)	(1.325)	(2.321)
Observations	594	594	594	594	594	594
R-squared	0.785	0.801	0.945	0.968	0.686	0.782
Number of countries	34	34	34	34	34	34
F-stat	252.3	247.4	1199	2088	151.2	219.8

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

Regarding the diagnostic tests, as reported in the bottom of the results table 5, the Anderson's test of under-identification, the Cragg-Donald's test of weak identification and the Sargan test of overidentification indicate that the set of instruments applied in each regression are relevant and exogenous. In fact, for all the specification, the Cragg Donald statistic is higher than the

[42] In this paper, W(….) is the average weighted of the variables in parenthesis in the foreign countries. Thus, W(CIT rate) therefore represents the weighted average CIT rate for the foreign countries.

Stock Yogo weak identification test critical value at 5% (16.85). The null hypothesis of weak identification is therefore rejected, suggesting that the instruments used are not weakly correlated to CIT rate in competing countries. In other words, the set of instrumental variables used are not weak instruments. The Anderson canonical correlation test rejects the null hypothesis of under-identification since the p-value associated to this test is null in all the specifications. This latter result suggests that the instrumental variables are correlated to the endogenous variable (CIT rate in competing countries) and therefore these instruments are relevant. Finally, the Sargan test does not reject the null hypothesis of absence of correlation between the instrumental variable and the error term indicating that the instruments are valid instruments.

In the results tables, the type of matrix of connectivity used in the regression is indicated at the head of columns. The label "inverse distance" indicated inverse geographic distance between countries is used as weights while "GDP weights" indicate that differences in GDP per capita between countries are used as weights. The label "Benchmark weights" indicates the weighting matrix combining economic (GDP per capita) and geographic distances (distance between capitals) as in Martinez Vasquez and Liu (2014).

The baseline results show that, using combined geographical and economic distance weighting scheme, the neighbors' average CIT rate [W(CIT rate)] positively affects the host country's CIT rate suggesting the existence of strategic interaction (strategic complementarity) in CIT rate between tax jurisdictions in Africa (Table 5, column 1). This result is consistent with the findings of Klemm and Van Parys (2012). Typically, one percentage point decrease in the statutory CIT rates of other countries causes, on average, a cut of 0.72 percentage points in the host country's corporate tax rate in response. However, when we control for time trend to control for correlated effects, that is, characteristics that the countries have in common, making them behave similarly (Jacobs et al., 2009), this impact is no longer statistically significant,

and its magnitude remarkably decreases (table 5, column 2). These results are robust to the use of alternative weighting matrices; the geographic distance weight (table 5, columns 3 and 4) and economic distance weight (table 5, columns 5 and 6).

Regarding the control variables, GDP per capita has always positive and significant impact on CIT rate although the amplitude of the impact is relatively small (0.001) indicating that African countries with highest GDP per capita tend to set higher corporate tax rate. In all the specification, the impact of trade openness on CIT rate is negative and statistically significant at 5%. This result suggests that international trade considerations play a role in the downwards trend in CIT rate in Africa. The estimated parameter for government consumption is positive and significant at 1% in all the specifications suggesting that on average higher public spending exert upwards pressure on CIT rate in the countries under investigation. However, in contrast to the predictions, we find that as the size of the population increases, CIT rate decreases. Since higher population implies in some extent higher demand for jobs, we speculate that this result could be explained by the fact that government may cut CIT rate for supporting the competitiveness of firms and their capacity to hire more people. In fact, policy makers may consider CIT rate cuts as stimuli for reducing unemployment rate which tend to grow with the population size. Finally, the impact of tax revenue on CIT rate is negative in all the specifications, but it is not statistically significant at the conventional significance levels. This result suggests that the level of tax revenue in Africa does not provide support to cuts in CIT rate.

Table 5: **CIT rate interactions in Africa: baseline results.**

CIT rate	(1)	(2)	(3)	(4)	(5)	(6)
Weighting schemes	Benchmark weights	Benchmark weights	Inverse distance	Inverse distance	GDP per capita weights	GDP per capita weights
W(CIT rate)	0.726***	0.216	0.935***	0.119	0.833***	0.214
	(0.085)	(0.224)	(0.099)	(0.675)	(0.092)	(0.151)
GDP per capita	0.001*	0.001***	0.001***	0.001***	0.001**	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness	-0.036***	-0.034***	-0.031***	-0.035***	-0.029**	-0.034***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)
Gov. consumption	0.190***	0.190***	0.190***	0.189***	0.192***	0.190***
	(0.053)	(0.051)	(0.052)	(0.051)	(0.054)	(0.051)
Population	-0.168***	-0.115**	-0.0954	-0.110*	-0.104*	-0.113**
	(0.058)	(0.057)	(0.060)	(0.058)	(0.062)	(0.057)
Tax revenues	-0.075	-0.066	-0.079	-0.069	-0.076	-0.070
	(0.050)	(0.049)	(0.050)	(0.050)	(0.052)	(0.049)
Time trend		-0.361***		-0.424		-0.357***
		(0.139)		(0.359)		(0.104)
Time trend	No	Yes	No	Yes	No	Yes
Observations	594	594	594	594	594	594
R-squared	0.373	0.418	0.392	0.414	0.340	0.421
Number of countries	34	34	34	34	34	34
F(p)	0.000	0.000	0.000	0.000	0.000	0.000
Anderson(p)	0.000	0.000	0.000	0.000	0.000	0.000
CD (stat)	237.636	34.890	963.123	51.187	123.642	87.546
Sargan	0.171	0.905	0.634	0.752	0.412	0.830

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

It is possible that it has a delay in the response of other countries to changes in a host country tax rate (Heinemann et al, 2010), we test the robustness of our main finding by including one-year lag of the average weighted CIT rate in neighboring countries. Results reported in table 6 below clearly show that our results remain qualitatively unchanged to a delay in a host country's reaction to modification in others CIT rate. These findings provide signals that the positive slope obtained from the estimation of tax rate reaction function between African economies may be due to common trend affecting these countries rather than a purely corporate tax rate competition among these economies. Positive interaction over CIT rate among African economies could be attributable to the implementation of similar tax policies (reduction of tax rates and broadening of tax bases) under the same technical assistance from technical and financial partners (IMF, World Bank, AfDB and UE) by these countries.

Table 6: Allowing for a delay in host country's reaction to change in other countries CIT rate.

CIT rate	(1) Benchmark weights	(2) Benchmark weights
L.WCIT_rate	0.728***	0.189
	(0.088)	(0.232)
GDP per capita	0.001**	0.001***
	(0.000)	(0.000)
Trade openness	-0.039***	-0.036***
	(0.012)	(0.011)
Gov. consumption	0.185***	0.180***
	(0.055)	(0.053)
Population	-0.140**	-0.0846
	(0.061)	(0.061)
Tax revenues	-0.088*	-0.074
	(0.051)	(0.049)
Time trend		-0.394***
		(0.148)
Time trend	No	Yes
Observations	562	562
R-squared	0.359	0.404
Number of countries	34	34
F(p)	0	0
Anderson(p)	0	0
CD(stat)	207.803	29.677
Sargan(p)	0.224	0.939

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

We continue the robustness analysis of the main findings by analyzing the role of personal income tax rate in a context of CIT rate competition. In fact, downwards pressure on CIT rate in the framework of tax competition may encourage individuals from incorporating themselves to escape tax on their earnings. We take onboard this consideration by including the top statutory personal income tax rate **(**PIT rate**)** among the set of control variables in the tax reaction equation (equation 1). Data on PIT rate are obtained from the IMF-FAD tax rate Indicators database. The regressions use the so-called benchmark weighting matrix, the combined geographic and economic inverse distance weighting matrix for the average weighted tax rate in competing countries. As usual, the control variables for competing countries are used as instruments. The inclusion of personal income tax rate among the explanatory variables does not change our main results. There is no longer positive interdependence in CIT rates when we control for common effects (table 7, columns 2). The personal income tax rate has a positive impact on CIT rate corroborating the theoretical prediction that personal income tax rate act as a backstop for corporate income tax rate for limiting tax avoidance behaviors (table 7, columns 1 and 2).

Furthermore, we also test whether our results remain unchanged to the use of FDI inflows weighting scheme. Since after all, one of the main purposes of tax competition is to attract and retain FDI, it is plausible that competition really occurs between the top recipient countries of FDI in the continent. More practically, competition will tend to be worse between countries that attract similar levels of FDI. We therefore take on board this aspect by using as weight matrix the inverse of the difference of FDI net inflows between countries. FDI net inflows data are taken from the WDI database, the World Bank. As reported in table 7 (columns 3 and 4), the main findings of this study are robust to the use of FDI net inflows distance as weighting

matrix. The control for the effect of common factors renders insignificant the coefficient of the weighted average CIT rate for competing economies.

Table 7: CIT rate interactions in Africa: Controlling for the impact of PIT rate and using FDI weighting scheme.

CIT rate	(1)	(2)	(3)	(4)
Weighting matrix	Benchmark weights	Benchmark weights	FDI weights	FDI weights
WCIT_rate	0.607***	-0.136	0.819***	0.447
	(0.126)	(0.436)	(0.108)	(0.369)
PIT rate	0.113***	0.112***		
	(0.032)	(0.033)		
GDP per capita	0.001	0.001	0.002***	0.001***
	(0.001)	(0.001)	(0.000)	(0.000)
Trade openness	-0.065***	-0.069***	-0.043***	-0.040***
	(0.017)	(0.018)	(0.012)	(0.012)
Gov. consumption	0.255***	0.229***	0.189***	0.187***
	(0.066)	(0.068)	(0.0557)	(0.0534)
Population	-0.136*	-0.048	-0.170***	-0.142**
	(0.078)	(0.085)	(0.060)	(0.063)
Tax revenue	0.029	0.012	-0.099*	-0.084
	(0.061)	(0.063)	(0.052)	(0.052)
Time trend		-0.513*		-0.216
		(0.266)		(0.212)
Observations	423	423	576	576
R-squared	0.428	0.414	0.314	0.371
Number of countries	32	32	33	33
F(p)	0	0	0	0
Anderson(p)	0.000	0.000	0.000	0.000
CD (stat)	120.8	11.18	118.7	12.80
Sargan (p)	0.546	0.707	0.136	0.138

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

Because it may take time to change corporate income tax regime due to adjustments costs for the private sector and resistance from some interest groups which think themselves as potential losers from the reform, there might be inertia in corporate tax policy in African countries (Klemm and Van Parys, 2012; Overesch and Rincke, 2011**)**. We check the robustness of our finding to potential inertia in corporate tax rate. To do so, we simply include in the baseline

empirical model specification (equation 1) a one-period lagged dependent variable among the explanatory variable. This leads us to estimate a dynamic spatial lag model. The estimation of this model raises two endogeneity problems. First, it is well known that in dynamic panel data models, the lagged dependent variable is endogenous due to its correlation with the individual fixed effects in the error term. In such conditions, estimating the model with fixed effect estimators will produce downward biased estimates (Nickell bias). The second endogeneity problem is related to the spatial lagged dependent variables because of interaction between CIT rates. In fact, in setting its corporate tax policy, the host country may be influenced by other countries CIT rate and reciprocally the host country corporate tax policy could also influence the corporate tax setting abroad. In such circumstances, ordinary least squares (OLS) estimators are not consistent for estimating this model.

To overcome these endogeneity problems and obtained unbiased estimates, we rely on the system GMM estimator developed by Blundell and Bond (1998) for estimating dynamic panel data model. System GMM estimator is performing well for panel data with large N and small T. Moreover, Kukenova and Monteiro (2009) demonstrates that system GMM are consistent in estimating the coefficient of the spatial lag dependent variable in dynamic spatial lag models with large N and T fixed. Our dataset T=19 and N=34 is not properly fitting with this setting because the time length T=19 could not be considered as small. We therefore decide to divide the time span of our dataset in three-years non-overlapping intervals to obtain three-year panel data except the last sub-period which is four-year panel data (1995/1997=1 1998/2000=2 2001/2003=3 2004/2006=4 2007/2009=5 2010/2013=6).

In system GMM estimator, the variables in levels are instrumented by their lagged differences, and the differenced variables are instrumented by the lagged variables in levels leading to increase the efficiency of system GMM estimator. If we agree that the control variables *(*GDP per capita, trade openness, government consumption, population and tax revenues) included in

the equation 1 affect the host country's corporate tax rate, it is also obvious that these variables for all the countries except the host countries also affect their corporate income tax rate suggesting that they can be used to instrument the average weighted corporate tax rate in equation 1. We therefore increase the set of instrumental variables by including the explanatory variables in other countries as external instruments for the weighted average corporate tax variable of other countries. To construct these instrumental variables, we use geographic inverse distance, economic distance (the difference in GDP per capita between countries i and j) weighting matrices and the combined geographic and economic distance matrix (benchmark matrix) used in the calculation of the spatially lagged dependent variable (average weighted CIT rate in foreign countries). Kukenova and Monteiro (2009), Foucault et al. (2008) and Klemm and Van Parys (2012) adopt the same approach for obtaining a set of instrumental variables to instrument the spatial lagged dependent variable for the system GMM estimations in their respective studies.

The system GMM estimator has the advantage to deal both with the endogeneity issue of the period lagged dependent variable and the other control variables that are potentially endogenous. This feature is interesting in our case as a control variable like trade openness may be endogenous because of reverse causality from trade openness to corporate tax policy. Indeed, trade liberalization policies for promoting competitiveness and trade may put downward pressures on corporate tax rates. Reciprocally, changes in corporate tax policy by affecting competitiveness may affect trade. We have therefore considered all the control variables as potentially endogenous except the total population for which the reverse causality with corporate tax rate is less evident.

The validity of the instrumental variables used in system GMM estimation is checked with the Hansen test of over-identifying restrictions and the Arellano and Bond's autocorrelation tests.

The Hansen J test of over-identifying restrictions tests the hypothesis of no correlation between the instrumental variables and the residuals. The Arellano and Bond's autocorrelation tests determine whether there is first-order serial correlation in the error term [AR (1)] and no second-order autocorrelation in the residuals [AR (2).]

We also paid attention to the problem of instrument proliferation in system GMM estimations. To avoid the "instruments proliferation" or "too many instruments" problem, the total number of instruments should not exceed the number of countries used in the regression (Roodman, 2009).

Table 8 reports the results of estimating the dynamic specification of equation (1), using in turn the three different weighting matrices that have been discussed at the paragraph on the choice of weighting matrices above. The columns (1) and (2) use geographic distance weighted rates; columns (3) and (4) GDP-weighted rates; and columns (5) and (6) combined geographic and GDP distance weighted rates. Except the second regression (column 2, table 8) for which the number of instrumental variables (36) is slightly higher than the number of countries (34), all the regressions pass all the standard diagnostic tests. There is no evidence of second-order residual autocorrelation, and the Hansen test confirms that the set of instrumental variables are exogenous (see bottom lines in table 8 after the line for the number of observations, in the appendix). In addition, for each system GMM regression carried out, the number of instruments does not exceed the number of countries. The main findings remain unchanged, whenever we control for the effect of common time trend, the impact of the weighted average CIT rate on the host' country CIT rate is no longer significant (columns 3 and 4, table 8). The estimated coefficient for the lagged dependent variable is positive and statistically significant at 1% in all the specifications thereby corroborating the prediction of path dependence in CIT rate for African economies.

Table 8 CIT rate interactions in Africa: Control for inertia in corporate income tax rate.

Dependent variable: CIT rate	(1)	(2)	(3)	(4)	(5)	(6)
Weighting matrix	Inverse distance	Inverse distance	GDP weights	GDP weights	Benchmark weights	Benchmark weights
L. (CIT rate)	0.893***	0.891***	0.938***	0.987***	0.874***	0.969***
	(0.036)	(0.027)	(0.040)	(0.038)	(0.038)	(0.061)
W (CIT rate)	0.108***	0.107	0.029	0.255	0.071	0.113
	(0.018)	(0.075)	(0.068)	(0.176)	(0.072)	(0.209)
GDP per capita	0.002***	0.001*	0.004	0.003	0.002**	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness	0.005	-0.001	-0.018	0.001	-0.030**	-0.037**
	(0.005)	(0.003)	(0.015)	(0.012)	(0.015)	(0.015)
Gov consumption	0.035	0.043*	-0.067	-0.091**	-0.024	-0.047
	(0.022)	(0.023)	(0.040)	(0.044)	(0.034)	(0.050)
Population	0.004	0.002	0.000	0.005	-0.014	-0.016
	(0.006)	(0.005)	(0.009)	(0.008)	(0.008)	(0.011)
Tax revenue	-0.054***	-0.054***	0.115*	0.026	0.044**	0.049
	(0.011)	(0.011)	(0.063)	(0.052)	(0.020)	(0.030)
Time trend		0.043		0.585*		0.306
		(0.122)		(0.321)		(0.378)
Observations	165	165	165	165	165	165
Nb. of countries	34	34	34	34	34	34
Hansen, pvalue	0.260	0.265	0.241	0.210	0.140	0.388
Instruments	33	36	22	27	25	21
ar2, pvalue	0.720	0.721	0.790	0.726	0.761	0.750
ar1, pvalue	0.011	0.012	0.011	0.011	0.012	0.011

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

In all the regressions, when time trend effect is controlled for, the positive interaction coefficient between CIT rates becomes statistically insignificant at the conventional significance levels. We interpret this result as an indication that the positive interdependence in CIT rate may be due to common conditions (correlated effects, intellectual trend). To

comfort this explanation, we rerun the regressions using an approach extensively used in the literature to test whether the tax interactions are common trends and not a pure tax competition (Manski, 1993). The uniform weight matrix is commonly used to test the common intellectual trend in fiscal competition literature (Cassette and Paty, 2008; Caldeira et al., 2015). The weights of the uniform matrix is given by $w_{ij}=1/(n-1)$ with n the number of countries. Results indicate that we cannot reject Manski's (1993) hypothesis of a common intellectual trend that drives countries' fiscal choices in the same directions in the absence of strategic behaviors in the countries. Specifically, with uniform weights, we find that the average tax rate in foreign countries positively affect the host country's CIT rate even if the effect of time trend is controlled (table 9, columns 1 and 2). This latter result support the idea that CIT interdependences among African economies are govern by common intellectual trend that steers fiscal choices in the same direction rather than tax competition consideration. In fact, African economies face the same policy advise environment under the guidance of multinational institutions like the IMF, the World Bank and the AfDB which often suggest similar fiscal policy orientations to African countries.

Table 9 CIT rate interaction in Africa: Testing the hypothesis of common intellectual trend.

Dependent variable: CIT rate	(1)	(2)

Weighting matrix	Uniform weights	Uniform weights
L.CIT_rate	0.9128***	0.9541***
	(0.0284)	(0.0236)
W(CITrate)	0.1061***	0.3890***
	(0.0354)	(0.0936)
GDP per capita	0.0009***	0.0003
	(0.0001)	(0.0002)
Trade openness	-0.0269***	-0.0092
	(0.0067)	(0.0060)
Gov. consumption	0.0959***	-0.0117***
	(0.0171)	(0.0031)
Population	0.0158**	-0.0105**
	(0.0060)	(0.0040)
Tax revenue	0.0210	-0.0594**
	(0.0221)	(0.0222)
Time trend		0.193***
		(0.056)
Observations	545	545
Number of countries	33	33
Instruments	32	32
Hansen, pvalue	0.660	0.510
ar1(p)	0.015	0.014
ar2(p)	0.333	0.483

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

6 Empirical evidence on CIT base effects in Africa

So far, this chapter actually focused on corporate tax rates interaction among African economies. However, rather than using tax rates, national tax jurisdictions can use tax rules and tax instruments affecting the corporate tax burden to compete among each others for attracting and keeping foreign capitals. In fact, beyond the tax rate, foreign investors may take into account tax rules such as depreciation rules, tax holidays to choose among countries the location of their investments. Accordingly, countries may compete via the tax base instead of

the tax rate. After analyzing corporate income tax rate interactions, we turn to the analysis of corporate income tax base interactions among African national tax jurisdictions[43]

6.1 Specification

Tax competition has two properties namely strategic complementarity and base spillover (Rota Graziosi, 2018). By strategic complementarity, countries react to a decrease in one country's CIT rate by decreasing their own CIT rate. By base spillover, change in one country's CIT rate affect other countries corporate tax bases. We have tested the existence of strategic complementarity among CIT rate in Africa in the previous section. In this section, we turn to the analysis of the existence of CIT base spillovers among African economies. To do so, we borrow the IMF's empirical model specification (mixed Nash-Stackelberg tax game model) for testing the presence of base spillover among countries (IMF, 2014). The model is specified as follows:

$$\boldsymbol{B_{it} = \delta B_{it-1} + \beta \tau_{it} + \rho W_{-it} \tau_{it} + \gamma X_{it} + \alpha_i + \mu_t + \varepsilon_{it}} \quad \textbf{(2)}$$

With B_{it} the corporate tax base in country i in year t. the corporate tax base is proxied by dividing corporate income tax revenue in proportion of GDP by the standard corporate tax rate (IMF, 2014; Keen and Mansour, 2010). B_{it-1} is the one-period lagged value of the corporate tax base. This variable is included to control for the inertia in tax base since it may take time to observe significant change in corporate tax base following a change in corporate tax rate because of adjustments costs. Technically, since there is inertia in CIT rate (Klemm and Van Parys, 2012; Overesch and Rincke, 2011) and dynamics in tax collection (Gnangnon and Brun, 2017; Gupta, 2007; Leuthold, 1991), a priori, there is no reason to cast doubt on the inertia of

[43] Experts argue that the corporate tax bases interactions tend to be are more important than corporate tax rate interactions. This is reasonable, since given inertia in tax rate, countries may have strong incentive to use tax instruments, which affect tax liabilities' of corporations, other than tax rate to compete among themselves.

corporate tax base proxied as the ratio of CIT revenue to the CIT rate. τ_{it} is the home country's CIT rate in percent. $W_{-it}\tau_{it}$ represents the average weighted corporate tax rate in abroad countries. α_i and μ_t respectively represent country and time-specific effects. ε_{it} is the usual error term.

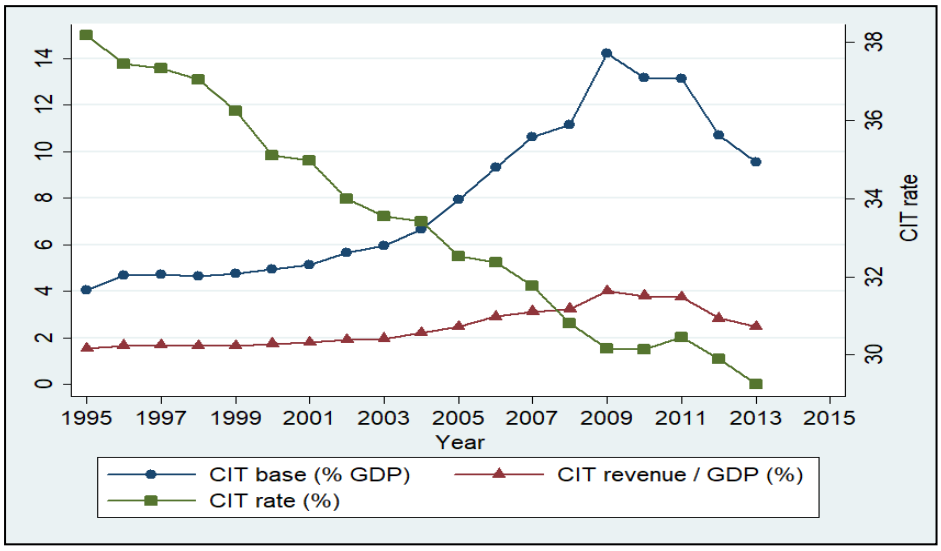
X_{it} is a vector of control variables that are likely to affect the corporate tax base. The variables include the GDP per capita, trade openness (sum of imports and exports in proportion of GDP), agriculture value added (in % GDP), inflation (changes in consumer price index) and natural resources rents (in %GDP). The GDP per capita is included to control for the effect of development level on corporate tax base while trade openness controls for the effect of international trade on corporate tax base. We include Agriculture value added to control for the sectoral composition of the economy on corporate tax base. We consider the effect of macroeconomic policies on corporate tax base by controlling for inflation. Natural resources rents are included to control for the role of the country's endowment in natural resources in size of the corporate tax base. IMF (2014) does not include a measure of natural resource wealth among the control variable in their specification for analyzing corporate tax base spillovers in developing countries whereas natural resources are an important component of corporate tax base in these countries.

As high income countries tend to attract more businesses, we expected that GDP per capita will positively affect the corporate tax base in our estimations. For promoting international trade, government can relax taxes on imports and grant tax incentives for firms whose activities are exported-oriented. From this perspective, trade openness may negatively affect corporate tax base in Africa. The agriculture sector is still under informality and dominated by subsistence agriculture. We therefore anticipated negative association between agriculture value added and corporate tax base. Inflation increase operating costs and reduces profits, thereby corporate tax base. Natural resources exploitation stimulates businesses and transactions. We therefore

predict positive impact of natural resources on corporate tax base. Data on GDP per capita, Agriculture valued added, Inflation and natural resources rents have been extracted from the database WDI, the World Bank. Data on Corporate income tax revenue in percentage of GDP are taken from the IMF-FAD Tax Revenue Indicators database.

Figure 3 shows the evolution of CIT revenue in proportion of GDP between 1995 and 2013 for Africa. While CIT rates have dropped in Africa from 1995 to 2013, CIT revenue in percentage of GDP have almost doubled (from around 2%GDP in 1995 to 4% GDP in 2009) excepted for the sub-period from the global recession of 2009 to 2013 where the declining of CIT rates is associated with decrease in CIT revenues. This rate-revenue paradox of corporate taxes could be explained by improvement in corporate tax administration and enforcement, corporate tax broadening (as shown in figure 3), improvement in business climate which in turn increases corporate profitability and corporatization (see Abbas and Klemm, 2013; Keen and Mansour, 2010).

Figure 3: CIT revenue, CIT base and CIT rates in Africa



Source: Author's construction from IMF-FAD.

6.2 Choice of the weighting matrix

In this section, we are exploring whether corporate tax rates abroad affect corporate tax base of a host country for African economies. In other terms, we are testing the existence of base spillovers effects in corporate taxation in Africa. Such effects mainly operate through two channels: investments decisions and profit shifting. Indeed, with capital mobility across countries, investors have strong incentive to reallocate their investments (assets) in countries with lower tax burden for ensuring a higher after-tax return on the investments. As discussed in the previous section above, countries with the same economic characteristics are most likely to compete each over through corporate tax policy as they offer similar business environment to investors. An advanced economy will be more sensible to changes in corporate tax policy of another advanced economy than for a small economy. Accordingly, the GDP per capita is a relevant candidate as a weighting matrix for the average tax rates abroad in equation 2. Practically, we use as weighting matrix the inverse of the absolute difference between the countries GDP per capita, such that the intensity of base spillovers effect will tend to be stronger for countries which have close development levels.

The effect of change in corporate tax rates abroad on domestic corporate tax base operate through profit shifting behaviours. Even if profit shifting behaviour is somewhat difficult to observe directly (Qian et al, 2017), one cannot cast doubt on the fact that it is highly motivated and fueled by the corporate tax rates differential between the host country and other countries abroad. Since profits shifting attitudes do not depend on macroeconomics or social factors but rather mainly depend on tax burden differential across tax jurisdiction, we use unweighted average tax rate in other countries to take into account profits shifting and base erosion consideration in corporate tax spillovers in Africa (IMF, 2014).

The dynamic nature of our model renders fixed effects estimators inappropriate for estimating it because of the correlation between unobserved fixed effects and the lagged dependent variable. In addition, because reforms affecting a host country corporate tax base could cause change in corporate tax policy abroad, the average corporate tax rate variable abroad is potentially endogenous in equation 2. The endogeneity problems of the lagged dependent variable and the average corporate tax rate abroad are addressed using the system GMM estimator (Blundell and Bond, 1998). Here again, to comply with the system GMM setting (large N and small T), we subdivide the time span of our dataset in three-year non-overlapping intervals. We obtain three-year panel data except the last sub-period which is four-year panel data (1995/1997=1 1998/2000=2 2001/2003=3 2004/2006=4 2007/2009=5 2010/2013=6).

6.3 Corporate income tax base effects in Africa: Estimation results

Table 10 displays results from the estimation of model (2) with system GMM estimator (two-step) using GDP weight and uniform weight for the average tax rate in other countries. The estimation results[44] pass all the standards validity tests. The Hansen test does not reject the null hypothesis of absence of correlation between the instruments and the error term. There is no second order serial correlation in residuals as indicated by the p-value of the autocorrelation test and the estimation do not suffer from instruments proliferation problem. The variables tax base and GDP per capita are taken in logs while the other variables are in levels.

Results show that an increase in the host country's tax rate will deteriorate its corporate tax base (table 10, column 2). The effect of one percentage point increase in the host country's CIT rate will decrease its corporate tax base by 4. 6%. Regarding the spillovers effects, results suggest that reduction in the foreign corporate tax rate is likely to reduce the host country's

[44] The number of countries used in the regressions has declined because of missing values in corporate tax base due to missing values for the corporate tax income revenue data.

corporate tax base. This effect is mainly significant for uniform weight (table 10, column 2) suggesting that corporate tax base erosion is Africa is operating through profit shifting activities. Typically, one percentage point reduction in the foreign countries' average corporate tax rate is likely to reduce the host country corporate tax base by 4.21% (table 10, column 2). If the host country reacts to one percentage point cut in foreign countries CIT rate by cutting by one percentage point its own CIT rate, this will increase the host country's CIT base by 4.6%, leaving a net corporate tax base loss of 0.4%. In terms of tax revenue, our calculations indicate that, on average, these tax base losses represent 2.3 percent of GDP for the economies used in the econometric estimation[45]. As expected, the level if development and natural resources wealth contribute to broaden the corporate tax base. Inflation has negative impact on corporate tax base as predicted. In contrast to predictions, results show that agriculture value added, and trade openness positively affect corporate tax base in Africa. Results show that the estimated coefficient for the lagged value of the corporate tax base is positive and statistically significant at 1% (table 10, columns 1 and 2). This result corroborates the prediction of inertia in corporate tax base and therefore suggests that countries that manage to broaden its corporate tax base today are more likely to have large corporate tax base tomorrow.

[45] The economies include Algeria, Angola, Botswana, Côte d'Ivoire, Cameroon, Congo republic, Cabo Verde, Ethiopia, Ghana, Kenya, Lesotho, Morocco, Madagascar, Mali, Malawi, Mauritius, Namibia, Senegal , Swaziland, Seychelles, Togo, Tunisia, Tanzania, Uganda, South Africa, Zambia and Zimbabwe.

Table 10: Impact of the average corporate tax rate of foreign countries on the corporate tax base of a host country.

Dependent variable: log(CIT_base)	(1)	(2)
Weighting schemes	GDP weights	Uniform weights
Lagged dependent variable, t-1	0.719***	0.578***
	(0.126)	(0.077)
CIT_rate	0.004	-0.042***
	(0.010)	(0.011)
W(CIT_rate)	0.013*	0.046***
	(0.007)	(0.003)
Log (GDP per capita)	0.187	0.187**
	(0.206)	(0.081)
Trade openness	0.002	0.002**
	(0.001)	(0.000)
Agriculture value added	0.016	0.012*
	(0.020)	(0.006)
Inflation	-0.020**	-0.016***
	(0.008)	(0.004)
Natural resources rents	0.018***	0.020***
	(0.004)	(0.004)
Observations	90	90
Number of countries	27	27
Hansen, pvalue	0.487	0.600
Number of instruments	27	22
ar2, p	0.709	0.753
ar1, p	0.058	0.057

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

6.4 Further analysis

Corporate tax base spillovers analysis could not be limited to the assessment of the effect of foreign countries corporate tax rate on domestic corporate tax base. Spillovers effect may arise from changes (tax holidays, depreciation allowances rules) which affect the foreign countries

corporate tax base while maintaining the CIT rate unchanged. In fact, an action on foreign countries corporate tax base could affect the host country's corporate tax base. We evaluate the impact of change in foreign countries' corporate tax base on the host country corporate tax base.

To take into account this consideration, we included among the explanatory variables in model (2), the foreign countries corporate tax base ($W_{-it}B_{it}$). We obtain the following specification:

$$\boldsymbol{B_{it} = \delta B_{it-1} + \beta \tau_{it} + \rho W_{-it}\tau_{it} + \theta W_{-it}B_{it} + \gamma X_{it} + \alpha_i + \mu_t + \varepsilon_{it}} \quad \textbf{(3)}$$

The average weighted corporate tax base abroad can be computed on balanced data in corporate tax base. Since corporate tax base are calculated by dividing corporate income tax revenue to the statutory corporate income tax rate, missing values in corporate tax revenue systematically translate into missing values for the corporate tax base data. We therefore manage to get as possible few missing values for the corporate tax base. For this purpose, we fulfill missing data on corporate tax revenue taken from IMF-FAD by corporate tax revenue data extracted from the International Conference for Taxation and Development Government Revenue Dataset (ICTD-GRD) where available[46]. This enables to have in the regressions 24 countries out of 34 countries for which we have balanced data on CIT rates.

Table 11 presents estimation results from the estimation of equation (3) by system GMM estimator using GDP and uniform weighting schemes. We find that with the GDP per capita weights, the impact of foreign countries tax base on the host country's corporate tax base is positive but not statistically significant (column 1, table 11) whereas this impact is positive and significant with the uniform weights (column 2, table 11) indicating strategic responses in corporate tax base policies. These results are indicating that the negative effect of tax incentives

[46] Before doing so, we have compared the data on corporate tax revenue for the two datasets for the periods where data are available for both of them. We remarked few differences between these two data, there are even equal for certain years.

provision in foreign countries on the host country's corporate tax base is occurring through profit shifting but not through relocation of real asset investments.

Table 11: Effect of changes in abroad countries' CIT base and CIT rate on the host country's CIT base.

Dependent variable: CIT_base Weighting schemes	(1) GDP weight	(2) Uniform weight
L.CIT_base	0.953***	0.924***
	(0.034)	(0.054)
CIT_rate	-0.123*	0.002
	(0.061)	(0.170)
WCIT_rate	0.282**	0.267
	(0.130)	(0.374)
WCIT_base	0.778	0.663**
	(0.491)	(0.299)
GDP per capita	-0.001*	0.0004
	(0.000)	(0.000)
Trade openness	-0.055**	-0.010
	(0.025)	(0.008)
Agriculture value added	-0.445***	-0.081*
	(0.102)	(0.046)
Inflation	-0.001*	-0.001***
	(0.000)	(0.000)
Natural resources rents	0.174**	0.147
	(0.069)	(0.087)
Observations	117	117
Number of countries	24	24
Hansen, pvalue	0.814	0.489
Instruments	20	20
ar 2, pvalue	0.450	0.365
ar1, pvalue	0.033	0.098

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

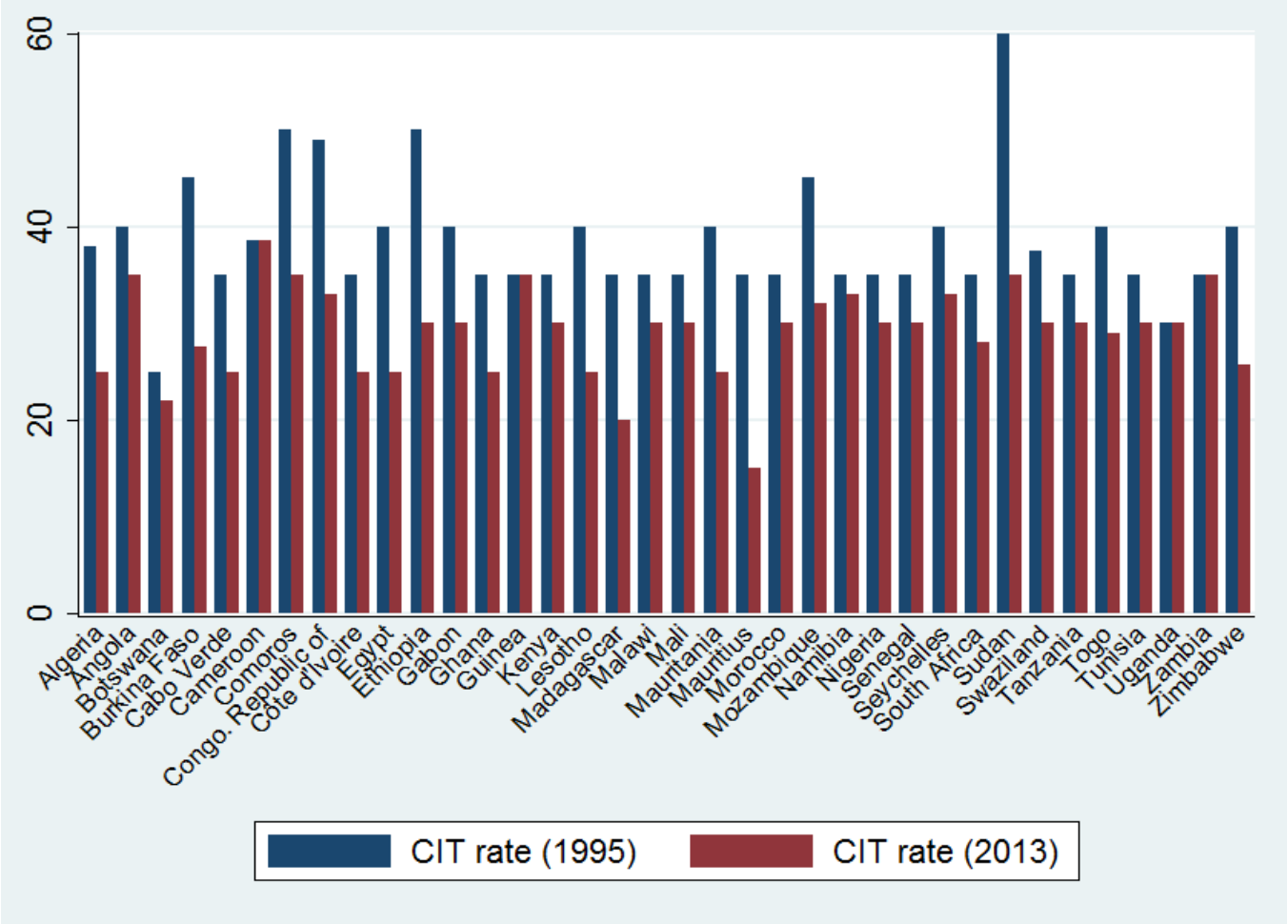
7 Conclusion

Globalization gives incentives to countries to compete against each other to attract foreign capitals through cuts in CIT rates and provision of tax incentives. This study analyzed in which extent African countries set CIT rate in response to each other. The chapter also examines corporate tax base spillovers between African economies. We do not find strong evidence of CIT rate competition between African economies. More precisely, we found strategic interaction in CIT rate only if we do not control for the effects of time trend. We therefore conclude that positive slope of the tax rate reaction function between African economies may be attributable to the same tax policy environment within which these economies evolve, under the technical assistance from the same technical and financial partners. rather than a pure CIT rate competition between these economies. With respect to base spillovers, the findings from this study that cut in the average tax rates abroad reduce the host country's corporate tax base. If the host country reacts to cut in foreign countries tax rates but cutting in own CIT rate in the same proportion, this will ultimately result in a net loss of corporate tax base in proportion of GDP of 0.4% and corporate tax revenue in proportion of GDP of 2.3% for the host country. Moreover, we find strategic responses in corporate tax base policies suggesting that countries react to tax incentives in other countries by also offering tax incentives. The strategic responses mainly operate through profit shifting but not through relocation of real asset investments. From policy implications perspective, these latter results suggest limiting corporate tax cuts and tax incentive for preventing corporate tax base erosion and profits shifting in Africa.

Appendix

List of countries: Algeria, Angola, Botswana, Burkina faso, Comoros, Congo, Cabo verde, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, Seychelles, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.

Figure 1 Statutory CIT in Africa



Source: Author's calculations from IMF-FAD.

Chapter 4: Tax Policy and Foreign Direct Investment in Africa: Do Spillover Effects Matter[47]?

Abstract

Foreign Direct Investment (FDI) inflows are crucial for economic development. To attract them, countries have typically used tax incentives, specifically reductions in Corporate Income Tax (CIT) rates. This chapter empirically assesses the impact of such CIT rate changes on FDI net inflows in Africa. Using a dynamic spatial Durbin model with fixed effects, we find that cuts in CIT rates increase FDI net inflows in the host country and in the neighboring countries in the short and long run. These results are robust to the use of alternative spatial weighting matrices as well as the inclusion of additional controls in the baseline specification. Furthermore, we find a strategic complementarity in FDI inflows between the countries in our sample, suggesting that an increase in FDI inflows in a host country is likely to stimulate FDI inflows of its neighbors.

JEL Code : C23, E62, F21, H25.

Keywords: FDI, statutory corporate tax rate, panel data, spatial econometrics.

[47] A version of this chapter which has been drafted in collaboration with Amadou Boly and Eric Kéré is published in the *African Development Bank Working Paper series* and is under review in the *Journal of African Economies*.

1. Introduction

Due to multiple expected development benefits, attracting Foreign Direct Investment (FDI) has been a key policy objective in many (developing) countries.[48] Therefore, in order to attract FDI, governments offer various incentives including fiscal incentives (such as reduced corporate tax rates), financial incentives (such as grants and preferential loans), or monopoly rights; with the possibility of neighboring countries engaging into harmful competition: the so-called "race to the bottom". The focus of this chapter is to empirically explore the effect of tax incentives, specifically changes in corporate income tax (CIT) rates, on attracting FDIs in African countries. In doing so, we analyze spillover effects, whereby changes in CIT rates in one country can have positive or negative effects on the level of FDI in neighboring countries. The debate around the effects of tax incentives on FDI is a relatively old one, which is nevertheless unsettled. Opponents argue that tax incentives negatively affect economic growth and development by depriving developing countries from tax resources that are much needed to finance investments in infrastructure, education or health; in addition to the fact that those incentives are not effective in attracting FDI (Oates, 1972; IMF, 2014; World Bank, 2005). In contrast, proponents of tax incentives suggest that tax incentives lead to a more effective use of public resources and limits rent seeking activities (e.g. Tiebout, 1956). These incentives to investors are also needed given the poor investment climate in developing countries (e.g. political instability, inadequate public infrastructure, or corruption). Moreover, revenue losses from tax incentives may be justified by the positive effects of FDI on economic growth, which will ultimately increase the income tax base (OECD, 2008).

[48] FDI is typically defined as investments realized in a country other than that of the investor and in which the foreign investor owns at least 10% of the capital that is invested. Expected benefits from FDI include increased capital inflows; spillover or demonstration-imitation effects related to technology or production/marketing/management methods; enhanced human capital through training and labor mobility; improved business environment due to increased competition; forward and backward linkages with domestic firms; better international trade integration through enhanced export capabilities (Borensztein, Gregorio and Lee, 1998; Van Parys and James, 2010; Guy-Dibi and Renard, 2015 for details).

Using panel data from 19 African countries[49] over the period of 1990-2012, we find that the levels of FDI between neighboring countries are strategic complements, suggesting that an increase of FDI net inflows in a given country increases FDI levels in neighboring countries, both geographically and economically. We also find that lowering of CIT rate increases FDI net inflows not only for the country that is carrying out the reform but also for its neighboring countries, suggesting that a 'tax competition' through lowering of CIT rate between by neighborhood countries can be beneficial to all of them in the short and long term.

We contribute to the literature on the impact of tax incentives on FDI in two ways. First, we focus on African countries for increase policy relevance, as FDI and their related attraction instruments can have differential effects in different regions (Kumar and Pradhan, 2002; Klemm and Van Parys, 2012). Previous studies have concentrated on either developed countries or developing countries. In the latter case, only three studies have examined the link between taxation and FDI in developing countries using samples that included African countries (Abbas and Klemm, 2013; Cleeve, 2008; Klemm and Van Parys, 2012). Second, previous studies have typically used gravity models that assume bilateral exchanges of FDI between countries (see Bénassy-Quéré et al., 2005). However, for most of African countries, FDI flows are predominantly one-way: from developed and transition countries to Africa.[50] Moreover, as pointed out by Blonigen et al. (2007), these previous studies have ignored spillover effects between countries, whereby an increase in FDI in one country can have positive or negative spillover effects on the level of FDI in neighboring countries. As emphasized by Lesage and Pace (2009), ignoring the spatial interactions in regression models

[49] The list of the countries is given in the Appendix.
[50] South Africa, which is the only African country to be among the top 10 investors in Africa, accounts for only 8% of the total stock of FDI on the continent (UNCTAD, 2016).

can not only bias the standard deviations but can impact the value of the estimates. This study takes spillover effects into account by using a spatial econometrics approach. The remainder of the chapter is as follows. In section 2, we briefly discuss previous a literature on the linkages between taxes and FDI. Sections 3 and 4 discuss the empirical approach and the results, respectively. We conclude in section 5.

2. Literature review

This section reviews previous studies on the impact of tax policy on FDI in Africa as well as the literature on the traditional determinants of FDI in Africa.

2.1 Related literature

Recent empirical studies on tax incentives, mainly based on developed countries, suggest that competition to attract FDI is likely to lead to a "race to a bottom" among countries (see Devereux et al, 2002; Klemm and Van Parys, 2012). These studies typically focus on the effects of tax incentives on government revenues or on public expenditures. To the best of our knowledge, only three studies (Abbas and Klemm, 2013; Cleeve, 2008; Klemm and Van Parys, 2012) estimated the empirical effects of tax incentives on FDI with samples of developing countries that included African countries. Klemm and Van Parys (2012), using a sample of 40 Latin America, Caribbean and African countries over the period 1985-2004, show that lowering of CIT rate has a significant positive impact on FDI in Latin and Central America but not in Africa. However, this study does not take into account spatial interaction in FDI inflows between countries. Focusing on 16 Sub-Saharan African countries, Cleeve (2008) estimates the impact of fiscal incentives in attracting FDI over the period 1990-2000. He proxied fiscal incentives by a tax holidays variable equal to 0 if no tax holiday is offered in the host country, 1 if the tax holiday is less than five years, and 2 if the tax holiday is greater than five years. Cleeve (2008) shows that tax holidays positively and significantly affect FDI inflows to Sub-

Saharan Africa (SSA), only when country fixed-effects are not controlled for. Moreover, none of the previous studies discusses the effect of a change in CIT rate of a host country on FDI inflows in neighbouring countries geographically or economically. Abbas and Klemm (2013) find that the Effective Marginal Tax Rate (EMTR) does not significantly affect FDI while only reductions in Effective Average Tax Rate (EATR) applicable to special tax regime positively affect inward FDI for 50 emerging and developing countries including 13 African countries over the period 1996-2007.[51] Saidu (2015) estimates the impact of corporate tax rate on foreign direct investment inflows for Nigeria over the period 1970-1980. The results show that corporate tax rate has negative and statistically significant impact on FDI in Nigeria suggesting that the reduction of corporate tax rate could stimulate FDI inflows into the country.

Root and Ahmed (1978) analyze the policy instruments that affect manufacturing FDI in developing countries. They classified countries in three groups depending on the FDI in manufacturing sector: “unattractive", "moderately attractive" and "highly attractive". These authors find that the level of the corporate tax rate significantly discriminates among the three country groups. Typically, the average corporate tax rate is higher for the Unattractive Group than for the “moderately attractive" and "highly attractive" groups. This result suggests that the average corporate taxation rate could be decisive in attracting FDI into developing countries.

Notably, these previous studies ignored spillover effects between countries, whereby an increase in FDI in one country can have positive or negative spillover effects on the level of FDI in neighboring countries.

[51] Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda, Zambia.

2.2 Determinants of FDI in Africa

Beside tax incentives, several determinants of FDI inflows can be found in the literature. These determinants can be classified into two main categories: demand and supply factors on the one hand, and institutional and macroeconomic factors on the other hand. Demand-supply side determinants with positive impact on FDI inflows include domestic market size typically proxied by population size (Diaw and Guidime, 2013), government spending relative to investments or consumption (Greene and Villanueva, 1991; Servers and Solimano, 1992; Mlambo and Elhiraika, 1997), openness to trade (Asiedu, 2002), natural resources endowment, particularly in African countries (Asiedu, 2002; Basu and Srinivasan, 2002). FDI determinants in the institutional and macroeconomic category with negative effect on FDI inflows comprise macroeconomic instability (proxy by inflation rate in the literature) and political risk (Busse and Hefeker, 2007). In contrast, the availability of skilled labor (Noorbakhsh and Paloni, 2001), financial development (Dutta and Roy, 2011; Desbordes and Wei, 2017), high quality infrastructure (Asiedu, 2002; Dupasquier and Osakwe, 2006; Diaw and Guidime, 2013) all stimulates FDI inflows through their positive impact on the productivity of investments. Likewise, exchange rate can increase FDI since depreciation makes local assets cheaper to buy while stimulating exports competitiveness (Froot and Stein, 1991).

Empirically, Asiedu (2006) examines the role of natural resources, market size, government policy, institutions and political instability in attracting FDI flows into SSA. For a panel of 22 SSA over the period 1984-2000, the results show that natural resources, good infrastructure, low inflation and efficient legal system attract FDI inflows, while political instability and corruption negatively affect FDI to SSA. In another study, Asiedu (2002) shows that FDI drivers in developing countries may differ in SSA countries. Typically, while infrastructure development and higher return to capital positively affect FDI inflows into other developing countries, they have no significant effect on FDI flows into SSA countries. Trade openness

promotes FDI inflow into SSA and non-SSA countries but the marginal effect of openness to trade is less for SSA countries highlighting heterogeneities in the factors that drive FDI across developing countries. For Africa, the author therefore warns from the blind application of reforms that was successful abroad in attracting FDI flows, since they may have differential effects for the continent.

Again in SSA, Bende-Nabende (2002) investigates on the factors that significantly influence the long-run FDI inflows in 19 SSA over the period 1970-2000. The empirical results show that the most dominant long-run determinants of FDI in SSA are market growth, export-orientation policy and FDI liberalization followed by real exchange rates, market size and openness.

Using panel data for 53 African countries over the period 1970-2003, Akinkugbe (2005) concludes that GDP per capita, trade openness, infrastructure and a high rate of return on investment are key drivers of investment flows in the continent. Dupasquier and Osakwe (2006) confirm somehow the results from Akinkugbe (2005). They find that political and macroeconomic instability, low growth, weak infrastructure, poor governance, regulatory environments slow down FDI inflows to Africa.

Naude and Krugell (2007) find that government consumption, inflation, investment, governance and education are key drivers of FDI flows to Africa. These authors conclude that market –seeking and re-exporting motives and geography do not seem to directly influence FDI inflows to Africa. Asiedu and Gyimah-Brempong (2008) conclude that liberalization of investment policies positively affects foreign investment. These authors also find that agglomeration, economic development, corruption, rule of law, and natural resources endowments exert a positive effect to FDI inflows to Africa while communications infrastructure have a significant negative impact on FDI inflows to these countries.

Hailu (2010) focuses on the demand side of FDI attractiveness in Africa. Using a panel data for 45 countries over the period 1980-2007, this author finds that natural resources, trade openness, labor quality, market accession and the quality of infrastructure positively affect FDI into Africa while government expenditure and private domestic investment have a negative impact on FDI inflows to Africa. Anyanwu (2012) analyzes the determinants of FDI flows into Africa. Using a cross country regressions over the period 1996-2008 finds the same results. Market size, trade openness, natural resources endowment, prevalence of rule of law, foreign aid favor FDI inflows while financial again development has negative impact on FDI flows to the continent.

Rather focusing on the whole Africa, some studies analyze the determinants of FDI at regional level in Africa. Mlambo (2005) analyses the determinants of FDI inflows to SADC countries and find that macroeconomic uncertainty, administrative barriers, inadequate physical infrastructure, weak financial system and corruption are the determinants of FDI in Africa. Kudaisi (2014) examine the key drivers of FDI for 16 countries in West Africa and conclude that that natural resources, labor availability, and official exchange rate favor FDI inflows into West Africa. Surprisingly, the study finds that GDP per capita, inflation, trade openness, and government policy are negatively correlated with FDI inflows to West Africa. In the same sub-region for the period 170-2010, Anyanwu and Yameogo (2015) find a U-shaped relationship between economic development and FDI inflows to West Africa while domestic investment, trade openness, first year lag of FDI, natural resources (oil and metals) endowment and exports, and monetary integration promote FDI inflows to the sub- region. As suggested by the results from studies on FDI determinants conducted on panel of countries belonging to the same region, overall the key drivers of FDI in Africa do not change when regions of the continent are considered instead of the whole Africa.

While most of the studies on the topic do not consider the origin of FDI, we nonetheless have found some studies which consider the origin of FDI. Sanfilippo (2010) analyses the determinants of Chinese FDI in Africa. For 41 African countries over the period 1998-2007, this study concludes that Chinese investment in Africa are mainly drive by natural resources endowment and market potential. Okafor (2015) extends this line in the literature by investigating the drivers of United States FDI flows into Africa. Using a panel dataset covering 23 sub-Saharan African countries for the period 1996–2010, the results show that United States outward FDI into SSA is motivated by the region's endowment in crude oil and natural gas, infrastructure development, market size and completion rates in primary education. Furthermore, his study finds that labor force and inflation have negative effect on United States FDI, while political instability, corruption, and the exchange rate have negative but not statistically significant effect on United States FDI into SSA.

3. Empirical Approach

The spatial interaction between countries' FDI flows and the cross-border effects generated by tax policy could potentially be captured using a Spatial Durbin Model (SDM). The SDM allows identifying both, the endogenous effects (spatially lagged endogenous variable) and the contextual effects (spatially lagged explanatory variables) (LeSage, 2014). It produces unbiased estimates even if the underlying data generator process is a Spatial Autoregressive Model (SAR) or Spatial Error Model (SEM) (Elhorst 2010b). Moreover, we take advantage of the panel data structure for the 1995 to 2012 period and therefore estimate a Dynamic Spatial Durbin Model (DSDM). The model is written as follows:

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

where $FDI_{i,t}$ represents the amount of FDI in country i at time t; $FDI_{i,t}-1$ the amount at time t-1;[52] W a spatial weight matrix ; $W\,FDI_{j,t}$ the amount of FDI in neighboring countries ; τ_{it} the statutory CIT rate in country i in year t ; $W\,\tau_{jt}$ the CIT rate in neighbors countries multiplied by the weights matrix W ; X_{it} a vector of FDI determinants in country i in year t ; $WFDI_{jt}$ the weighted average values of FDI determinants in other countries except i ; ϑ_i country fixed effects to control for time-invariant unobserved country heterogeneity ; μ_t time dummies controlling for common shocks affecting African countries each year ; ε_{it} an independent and identically distributed error term; and ρ a spatial autocorrelation coefficient.

This DSDM model includes spatially lagged explanatory variables (WX), spatially lagged variables of the dependent variable (WY). Spatial autocorrelation relates to the first law of geography: "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970: 236). Spatial autocorrelation is likely to exist in our study given that FDI decisions can be affected not only by domestic CIT rate but also by CIT rates in neighboring countries. First, there can be substitution between FDI in the preferred country and FDI in other destination markets. For example, a multinational firm can invest in an African country and use it as a platform to export to neighboring countries (Blonigen et al., 2007). Second, FDI in a host country could be a factor of attractiveness for a neighboring country. For example, if a lead multinational enterprise in a sector decides to invest in an African country, other firms operating in the same sector may follow this first mover in its new location or in a neighboring country in order to preserve their market shares in this country or region (Knickerbocker, 1973). Third, a multinational firm operating in country A may react to FDI in country A from another multinational located in neighboring country B by also investing in country B following the so-called "aggressor attacked" strategy (Mucchielli, 1985). Fourth, the

[52] Technically, as pointed by Singh and Jun (1995), the inclusion of the lagged dependent variable among the explanatory variables allows taking into account autocorrelations of errors and to indirectly capture the impact of factors omitted from the model, but which may have affected FDI in the past.

degradation of the macroeconomic and institutional environment in neighboring countries could lead FDI to move from these countries to a given host country suggesting that FDI traditional determinants in neighbors' countries may affect FDI inflows in a host country.

Our model also includes a one-period lagged value of the dependent variable (Y_{t-1}). This is motivated by the fact that foreign investors may decide to invest because their previous investments have produced satisfactory results (Batana, 2011); suggesting that the current level of FDI depends on previous investments decisions (Singh and Jun, 1995; Diaw and Guidime, 2013; Batana, 2011).

To estimate spatial autocorrelation, we need to define how countries are connected to each other. Following standard practice in spatial econometrics, we use geographical distance to measure closeness using a spatial weights matrix *W*, which has to be symmetric.[53] Algebraically, an element w_{ij} of the geographic distance weighting matrix takes the following form:

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

with d_{ij} being the Euclidean distance between the capitals of countries i and j. Economic neighborhood (GDP per capita distance) is also considered as a relevant measure for building the weights matrix in tax competition studies (Devereux et al, 2008; Cassette and Paty, 2008), assuming that countries with similar income level are more likely to compete against each another in attracting FDI. With economic neighborhood matrix, each country is linked to all other countries, but the intensity of connectivity is stronger between countries with similar levels of development. For example, the more developed countries of Sub-Saharan Africa

[53] This symmetric matrix defines for each observation (row) those locations that belongs to its neighborhood set as non-zero elements.

(Kenya, Côte d'Ivoire, Ghana, South Africa, or Nigeria) will be more likely to be in competition between them to attract FDI than with lower income countries such as Niger, Burundi, and Burkina Faso.

The elements of this weighting matrix are based on the absolute difference in GDP per capita (GDPpc) between countries i and j. We take the inverse of the absolute difference so that the weighting matrix attributes a higher weight to countries that have a smaller absolute difference in GDP per capita. Algebraically, an element w_{ij} of the economic distance weighting matrix takes the following form:

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

In contrast to most previous studies, our study considers a spatial weight matrix combining both geographic and economic distance. The underlining idea is the fact that tax competition can take place between both geographically and economically close countries (Martinez-Vasquez and Liu, 2014). Following Martinez-Vasquez and Liu (2014), the elements w_{ij} of this mixed weight matrix are computed as follows:

$$w_{ij} = \begin{cases} \frac{e_{ij} d_{ij}}{\sum_{j=1}^{N} e_{ij}\, d_{ij}}, & for\ i \neq j \\ 0, & for\ i = j \end{cases}$$

where e_{ij} is the inverse of the absolute value of the difference in GDP per capita between countries i and j; and d_{ij} is the inverse of Euclidian distance between the capital cities of countries i and j.

To our knowledge, this is the first study that models explicitly and estimates the spatial spillover effects using geographic or/and economic neighborhood matrices and a Dynamic Spatial Durbin Model to characterize the nature of spillovers effects (complementarity or

substitution) of FDI inflows to African's countries. In order to obtain consistent and efficient estimates, we apply the Maximum Likelihood method estimator developed by Elhorst (2010a) and Lee and Yu (2010) and implemented in Stata by Belotti et al. (2013) under the command "xsmle".

4. Data

We use statutory CIT rates data from the Tax Rate Database of the Fiscal Affairs Department of IMF (IMF-FAD). Our sample includes 19 African countries in total for the period 1995-2012 due to data availability. The number of countries in the sample and the period are mainly dictated by the spatial econometric method, which requires balanced panel data, or database with few missing values. Missing data can be problematic for spatial econometric models for two reasons mainly: i) in a spatial context, the outcome for one observation depends on the outcomes of others, with each observation thus representing a part of the spatial lag for other observations; ii) missing data can complicate the convergence of the model.

To measure tax incentives, we use the statutory CIT rate which is a highly visible and simple indicator of a tax incentives and which reflects the intent of decisions makers (Chen et al., 2014). As a result, the CIT rate is commonly used to evaluate countries' reaction to changes in international corporate taxation (Klemm and Van Parys, 2012). A potential limitation of this indicator is that a country could also be attractive because of its special regimes and not because of low statutory corporate tax rate only. Unfortunately, data that captured special regimes are not available for a large number of African countries and over the years. Nonetheless, it is worth pointing out that there is high correlation between statutory CIT rate, effective rate and special regime (IMF, 2014), which are alternative measures used in the empirical literature on tax incentives but difficult to implement in an African context. The impact of CIT rate on FDI is therefore difficult to predict. Because it negatively affects after-tax returns, a higher CIT rate

reduces the amount of FDI inflows (Gordon and Hines, 2002). Yet, a low corporate tax burden cannot always compensate for an unattractive business environment, with weak institutions and poor public infrastructure (OECD, 2008).

We extract data on FDI net inflows (in percentage of GDP) from the World Development Indicators (WDI). Table 3 control variables that are included in our regressions and provides summary statistics which we shall present in the next section for these variables. Control variables taken from WDI are: trade openness (as (X+M)/GDP), fixed phone subscriptions (per 1000 inhabitants) used as a proxy of infrastructure (see Asiedu, 2002), annual inflation rate as a proxy for the country's macroeconomic conditions, financial development (domestic credit provided by financial sector in percentage of GDP), population to measure market size, natural resources rents (percentage of GDP) to proxy natural resources endowment come from WDI. Political rights, taken from the Freedom House database, are used as a proxy of institutions; while nominal exchange rate and human capital measures come from the Penn World Table version 9.0 (PWT9.0) (Feenstra et al, 2015). Data on total tax revenues as a percentage of GDP was extracted from the ICTD Government Revenue Database (ICTD-GRD) (Prichard et al, 2014).[54]

5. Corporate tax rate and FDI in Africa: Main results

We start by presenting descriptive statistics and results from specification tests, before discussing regression results obtained from the estimation of the impact of CIT rates on FDI inflows.

[54] Where missing, ICTD-GRD tax revenues data have been fulfilled by tax revenues data as a percent of GDP from the recent IMF's World Revenue Longitudinal Data set (WoRLD). For Cameroon this concerns the years 1990, 1991, 1992, 2007 and 2008. For Nigeria, the years 2010, 2011, 2012. For Tunisia, the years 1990 and 2012. For South Africa, the period 1990-1995 and finally the year 2012 for Swaziland. Furthermore, for Nigeria again, data on tax revenues for the years 1990 and 1991 have been extracted from the database on tax revenue in SSA (Mansour, 2014) because these data are missing both in ICTD-GRD and IMF-WoRLD datasets.

5.1 Trends in FDI net inflows and CIT rate in Africa

We first provide descriptive statistics on CIT rate and FDI inflows before analyzing trends in these variables. As reported in table 3 below, the average FDI net inflows in our sample of 19 African countries is 2.24% of GDP while the average statutory CIT rate is 33.68% with the lowest rate at 15% and the highest at 60% (applied in Sudan in 1990).

Table 3 : Summary statistics

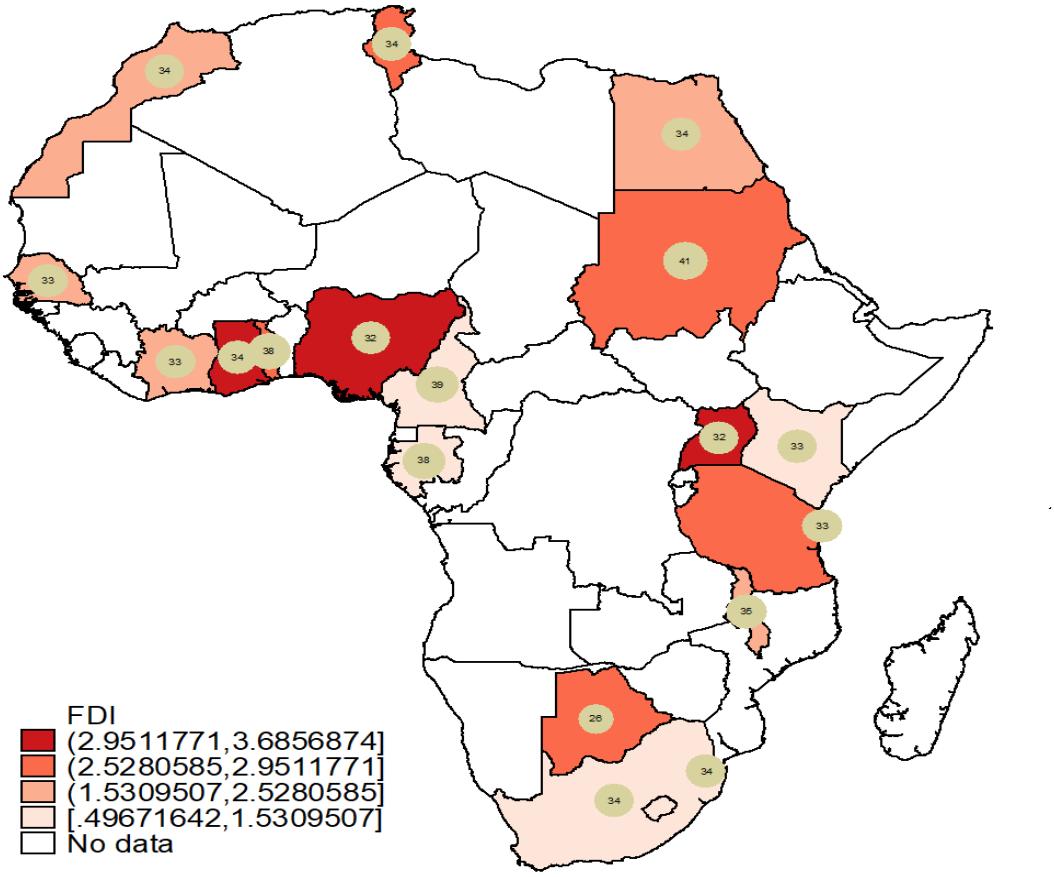
Variable	Mean	Std. Dev.	Min.	Max.	N
FDI net inflows (%GDP)	2.237	2.673	-8.589	20.049	437
CIT rate	33.685	7.167	15	60	437
Nominal exchange rate	275.912	432.847	0.013	2522.746	437

GDP growth	3.989	3.955	-15.096	33.736	437
Gov. consumption (%GDP)	14.33	4.21	4.833	31.554	437
Political rights	4.597	1.875	1	7	437
Human capital	1.798	0.359	1.185	2.762	437
Trade openness (X+M)/GDP	71.172	30.88	11.087	202.85	437
Fixed phone subscriptions (per 1000 inhabitans)	4.063	5.862	0.107	31.503	437
Inflation	11.075	16.378	-11.686	132.824	437
Financial development	36.415	41.077	-79.092	192.66	437
Population	25.725	30.315	0.863	168.24	437
Natural resources rents (%GDP)	0.463	1.366	0.000	12.011	437
Capital account openness	-0.553	1.208	-1.894	2.389	436
Human capital	1.798	0.358	1.185	2.761	437
Tax revenues (%GDP)	14.435	6.339	3.206	38.487	437

Source: Authors calculations from IMF-FAD, Freedom House, PWT9.0 and WDI.

Figure 1 shows the spatial distribution of FDI inflows and CIT rate for the countries in our sample. On average over the observation period, Nigeria, Ghana, Uganda, Sudan, Tanzania and Botswana are the major recipient countries for FDI flows. The average highest CIT rates are observed in Sudan, Togo, Cameroon and Gabon, while Mauritius has the lowest rate (see figure 1 below).

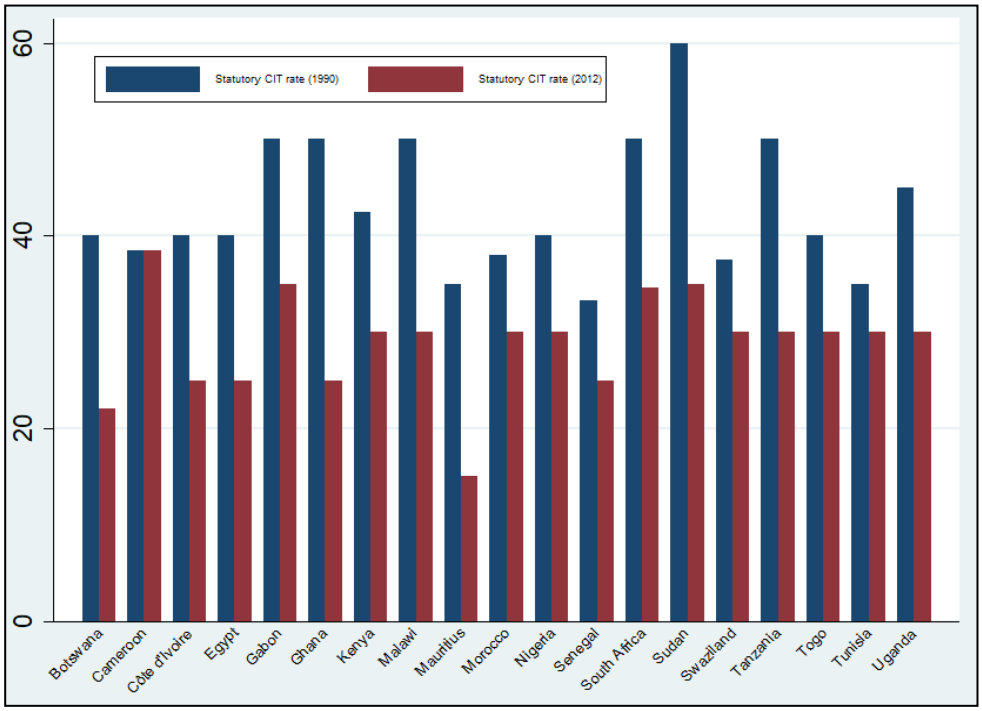
Figure 1: Map of FDI net inflows and CIT rate (in the circles), 1990-2012.



Source: Own calculation, based on WDI, the World Bank and IMF-FAD data. FDI net inflows and CIT rate are averages from 1990 to 2012.

As complement for figure 1, we graph in figure the statutory CIT rate for each country, in 1990 and 2012. Except Cameroon, all other countries have reduced their CIT rates. Sudan is the country that cut its CIT rate the most during the period, from 60% in 1990 to 35% in 2012 (figure 2). At the same time, FDI inflows to Africa increased from 0.8% of GDP in 1994-1999 to 3.06 % of GDP in 2005-2009 (table 1).

Figure 2: Statutory CIT rate in Africa



Source: Authors calculations from IMF-FAD.

Except Western Africa, all other regions have experienced an increase of their net inflows of FDI from 1995-1999 to 2000-2004 (table 1). Similarly, except Eastern Africa, all other regions have recorded a decrease of their FDI inflows from 2005-2009 to 2010-2014; likely due to the 2009 financial crisis and the instability in oil and commodity prices over the period 2010-2014.

Table 1: Annual averages of FDI net inflows (% GDP) to Africa, 1990-2014[55]

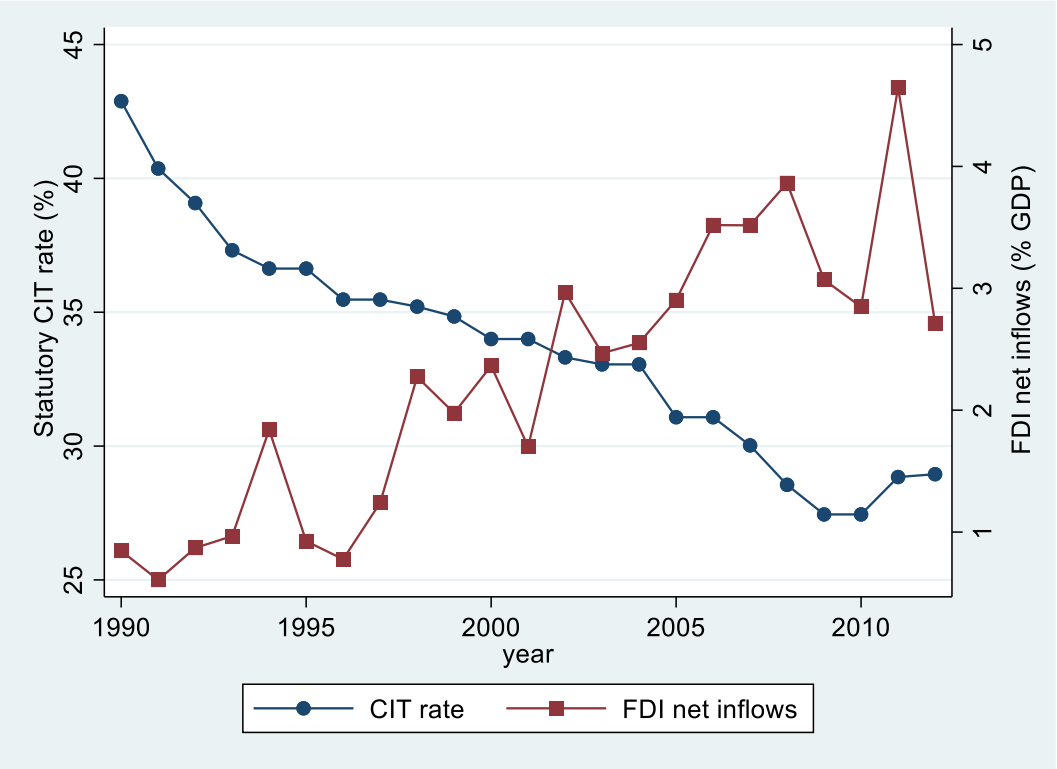
[55] FDI attractiveness performance recorded in Central Africa over the period 2000/2004 was mainly driving by Equatorial Guinea (the same observation is in AVOM and NGO NKOA , 2013) and Chad, two major oil producing

Region	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014
Africa	0.797	1.518	2.242	3.066	2.287
Western Africa	1.843	2.353	1.886	2.855	2.502
Central Africa	0.525	2.945	7.275	2.517	1.792
Eastern Africa	0.505	1.969	2.200	3.078	4.815
Southern Africa	0.169	1.156	1.879	2.329	1.679
Northern Africa	0.874	1.003	1.775	3.857	1.753

Source: Author's calculations from UNCTAD.

As highlighted in Figure 3, even if there are some episodes where reductions in CIT rates are followed by reduction in FDI inflows, the overall picture suggests that FDI inflows to Africa has increased with reductions in CIT rates over the period 1990-2012.

Figure 3: FDI net inflows and CIT rate in Africa



Source: Authors calculations from IMF-FAD and WDI.

countries. In fact, the oil industry has significantly stimulated the economic growth of Equatorial Guinea over the period 2000-2004 (70% in 2001) resulting in an increase in FDI in the country (African Economic Outlook, 2013).

5.2 Specification tests

In order to confirm the choice of the DSDM, we test the suitability of the Dynamic Spatial Autoregressive Model (DSAR) and SEM models for analyzing the impact of CIT rates on FDI against the DSDM. According to LeSage and Pace (2009), the DSDM specification is reduced to DSAR specification if the coefficients of the spatially lagged explanatory variables are not significantly different from zero. Thus, to assess the appropriateness of the DSDM against the DSAR, we test the joint nullity of the coefficients of the spatially lagged explanatory variables ($\beta_2 = \theta_2 = 0$, see Equation 1). This test, significant at the 1% level ($\chi2$ (9) = 317.48, Prob > $\chi2$ = 0.00), leads to the rejection of the null hypothesis, thereby rejecting the DSAR specification. The SEM can also be viewed as a special case of the DSDM if $\rho\beta_1 + \beta_2 = 0$ and $\rho\theta_1 + \theta_2 = 0$ in equation 1 (Burridge, 1981). We reject the null hypothesis that $\rho\beta_1 + \beta_2 = 0$ and $\rho\theta_1 + \theta_2 = 0$ (χ (9) = 383.79, Prob > $\chi2$ = 0.00) at the 1% level of significance, suggesting that the DSDM is preferable than the SEM.[56] The two likelihood ratio tests comfort the DSDM with respect to the SEM and DSAR specifications. Finally, we use the Hausman test to choose between the fixed effects and the random effects DSDM. The result of the Hausman test (χ (19) =887.42, Prob>$\chi2$ = 0.0000) points to the rejection of the null the hypothesis of independence between the unobserved individual effects and the explanatory variables. Therefore, a fixed effects DSDM is chosen in the present study.

5.3 Pattern of spatial autocorrelation, direct and indirect effects

Our main empirical results are presented in Table 2 below. The presence of spatial interactions in FDI is confirmed by a significant value of ρ. Specifically, $\rho > 0$ suggests that in Africa, an increase in the amount of FDI in a given country is likely to be a factor of attractiveness for its

[56] Abate (2016) and Elhorst (2010b) mentions that even if the true data generator process fits in a SEM, the SDM still produces unbiased estimates because the SEM is nested in the SDM so that the error dependence is taken into account in the variance-covariance matrix of the specification SDM.

neighbors. Moreover, as shown in Column 1 of Table 2, the estimated coefficient for the FDI variable in year t-1 is positive and statistically significant at the x% level, suggesting that the success of past FDI matters in attracting more FDI to African countries.

Following LeSage and Pace (2009), we break down the impact of the explanatory variables on the dependent variable into direct and indirect effects. The direct effects of CIT rate variable measure the impact of a change in the CIT rate in country i on the amount of FDI in country i. The indirect effect measures the impact of a change of the CIT rate in country i on the amount of FDI in the other countries. Indirect effects are global spillovers because they affect all countries (not just neighboring countries), but their impacts decrease with the distance between two countries. Marginal direct, indirect and total effects are presented in Column 3 to 8 of Table 2. The direct and indirect effects associated with the CIT rate are negative and significantly different from 0 at the 1% level. One percentage point reduction in the CIT rate will increase not only inflows of FDI by 0.05 percent points of GDP in the policy-initiating country (direct effect), but also by 0.1 percentage point of GDP in its neighboring countries (indirect effect).

5.4 Short-term and long-term effects

Using a DSDM also allows computing both short-term and long-term effects of CIT changes on FDI flows. Short-term effects are computed as partial derivatives of FDI with respect to an explanatory variable at a particular point in time, while ignoring δ in equation (1). Long-term effects are computed as partial derivatives of FDI with respect to an explanatory variable at a particular point in time, while setting $FDI_{i,t-1} = FDI_{i,t} = FDI^*$ and $W.FDI_{i,t} = W.FDI^*$ (see Elhorst 2014, p.106 for details). Long-term effects are similar to a steady-state where the share of FDI in GDP remains constant in all countries.

In the short term, one-percentage-point cut in the CIT contributes to increasing not only the FDI-to-GDP ratio of 0.04 percentage points (direct effect) in the country that implemented the

policy but also the FDI-to-GDP ratio of the neighboring countries of 0.09 percentage points (indirect effect). Thus, the total effect of the cut in the tax is 0.14 percentage points. Failure to take into account spatial interactions would have contributed to underestimating the effect of the CIT.

These results suggest that change in national CIT policy has both domestic and cross border impacts on FDI. Typically, each country will benefit both from the competitiveness and attractiveness gains associated with a reduction of its own CIT rate, but also from spillovers effects that could result from a reduction in the CIT rates of its neighbors. These spatial spillovers effects stem from the region's overall attractiveness gains, as well as better knowledge of the region's business environment by foreign investors.

In the long term, a CIT cut of one-percentage-point brings about an increase in the FDI to GDP ratio of 0.06 percentage point in the country, 0.12 percentage point in the neighboring countries for a total effect of 0.18 percentage point. The short-term and long-term effects are in the same direction, although the long-run effects are slightly larger. Our findings support proponents of tax incentives, according to which the cuts in taxes could be effective in attracting FDI in lows income countries since such reductions support the economic profitability of the companies subjected to a generally unfavorable economic and business environment (institutional deficiencies, poor quality of the infrastructures and labor force). In the long term, the cut in taxes will favor the installation of new companies, will increase of the activity of the companies' already in place and boost job creation, which will lead to an increase in the tax base and compensate the initial losses of tax revenues.

5.5 Control variables

Regarding the traditional determinants of FDI inflows in Africa (see Columns 3 and 6, Table 2), in line with our theoretical predictions, we find that GDP growth, government consumption,

and financial development are important for attracting FDI in Africa. Besides, our results show that trade openness increases the attractiveness of a country in the long run. In the short run, trade openness tends to have a negative effect on FDI attraction in Africa, likely due to the fact that the policy environment is characterized by persistence trade barriers (Cantah et al, 2016). Similarly, we find that population size used as a proxy market size in the host country negatively affects FDI in short run but acts as an engine of FDI in long run. Furthermore, we find that macroeconomic instability proxied by inflation rate reduces FDI net inflows. An increase in the nominal exchange rate (appreciation of the domestic currency, direct quote) is positively associated to FDI inflows. This result may be explained by the fact that an appreciation of the domestic currency may be interesting for foreign investors aiming to transfer profits in their origin country. The estimated coefficient for the "Infrastructure" variable, measured by fixed phone subscribers per 1000 inhabitants, is not statistically significant.

Table 2: Tax policy and FDI: Results from the baseline specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.270***							
	(0.0971)							
CIT_rate	-0.0547***	-0.114***	-0.0491***	-0.0984***	-0.147***	-0.0646***	-0.128***	-0.193***
	(0.00839)	(0.0174)	(0.00819)	(0.0161)	(0.0214)	(0.0111)	(0.0217)	(0.0288)
Nominal exchange rate	0.00184***	0.00372***	0.00166***	0.00324***	0.00490***	0.00218***	0.00423***	0.00641***
	(0.000259)	(0.00125)	(0.000279)	(0.00118)	(0.00113)	(0.000405)	(0.00158)	(0.00147)
GDP growth	0.0764***	0.0617*	0.0738***	0.0472	0.121**	0.100***	0.0581	0.158**
	(0.0219)	(0.0373)	(0.0203)	(0.0311)	(0.0498)	(0.0270)	(0.0401)	(0.0646)
Gov. Consumption	0.0911***	0.00415	0.0926***	-0.00903	0.0836***	0.128***	-0.0184	0.109***
	(0.0235)	(0.0171)	(0.0241)	(0.0129)	(0.0314)	(0.0331)	(0.0165)	(0.0407)
Trade openness	-0.0220***	-0.00618	-0.0219***	-0.00257	-0.0245	-0.0301***	-0.00201	-0.0321
	(0.00576)	(0.0134)	(0.00513)	(0.0126)	(0.0165)	(0.00681)	(0.0167)	(0.0216)
Fixed phone subscr,	0.00241	0.0917	-0.00165	0.0837	0.0820	-0.00457	0.112	0.108
	(0.0216)	(0.0914)	(0.0230)	(0.0827)	(0.0758)	(0.0327)	(0.111)	(0.0995)
Inflation	-0.00713***	0.0374***	-0.00935***	0.0356***	0.0263***	-0.0140***	0.0483***	0.0343***
	(0.00270)	(0.0102)	(0.00233)	(0.00933)	(0.00998)	(0.00313)	(0.0125)	(0.0129)
Financial Dev.	0.0150***	0.00974	0.0146***	0.00727	0.0219**	0.0199***	0.00873	0.0286**
	(0.00357)	(0.0107)	(0.00375)	(0.00965)	(0.00896)	(0.00528)	(0.0130)	(0.0117)
Population	-0.0655***	0.0116	-0.0665***	0.0198	-0.0468***	-0.0921***	0.0309*	-0.0612***
	(0.0107)	(0.0143)	(0.0102)	(0.0128)	(0.0171)	(0.0139)	(0.0168)	(0.0224)
rho	0.146***							
	(0.0226)							
sigma2_e	4.394***							
	(0.815)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-920.0	-920.0	-920.0	-920.0	-920.0	-920.0	-920.0	-920.0

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

5.6 Robustness check

In the following sub-sections, we undertake two series of robustness checks. First, we check the sensitiveness of our baseline results to the spatial weight matrix choice. Specifically, we use either geographic distance or economic distance as weighting matrices, noting the baseline results are based on a mixed (economic and geographic) weight matrix. Second, we add additional controls to the baseline specification and check if our main results remain unchanged.

5.6.1 Alternative Weighting Matrices

The results discussed in Table 2 are based on a mixed (economic and geographic) weight matrix. In Table 4, we report results obtained from the estimation of our baseline specification using the inverse economic distance as the spatial weight matrix. Our main findings remain unchanged. In the short run and long term, a cut in CIT rate increases FDI both in the host country and the neighboring countries.

Table 4: Impact of CIT rate on FDI: inverse economic distance interaction matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.261**							
	(0.102)							
CIT_rate	-0.0553***	-0.170***	-0.0485***	-0.123***	-0.172***	-0.0630***	-0.152***	-0.215***
	(0.00938)	(0.0361)	(0.00874)	(0.0296)	(0.0357)	(0.0116)	(0.0380)	(0.0457)
Nominal exchange rate	0.00199***	0.00685***	0.00170***	0.00512***	0.00682***	0.00219***	0.00633***	0.00851***
	(0.000268)	(0.00246)	(0.000269)	(0.00194)	(0.00190)	(0.000390)	(0.00245)	(0.00235)
GDP growth	0.0793***	0.122	0.0750***	0.0791	0.154*	0.100***	0.0920	0.192*
	(0.0240)	(0.0842)	(0.0207)	(0.0607)	(0.0798)	(0.0268)	(0.0744)	(0.0987)
Gov. Consumption	0.0857***	-0.0262	0.0893***	-0.0437**	0.0456	0.123***	-0.0660**	0.0569
	(0.0263)	(0.0279)	(0.0271)	(0.0202)	(0.0340)	(0.0372)	(0.0261)	(0.0423)
Trade openness	-0.0205***	0.00128	-0.0210***	0.00655	-0.0144	-0.0288***	0.0106	-0.0182
	(0.00662)	(0.0306)	(0.00553)	(0.0246)	(0.0285)	(0.00713)	(0.0312)	(0.0357)
Fixed phone subscr,	-0.00835	0.0826	-0.0112	0.0682	0.0569	-0.0169	0.0881	0.0712
	(0.0241)	(0.123)	(0.0239)	(0.0930)	(0.0932)	(0.0328)	(0.119)	(0.117)
Inflation	-0.00336	0.0827***	-0.00727***	0.0674***	0.0601***	-0.0117***	0.0867***	0.0750***
	(0.00270)	(0.0181)	(0.00211)	(0.0132)	(0.0136)	(0.00280)	(0.0165)	(0.0166)
Financial Dev.	0.0154***	0.0293	0.0142***	0.0205	0.0347**	0.0189***	0.0245	0.0433**
	(0.00368)	(0.0238)	(0.00407)	(0.0187)	(0.0171)	(0.00579)	(0.0240)	(0.0213)
Population	-0.0572***	0.0377	-0.0595***	0.0454*	-0.0141	-0.0822***	0.0646**	-0.0176
	(0.0112)	(0.0293)	(0.0110)	(0.0232)	(0.0270)	(0.0147)	(0.0293)	(0.0337)
rho	0.311***							
	(0.0400)							
sigma2_e	4.310***							
	(0.787)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-938.6	-938.6	-938.6	-938.6	-938.6	-938.6	-938.6	-938.6

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

A country may also have strong incentives to cut statutory CIT rate if its geographical neighbors lower their statutory CIT rates (Heinemann et al, 2010). As a result, the inverse geographical distance has been commonly used as a weighting matrix in empirical studies on tax incentives (Heinemann et al, 2010; Klemm and Van Parys, 2012). We therefore estimate the baseline model using the inverse distance between countries as weighting matrix. [57] The

[57] Geographic distance between countries i and j is the Euclidian distance between the capitals of countries i and j.

estimation results are displayed in Table 5. Again, we find that, a reduction of CIT rate increases FDI net inflows in the in all the countries engaged in CIT rate reduction.

Table 5: Impact of CIT rate on FDI: inverse geographical distance weighting matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.249***							
	(0.0797)							
CIT_rate	-0.0553***	-0.264***	-0.0427***	-0.133***	-0.176***	-0.0535**	-0.151***	-0.204***
	(0.0133)	(0.0640)	(0.0164)	(0.0388)	(0.0309)	(0.0234)	(0.0479)	(0.0356)
Nominal exchange rate	0.00111***	-0.00235***	0.00130***	-0.00196***	-0.000661	0.00183***	-0.00260***	-0.000767
	(0.000283)	(0.000797)	(0.000272)	(0.000441)	(0.000525)	(0.000375)	(0.000527)	(0.000610)
GDP growth	0.0771**	0.258	0.0662**	0.118	0.184*	0.0860**	0.127	0.213*
	(0.0352)	(0.172)	(0.0280)	(0.0841)	(0.110)	(0.0355)	(0.0947)	(0.126)
Gov. Consumption	0.0579***	0.114	0.0551**	0.0364	0.0915	0.0739**	0.0324	0.106
	(0.0187)	(0.160)	(0.0226)	(0.0948)	(0.0858)	(0.0324)	(0.116)	(0.0997)
Trade openness	-0.0236***	0.0591***	-0.0280***	0.0473***	0.0192**	-0.0396***	0.0619***	0.0223**
	(0.00321)	(0.0175)	(0.00305)	(0.00952)	(0.00937)	(0.00421)	(0.0115)	(0.0108)
Fixed phone subscr,	-0.0375**	-0.0175	-0.0376**	0.00472	-0.0329	-0.0513**	0.0130	-0.0383
	(0.0181)	(0.206)	(0.0158)	(0.115)	(0.113)	(0.0224)	(0.137)	(0.131)
Inflation	-0.00885*	0.0578**	-0.0126***	0.0391**	0.0266	-0.0183***	0.0492***	0.0309
	(0.00477)	(0.0292)	(0.00396)	(0.0154)	(0.0182)	(0.00517)	(0.0179)	(0.0211)
Financial Dev.	0.0153***	-0.140***	0.0237***	-0.0926***	-0.0688***	0.0353***	-0.115***	-0.0798***
	(0.00536)	(0.0360)	(0.00537)	(0.0200)	(0.0194)	(0.00768)	(0.0241)	(0.0224)
Population	-0.0870***	0.114	-0.0974***	0.112*	0.0142	-0.136***	0.153**	0.0166
	(0.0163)	(0.111)	(0.0124)	(0.0581)	(0.0667)	(0.0160)	(0.0675)	(0.0773)
rho	0.817***							
	(0.0559)							
sigma2_e	3.931***							
	(0.710)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-988.6	-988.6	-988.6	-988.6	-988.6	-988.6	-988.6	-988.6

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

5.6.2 Additional control variables

We run another robustness check through the inclusion of additional controls in the baseline specification (institutions, natural resources, education, total taxes, and capital account openness). Cuts in CIT rates for attracting FDI are likely to result in losses in CIT revenue and therefore in total tax revenue. Thus, policy makers from a country engaged in reducing CIT rate may implement measures aiming at compensating for losses in tax revenue in order to

ensure proper provision of public goods and services. These measures range from broadening the corporate taxation base to increasing the tax burden of other tax instruments in the economy (Devereux et al, 2002). One could argue that countries may temporarily rely on debt to avoid under provision of public goods and services, if they face downward pressure on tax revenues due to cuts in CIT rate. However, this solution is more difficult for African economies due to the relative scarcity of external funding. To control for all of the adjustments in other taxes and in the CIT base induced by CIT rate reduction in a context of tax competition, we follow Arcalean (2016) by including the total tax revenues in the baseline specification. Table 6 provides the results obtained when total taxes are included in the baseline model. Our main results are robust. A reduction of CIT rate increases FDI inflows in the short run (Table 6; Columns 3, 4 and 5) and in the long run in the host economy and in other neighboring economies (Table 6; Columns 6, 7 and 8). In the short run, total tax revenue negatively affects FDI in the host country, while in the long run, total tax revenue is positively correlated with FDI net inflows in Africa; suggesting that there is compatibility between the objectives of tax revenues mobilization and FDI attractiveness in Africa in the longer run. Moreover, both in the short run and long run, we find that an increase in total tax revenues in a host country do not significantly affect FDI net inflows in neighboring countries (see columns 4 and 7, table 6). Plausibly, if the increase in total tax revenues is not a consequence of a CIT rate increase, other things being equals, domestic capitals will not move to other countries.

Table 6: CIT rate and FDI in Africa: Controlling for the impact of substitution in total tax composition.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.270***							
	(0.0944)							
CIT_rate	-0.0531***	-0.114***	-0.0474***	-0.0981***	-0.146***	-0.0624***	-0.128***	-0.191***
	(0.00845)	(0.0200)	(0.00812)	(0.0190)	(0.0239)	(0.0110)	(0.0256)	(0.0320)
Nominal exchange rate	0.00187***	0.00374***	0.00248	0.00324*	0.00572	0.00331	0.00418	0.00749
	(0.000256)	(0.00120)	(0.0286)	(0.00179)	(0.0273)	(0.0394)	(0.00406)	(0.0358)
GDP growth	0.0758***	0.0607*	0.0733***	0.0458	0.119**	0.0995***	0.0561	0.156**
	(0.0209)	(0.0366)	(0.0194)	(0.0307)	(0.0484)	(0.0258)	(0.0396)	(0.0629)
Gov. Consumption	0.0904***	0.00332	0.0918***	-0.00977	0.0820***	0.127***	-0.0194	0.107***
	(0.0220)	(0.0179)	(0.0223)	(0.0141)	(0.0318)	(0.0307)	(0.0178)	(0.0414)
Trade openness	-0.0219***	-0.00539	-0.0219***	-0.00178	-0.0237	-0.0302***	-0.000922	-0.0311
	(0.00563)	(0.0130)	(0.00594)	(0.0124)	(0.0161)	(0.00800)	(0.0165)	(0.0212)
Fixed phone subscr,	0.00483	0.0984	0.000428	0.0908	0.0912	-0.00202	0.122	0.120
	(0.0205)	(0.0893)	(0.0220)	(0.0793)	(0.0727)	(0.0313)	(0.107)	(0.0953)
Inflation	-0.00783***	0.0381***	-0.00996**	0.0368***	0.0268**	-0.0149**	0.0499***	0.0350**
	(0.00288)	(0.01000)	(0.00493)	(0.00874)	(0.0107)	(0.00674)	(0.0117)	(0.0138)
Financial Dev.	0.0146***	0.00999	0.0141***	0.00743	0.0216**	0.0192***	0.00897	0.0282**
	(0.00367)	(0.0102)	(0.00392)	(0.00953)	(0.00917)	(0.00550)	(0.0128)	(0.0119)
Population	-0.0668***	0.0131	-0.0677***	0.0215	-0.0462***	-0.0938***	0.0334*	-0.0604***
	(0.0105)	(0.0147)	(0.0105)	(0.0133)	(0.0171)	(0.0144)	(0.0175)	(0.0223)
Political instability	-0.0504**	0.0292	-0.0513**	0.0314	-0.0199	-0.0714**	0.0456	-0.0258
	(0.0240)	(0.0814)	(0.0248)	(0.0748)	(0.0746)	(0.0345)	(0.100)	(0.0975)
rho	0.147***							
	(0.0209)							
sigma2_e	4.392***							
	(0.798)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-919.9	-919.9	-919.9	-919.9	-919.9	-919.9	-919.9	-919.9

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

As previously discussed, (see the section on the determinants of FDI), political risk can affect FDI net inflows in Africa. We therefore control for the impact of political instability on FDI using the political rights index from Freedom House (2014). We find that in the short run, an improvement in political rights (reduction of political rights index) is likely to stimulate FDI inflows in Africa (see table 7) while in the long run political rights index has no significant impact on FDI inflows.

Table 7: CIT rate incentives and FDI in Africa: controlling for the quality of institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.256***							
	(0.0983)							
CIT_rate	-0.0519***	-0.117***	-0.0456***	-0.100***	-0.146***	-0.0586***	-0.129***	-0.187***
	(0.00933)	(0.0191)	(0.00915)	(0.0172)	(0.0239)	(0.0122)	(0.0227)	(0.0314)
Nominal exchange rate	0.00203***	0.00402***	0.00181***	0.00346***	0.00527***	0.00234***	0.00443***	0.00677***
	(0.000247)	(0.00140)	(0.000250)	(0.00128)	(0.00125)	(0.000355)	(0.00168)	(0.00158)
GDP growth	0.0742***	0.0577*	0.0717***	0.0423	0.114***	0.0954***	0.0507	0.146***
	(0.0199)	(0.0312)	(0.0185)	(0.0259)	(0.0425)	(0.0242)	(0.0327)	(0.0541)
Gov. Consumption	0.0654***	-0.0243	0.0686***	-0.0327**	0.0358	0.0935***	-0.0476**	0.0459
	(0.0253)	(0.0165)	(0.0263)	(0.0145)	(0.0284)	(0.0357)	(0.0196)	(0.0363)
Trade openness	-0.0197***	-0.00116	-0.0199***	0.00197	-0.0179	-0.0269***	0.00388	-0.0230
	(0.00471)	(0.0122)	(0.00424)	(0.0112)	(0.0138)	(0.00558)	(0.0147)	(0.0177)
Fixed phone subscr,	-0.0245	0.0914	-0.0291	0.0892	0.0601	-0.0418	0.119	0.0772
	(0.0206)	(0.0922)	(0.0221)	(0.0834)	(0.0744)	(0.0309)	(0.110)	(0.0956)
Inflation	-0.00978**	0.0346***	-0.0120***	0.0335***	0.0215**	-0.0173***	0.0448***	0.0275**
	(0.00313)	(0.0110)	(0.00262)	(0.00958)	(0.0106)	(0.00341)	(0.0126)	(0.0135)
Financial Dev.	0.0219***	0.0122	0.0214***	0.00805	0.0295***	0.0286***	0.00913	0.0378***
	(0.00451)	(0.0118)	(0.00437)	(0.0105)	(0.0114)	(0.00591)	(0.0137)	(0.0144)
Population	-0.0838***	0.00364	-0.0844***	0.0153	-0.0691***	-0.114***	0.0256*	-0.0887***
	(0.0117)	(0.0128)	(0.0117)	(0.0119)	(0.0143)	(0.0157)	(0.0155)	(0.0186)
Tax revenues	-0.132***	-0.0818*	-0.128***	-0.0573	-0.186***	-0.171***	-0.0666	-0.238***
	(0.0276)	(0.0469)	(0.0243)	(0.0358)	(0.0560)	(0.0320)	(0.0448)	(0.0706)
rho	0.157***							
	(0.0249)							
sigma2_e	4.299***							
	(0.788)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-923.9	-923.9	-923.9	-923.9	-923.9	-923.9	-923.9	-923.9

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

Natural resources rich countries may for instance be able to attract more FDI than non-resource rich countries even when CIT is lower in the non-resource rich countries. We take this into account by controlling for the impact of natural resources in the baseline specification using data on natural resources rents from WDI. Where missing, natural resources rents are calculated as the sum of oil rents in % GDP, mineral rents in % GDP and natural gas rent in % GDP also using WDI data. We find that natural resources rents are positively associated with FDI inflows in Africa (table 8, columns 3 and 6).

Table 8: CIT incentives and FDI in Africa: controlling for the impact of natural resources

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.252***							
	(0.0901)							
CIT_rate	-0.0358***	-0.101***	-0.0307***	-0.0888***	-0.119***	-0.0389***	-0.114***	-0.153***
	(0.00727)	(0.0133)	(0.00708)	(0.0122)	(0.0159)	(0.00942)	(0.0161)	(0.0208)
Nominal exchange rate	0.00212***	0.00448***	0.00189***	0.00391***	0.00580***	0.00243***	0.00501***	0.00744***
	(0.000302)	(0.00118)	(0.000306)	(0.00110)	(0.00112)	(0.000423)	(0.00143)	(0.00143)
GDP growth	0.0725***	0.0575	0.0699***	0.0433	0.113**	0.0926***	0.0523	0.145**
	(0.0230)	(0.0350)	(0.0216)	(0.0285)	(0.0486)	(0.0283)	(0.0358)	(0.0618)
Gov. Consumption	0.0867***	0.0168	0.0873***	0.00371	0.0910***	0.117***	-0.000502	0.117***
	(0.0223)	(0.0147)	(0.0231)	(0.0117)	(0.0269)	(0.0311)	(0.0153)	(0.0342)
Trade openness	-0.0280***	-0.00939	-0.0278***	-0.00471	-0.0325**	-0.0373***	-0.00454	-0.0418**
	(0.00527)	(0.0110)	(0.00484)	(0.0104)	(0.0141)	(0.00630)	(0.0136)	(0.0183)
Fixed phone subscr,	0.0209	0.116	0.0161	0.105	0.121	0.0191	0.137	0.156
	(0.0205)	(0.0976)	(0.0221)	(0.0885)	(0.0814)	(0.0306)	(0.117)	(0.105)
Inflation	-0.00543*	0.0341***	-0.00745***	0.0324***	0.0250**	-0.0109***	0.0428***	0.0319**
	(0.00288)	(0.0102)	(0.00238)	(0.00891)	(0.00994)	(0.00307)	(0.0116)	(0.0126)
Financial Dev.	0.0135***	0.00809	0.0131***	0.00584	0.0189**	0.0174***	0.00684	0.0242**
	(0.00379)	(0.0101)	(0.00389)	(0.00901)	(0.00887)	(0.00529)	(0.0118)	(0.0113)
Population	-0.0308***	0.0222	-0.0321***	0.0253	-0.00681	-0.0438***	0.0350*	-0.00874
	(0.0106)	(0.0172)	(0.0102)	(0.0155)	(0.0237)	(0.0135)	(0.0200)	(0.0304)
Natural ressource rents	0.0746***	0.0254	0.0739***	0.0144	0.0882***	0.0987***	0.0145	0.113***
	(0.0186)	(0.0207)	(0.0194)	(0.0192)	(0.0214)	(0.0262)	(0.0253)	(0.0277)
rho	0.146***							
	(0.0241)							
sigma2_e	4.321***							
	(0.820)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-916.8	-916.8	-916.8	-916.8	-916.8	-916.8	-916.8	-916.8

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

We also control the impact of human capital in attracting FDI in Africa, which is assumed to enhance a country's FDI attractiveness. Annual data on human capital is obtained from Penn World Table version 9.0 (PWT9.0) (Feenstra et al, 2015). With the inclusion of human capital in the baseline specification, we find that lowering CIT rate increase FDI inflows in short and long run for African economies suggesting that the main results of this chapter remain robust

when we control for the impact of human capital (table 9, columns 3, 5, 6 and 8). Estimations show that human capital stimulates FDI inflows in Africa. (Table 9).

Table 9: Tax policy and FDI: controlling for the impact of human capital

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflows	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.215**							
	(0.0843)							
CIT_rate	-0.0577***	-0.0672***	-0.0550***	-0.0566***	-0.112***	-0.0693***	-0.0689***	-0.138***
	(0.0100)	(0.0159)	(0.0103)	(0.0136)	(0.0154)	(0.0132)	(0.0171)	(0.0191)
Nominal exchange rate	0.00179***	0.00394***	0.00162***	0.00354***	0.00517***	0.00201***	0.00438***	0.00639***
	(0.000253)	(0.00135)	(0.000277)	(0.00128)	(0.00121)	(0.000368)	(0.00159)	(0.00148)
GDP growth	0.0743***	0.0598	0.0721***	0.0475	0.120**	0.0912***	0.0567	0.148**
	(0.0199)	(0.0374)	(0.0185)	(0.0321)	(0.0491)	(0.0231)	(0.0392)	(0.0603)
Gov. Consumption	0.0886***	0.0106	0.0897***	-0.00103	0.0887***	0.114***	-0.00484	0.110***
	(0.0227)	(0.0167)	(0.0236)	(0.0152)	(0.0272)	(0.0301)	(0.0194)	(0.0335)
Trade openness	-0.0182***	0.00550	-0.0186***	0.00742	-0.0112	-0.0239***	0.0100	-0.0139
	(0.00489)	(0.0153)	(0.00480)	(0.0150)	(0.0147)	(0.00622)	(0.0189)	(0.0183)
Fixed phone subscr,	-0.0130	0.0608	-0.0149	0.0586	0.0437	-0.0198	0.0740	0.0541
	(0.0272)	(0.0871)	(0.0274)	(0.0805)	(0.0769)	(0.0353)	(0.101)	(0.0952)
Inflation	-0.0106***	0.0409***	-0.0126***	0.0398***	0.0272**	-0.0168***	0.0504***	0.0336**
	(0.00230)	(0.0129)	(0.00202)	(0.0117)	(0.0120)	(0.00257)	(0.0147)	(0.0147)
Financial Dev.	0.0142***	-0.00217	0.0144***	-0.00337	0.0111	0.0185***	-0.00482	0.0137
	(0.00546)	(0.0106)	(0.00543)	(0.00955)	(0.0115)	(0.00693)	(0.0119)	(0.0142)
Population	-0.101***	0.0351**	-0.103***	0.0448***	-0.0581***	-0.132***	0.0601***	-0.0719***
	(0.0105)	(0.0151)	(0.0102)	(0.0144)	(0.0212)	(0.0128)	(0.0181)	(0.0264)
human capital	7.464***	-0.850	7.546***	-1.698	5.848***	9.661***	-2.416	7.245***
	(0.701)	(2.535)	(0.717)	(2.394)	(2.202)	(0.931)	(3.047)	(2.751)
rho	0.120***							
	(0.0219)							
sigma2_e	4.192***							
	(0.809)							
Observations	418	418	418	418	418	418	418	418
Number of countries	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-929.6	-929.7	-929.8	-929.9	-929.10	-929.11	-929.12	-929.13

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

As documented by Asiedu and Lien (2004), control of capital flows across countries can affect FDI inflows. We consider this situation by testing for the impact of capital account

liberalization on FDI inflows in Africa using capital account openness data (KAOPEN) from Chinn and Ito (2006). In theory, capital account liberalization increases FDI inflows. However, despite relatively low restrictions on capital flows, developing countries, including some African countries have only attracted low levels of FDI inflows, making the impact of capital account liberalization on FDI inflows in Africa somehow unpredictable (Kose and Prasad, 2012). Controlling for the impact of capital account openness does not change our main results qualitatively. CIT rate reduction increases FDI inflows in Africa (table 10). The estimates show that capital account liberalization favors FDI inflows in the short run and in the long run in Africa (table 10).

Table 10 Tax policy and FDI: controlling for the impact of capital account openness.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.261***							
	(0.097)							
	-		-			-		
CIT_rate	0.0493***	-0.102***	0.0441***	-0.087***	-0.131***	0.0574***	-0.113***	-0.170***
	(0.007)	(0.016)	(0.0072)	(0.0158)	(0.0188)	(0.0097)	(0.0212)	(0.0249)
Nominal exchange rate	0.0017***	0.0035***	0.0024	0.0031	0.0054	0.0031	0.0039	0.0070
	(0.000)	(0.0012)	(0.0293)	(0.00233)	(0.0274)	(0.0398)	(0.00481)	(0.0354)
GDP growth	0.0770***	0.0610	0.0744***	0.0456	0.120**	0.0997***	0.0553	0.155**
	(0.0215)	(0.0379)	(0.0199)	(0.0318)	(0.0502)	(0.0261)	(0.0406)	(0.0644)
Gov. Consumption	0.0940***	0.0199	0.0948***	0.0047	0.0994***	0.129***	-7.75e-05	0.128***
	(0.0263)	(0.0205)	(0.0268)	(0.0159)	(0.0372)	(0.0362)	(0.0201)	(0.0478)
	-		-			-		
Trade openness	0.0207***	-0.0064	0.0206***	-0.0028	-0.0234	0.0279***	-0.0025	-0.0303
	(0.0058)	(0.0133)	(0.0051)	(0.0125)	(0.0164)	(0.0068)	(0.0164)	(0.0212)
Fixed phone subscr,	-0.0169	0.0868	-0.0211	0.0837	0.0626	-0.0309	0.112	0.0811
	(0.0169)	(0.0918)	(0.0177)	(0.0832)	(0.0793)	(0.0248)	(0.110)	(0.103)
			-			-		
Inflation	-0.0063**	0.0403***	0.0087***	0.0386***	0.0298***	0.0131***	0.0515***	0.0385***
	(0.0027)	(0.0112)	(0.0031)	(0.0098)	(0.0106)	(0.0042)	(0.0130)	(0.0135)
Financial Dev.	0.0110**	0.0045	0.0108**	0.0027	0.0136*	0.0146**	0.0029	0.0175*
	(0.0044)	(0.0084)	(0.0048)	(0.0077)	(0.0075)	(0.0066)	(0.0103)	(0.0097)
	-		-		-	-		-
Population	0.0689***	0.0079	0.0697***	0.0173	0.0525***	0.0952***	0.0273	0.0679***
	(0.0098)	(0.0147)	(0.0096)	(0.0135)	(0.0178)	(0.0130)	(0.0176)	(0.0231)
Capital account open.	0.188**	0.318***	0.175**	0.266***	0.440***	0.229*	0.340***	0.569***
	(0.0919)	(0.120)	(0.0883)	(0.0994)	(0.167)	(0.118)	(0.128)	(0.214)
rho	0.150***							
	(0.0202)							
sigma2_e	4.368***							
	(0.808)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Logpseudolikelihood	-918.5	-918.6	-918.7	-918.8	-918.9	-918.10	-918.11	-918.12

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

We already outlined that previous FDI affects the current level of FDI in a given country. Beyond borders, the history of FDI in neighboring countries could affect the attractiveness of a host country. Indeed, if previous FDI in neighboring countries have produced good results

(bad results), foreign investors will consider these countries more attractive (less attractive) than a host country. To examine this hypothesis, we include in the baseline specification one-year lag of the weighted average FDI in neighboring countries ($WFDI_{t-1}$). Table 11 in the Appendix shows the results obtained from this model (called Full DSDM). Our main results remain robust: in short run, CIT rate reduction positively affects FDI inflows while it reduces FDI net inflows in long run. The estimates also indicate that previous FDI in neighboring countries stimulate the attractiveness of a host country (Table 11, column 1).

Table 11: Tax policy and FDI in Africa: Full DSDM estimation.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FDI net Inflow	Estimate		Short run Marginal Effects			Long run Marginal Effects		
VARIABLES	Main	WX	Direct	Indirect	Total	Direct	Indirect	Total
L.FDI_net_inflows	0.275***							
	(0.0960)							
L.W.FDI_net_inflows	0.0523**							
	(0.0231)							
CIT_rate	-0.0534***	-0.108***	-0.0477***	-0.0928***	-0.141***	-0.0666***	-0.130***	-0.197***
	(0.00840)	(0.0178)	(0.00749)	(0.0170)	(0.0216)	(0.0105)	(0.0244)	(0.0310)
Nominal exchange rate	0.00171***	0.00360***	0.00150***	0.00313***	0.00463***	0.00210***	0.00438***	0.00647***
	(0.000241)	(0.00124)	(0.000268)	(0.00118)	(0.00110)	(0.000371)	(0.00162)	(0.00153)
GDP growth	0.0774***	0.0647*	0.0754***	0.0496	0.125**	0.104***	0.0702*	0.174***
	(0.0221)	(0.0379)	(0.0203)	(0.0304)	(0.0489)	(0.0281)	(0.0422)	(0.0677)
Gov. Consumption	0.0920***	0.00258	0.0932***	-0.0112	0.0819***	0.128***	-0.0138	0.114***
	(0.0239)	(0.0164)	(0.0233)	(0.0130)	(0.0307)	(0.0322)	(0.0181)	(0.0425)
Trade openness	-0.0221***	-0.00633	-0.0216***	-0.00255	-0.0242	-0.0299***	-0.00403	-0.0339
	(0.00554)	(0.0129)	(0.00482)	(0.0119)	(0.0153)	(0.00670)	(0.0167)	(0.0216)
Fixed phone subscr,	0.00221	0.104	-0.00259	0.0931	0.0905	-0.00266	0.129	0.127
	(0.0216)	(0.0912)	(0.0229)	(0.0821)	(0.0757)	(0.0312)	(0.114)	(0.106)
Inflation	-0.00745***	0.0341***	-0.00935***	0.0330***	0.0236**	-0.0126***	0.0456***	0.0329**
	(0.00281)	(0.00996)	(0.00254)	(0.00855)	(0.00942)	(0.00349)	(0.0118)	(0.0130)
Financial Dev.	0.0148***	0.00756	0.0144***	0.00514	0.0196**	0.0199***	0.00742	0.0274**
	(0.00355)	(0.0103)	(0.00384)	(0.00899)	(0.00829)	(0.00525)	(0.0124)	(0.0115)
Population	-0.0660***	0.0130	-0.0670***	0.0209*	-0.0461***	-0.0921***	0.0276	-0.0645***
	(0.0108)	(0.0145)	(0.0110)	(0.0123)	(0.0162)	(0.0151)	(0.0169)	(0.0226)
rho	0.148***							
	(0.0206)							
sigma2_e	4.389***							
	(0.815)							
Observations	418	418	418	418	418	418	418	418
Number of country	19	19	19	19	19	19	19	19
Log-pseudolikelihood	-920.5	-920.5	-920.5	-920.5	-920.5	-920.5	-920.5	-920.5

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

6. Conclusion

This chapter evaluates the effectiveness of cuts in CIT rate in attracting FDI for a balanced panel of 19 African countries over the period 1990-2012. In contrast to previous similar studies, our study takes into account spatial autocorrelation in FDI between countries by estimating a dynamic spatial durbin model with fixed effects.

The empirical results are twofold. First, we find that cuts in statutory CIT rate increase FDI net inflows to the host country and in the other neighboring countries in the short and long term. Therefore, lowering the corporate tax burden is an economic policy instrument that could attract more FDI. However, to reduce the potential negative effects of lower tax revenues from cuts in corporate tax rate, governments can broaden the tax base and strengthen tax collection capacities to finance development needs. Indeed, it is possible to increase tax effort in Africa since many countries in the continent still have weak tax revenue in relation to their tax potential (Brun et al, 2015). In 2014, the average tax-to-GDP ratio in Africa was only about 17.1 percent, which is much lower than the estimated level of about 25 percent required for financing basic development needs (AfDB, 2018).

Second, we find that an increase in FDI in a host country is likely to improve its neighboring countries' attractiveness to FDI indicating that FDI inflows in some extent, could contribute to boost regional integration in Africa. Furthermore, our results show that FDI in previous years positively affect FDI in current period suggesting that countries that manage to attract and retain FDI inflows today will attract more FDI in the future. These results are robust to changes in weighting matrix and additional controls. In line with theoretical predictions, we find that GDP growth, government consumption and financial development stimulate FDI net inflows to African countries.

While the results from this study are in line with the view that reduction in corporate tax burden could be effective for attracting FDI in low income countries context, they also suggest putting emphasis on structural factors that boost economic growth and develop the financial sector for attracting FDI.

Appendix

List of countries

Botswana | Cameroon | Côte d'Ivoire | Egypt | Gabon | Ghana | Kenya | Malawi | Mauritius | Morocco | Nigeria | Senegal | South Africa | Sudan | Swaziland | Tanzania | Togo | Tunisia | Uganda. |

GENERAL CONCLUSION

Financing for development is at the heart of policy debate in Africa. The financial needs of African countries are huge and require the mobilization of unprecedented levels of financial resources. Nonetheless, the unpredictability of ODA and instability in commodity prices combined with cuts in trade taxes in the framework of liberalization policies suggest the imperative to increase domestic non-resource tax revenue mobilization for African countries. Furthermore, while the importance of raising domestic tax revenue mobilization is well established and acknowledged for African countries, a substantial portion of external financing flows, especially FDI inflows, one of the most important and stable external financial flows to Africa could be critical to complement domestic tax revenue for properly financing sustainable development in the continent.

However, the mobilization of non-resource tax revenue in Africa is facing several challenges ranging from income inequality, poverty, weak institutions and lack of economic diversification to name few. Furthermore, domestic tax revenue mobilization is challenged by cuts in corporate tax rate for attracting FDI inflows in Africa.

With this background, the objective of this thesis was to contribute to the literature on financing for development in Africa. For achieving this objective, we articulate the dissertation around four essays in which we mobilize different economic analysis and econometrics methods. The thesis is divided into two parts. The first part including chapters 1 and 2 is devoted on non-resource tax revenue mobilization while the second part encompassing chapters 3 and 4 deals with tax policy considerations in attracting FDI inflows to Africa.

Main results

The first chapter (chapter 1) analyses the relationship between natural resources wealth and non-resource tax revenue in Africa depending on the quality of institutions and the level of economic diversification. A PSTR model is estimated using data for 29 African countries over the period 1995-2012.The estimations indicate three important results from this chapter. First, the direct impact of natural resource rents on non-resource tax revenue is negative in Africa. The second main result shows however that the negative effect of resource rents on non-resource tax revenue is reversed in countries with good institutional environment. Finally, we also find evidence that natural resource rents enhance non-resource tax mobilization for countries with relatively more diversified economies. These results urge African governments to further put emphasis on economic diversification and to strengthen the quality of institutions such that natural resources revenues contribute to increase non-resource tax revenue collection in the continent. In other words, our findings suggest that the crowding out effect of natural resources wealth on non-resource tax revenue could be mitigated and avoided when revenue from natural resources revenue is used towards supporting the diversification of the economy and improving the quality of institutions.

Chapter 2 examines the role of the social environment in non-resource tax revenue collection in Africa. More precisely, in this chapter, we estimate the impact of social indicators, namely income inequality and poverty on non-resource tax revenue performance in Sub-Saharan Africa. The estimation results indicate that both income inequality and poverty reduce non-resource tax revenue in Sub-Saharan Africa. From policy recommendation perspective, these findings help inform policymakers that reducing income inequality and poverty could be viewed not only as an important dimension of development or a vector of social justice, but also an important engine of non-resource tax revenue mobilization in Sub-Saharan African countries.

The third chapter of this thesis (Chapter 3) is devoted to a critical issue that is closely linked to tax revenue mobilization in Africa, namely tax competition through cuts in corporate tax rates[58]. With limited empirical evidence, it is commonly thought that African countries are competing among themselves for attracting foreign capitals and that competition leads to significant losses of tax revenue for all the players. To contribute to this policy-oriented debate, we estimate a tax reaction function inspired from Nash to empirically test the existence of corporate tax rate competition among African countries to shed light and guide public decisions on the topic. Using a balanced panel data in statutory corporate income tax (CIT) rate for 36 African countries over the period 1995-2013, we find that the neighbors' average CIT rate positively affects the host country's CIT rate suggesting the existence of strategic interaction (strategic complementarity) in CIT rates between African economies. However, when we control for the effect of time trend in the baseline specification, this positive impact of neighbors' average CIT rate on the host country's CIT rate is no longer statistically significant. We conclude that the evidence of pure corporate tax competition among African countries is therefore weak. African countries' tendency to implement similar fiscal policies may explain the positive slope reaction between their CIT rates. However, we find that cuts in foreign countries' average corporate tax rate reduce the host country's corporate tax base. Typically, a host country would experience a net deterioration of corporate tax base by 0.4% GDP representing a loss of corporate tax revenue by 2.3% GDP if it also reduces in the same proportion its corporate tax rate in reaction to reduction in foreign countries average corporate tax rates. Furthermore, we find that countries react to measures that tend to reduce corporate tax base (tax incentives) in abroad countries by also undertaking similar measures.

[58]"*Tax revenue is the cornerstone of any model of tax competition"* (Rota Graziosi, 2018).

Finally, chapter 4, an extension of chapter 3 analyses the effectiveness of cuts in corporate income tax rate in attracting FDI net inflows in Africa. In fact, the economic development benefits associated to FDI inflows give strong incentives to African governments to cut corporate tax rates for attracting these financial flows into their respective countries. The literature on the impact of tax policy on FDI attractiveness in Africa is abundant. However, to our knowledge, no study has tried to disentangle the impact of tax policy on FDI both in the short run and in the long run. As the foreign investors may take time to react and adjust their investment decisions to change in the country's tax policy, the impact of such a change may be different in the short term and in the long run. Moreover, previous studies on the determinants of FDI inflows in Africa have not taken into consideration the potential spatial spillovers effects of FDI between countries whereas there is evidence that FDI in a host country could affect the attractiveness of FDI in its neighboring countries.

We take onboard these considerations to estimate the impact of cuts in CIT rate on FDI inflows in Africa. Using a dynamic spatial Durbin model with fixed effects, we find that cuts in CIT rate increase FDI net inflows in the host country and in the neighboring countries in short and long run. Moreover, we find evidence of a strategic complementarity in FDI inflows between African economies, indicating that an increase in FDI inflows in a host country is likely to stimulate the FDI inflows of its neighbors. This latter result suggests that FDI inflows could play a catalyst role in fostering regional integration in Africa.

Policy implications

The key message that could be drawn from this thesis is that African countries may consider increasing efforts towards improving the country's social environment by addressing inequality and poverty; improving the quality of institutions and diversifying their economies

for better non-resource tax revenue mobilization. These efforts must be complemented by better management of revenue from natural resources exploitation and a rationalization of tax incentives.

In fact, the policy orientation that could be derived from the results of chapter 1 is that resource revenue could significantly boost non-resource tax revenue collection if African countries use revenue from natural resources to finance and support economic diversification policies. African countries can diversify their economies by attracting foreign direct investments in non-resource sectors investing in physical infrastructure and improving business climate through reducing the cost of doing business for fostering economic diversification. Furthermore, these countries could experience more non-resource tax revenue in addition to greater resource revenue if the latter revenues are used to establish and strengthen the quality of institutions.

The second chapter suggests that African government pay more attention to the political and social environment by reducing income inequality and poverty for better non-resource tax mobilization. Income inequality and poverty could be reduced through public investments for improving access to education and health services for enhancing human capital. There are also possibilities to alleviate poverty and reduce income inequality through facilitating the access to credit for financing projects and businesses for low income individuals.

The conclusion from chapter 3 vehicles the message that while there is no evidence of pure CIT rate competition between African countries, cuts in foreign countries CIT rate and corporate tax base however lead to a net loss of corporate tax revenue for the host country if this latter reacts by cutting its own CIT rate. These results suggest that African countries could consider working towards improving international tax rules and tax cooperation through harmonization of tax rules and exchange of information for fighting against all forms of tax avoidance and base erosion. International development institutions could play a role in this

regard. They could strengthen their assistance to African countries in the areas of audit and control of large companies and multinationals.

In terms of policy implications, the results from chapter 4 suggest that cuts in corporate tax rate could attract FDI net inflows. However, cuts in corporate tax rate could impede corporate tax revenue collection (see chapter 3) and thereby weaken the government financial capacities to build socioeconomic infrastructures and improve the business climate, factors that are crucial in attracting foreign direct investment. In this regard, policy makers may consider the digitalization of tax administration, accentuate awareness for tax compliance and bring close tax administration to taxpayers for compensating eventual losses from cuts in CIT rate. An additional policy orientation that could be derived from the results of chapter 4 is that foreign direct investments could be a vector of regional integration in Africa as these results indicate that a foreign direct investment realized in a host country could increase the attractiveness of its neighboring countries. This reality is observed in natural resources sectors where a production of oil or gas in a landlocked host country could generate and motivate a pipeline project in its neighboring country with openness on the sea. The case of Chad-Cameroon pipeline[59], the West Africa gas pipeline (WAGP)[60] and Uganda-Tanzania pipeline project[61] could be used to illustrate this idea.

Limits and possible future researches

This thesis has been mainly based on empirical analyzes, and sensitivity analyzes were conducted to obtain robust results. However, like other studies in this type, some limitations may be found which may nevertheless constitute relevant opportunities for future researches.

[59] A 1,070 kilometres pipeline for transporting crude oil from oil fields near Doba in southern Chad to a floating storage and offloading vessel (FSO) located near the city of Kribi off Cameroonian coasts.
[60] WAGP is a 678 kilometres long natural gas pipeline to export gas from Nigeria's Escravos region (Niger Delta area) to Benin, Togo and Ghana. There are ongoing discussions to extend the pipeline to Côte d'Ivoire.
[61] Around 1,410 kilometres export pipeline to transport oil from Uganda's oil fields in the Hoima district (Western region) to the Port of Tanga, Tanzania on the Indian Ocean.

In chapter 1, we employed an institutional indicator for evaluating the effect of natural resource rents on non-resource tax revenue mobilization depending on institutions. For future research, in addition to an institutional indicator, it would be interesting to use a natural resource governance indicator like the one that is produced by the Natural Resource Governance Institute (natural resource governance index which is not yet available over sufficient years to be used in time series regressions) to test the conditional effect of natural resources revenue on non-resource tax revenue depending on institutions. This kind of institutional indicator is more specific and better captures the institutional framework surrounding the natural resource sectors.

In chapter 2, we have estimated the effect of inequality and poverty without considering the tolerance for inequality and poverty (non-linear effect of inequality and poverty on non-resource tax revenue). In fact, the impact of inequality and poverty on tax effort may be different in countries having citizens with different perceptions of inequality and poverty. Accordingly, the elasticity of non-resource tax revenue to income inequality and poverty may depend on the subjective perception of inequality and poverty in the society. Thus, future research will attempt to estimate the impact of inequality and poverty on non-resource tax effort depending on the tolerance for poverty and inequality.

In the third and fourth chapter, statutory corporate tax rate is employed respectively as the tax competition tool and the tax policy instrument for attracting foreign direct investments. Even if statutory corporate tax rate is an important determinant of tax shifting incentives between tax jurisdictions, a country could be attractive because of its special regimes not because of low statutory corporate tax rate. The effective tax rates, namely the marginal effective corporate tax rate (EMTR)-the tax rate applied on a new marginal investment (Devereux and Griffith, 2003)- and the effective average tax rate (corporate taxes paid divided by accounting profits) have the advantage to take into account both statutory tax rate, investment tax credit

and accelerated depreciation allowances and more broadly special tax provisions. Future research will attempt to find a simple methodology, in a context of constraints on data availability, for calculating the effective tax rates[62] (marginal effective corporate tax rate and effective average tax rate) for African economies and use these effective rates in addition to the statutory corporate tax rate for analyzing the impact of tax policy on FDI inflows.

Moreover, in chapter 4, the use of only 19 countries in the sample because of data limitations may limit the scope for generalization of the results to the rest of the 54 countries of Africa. Even if the sample used tends to be quite representative of the rest of the Africa countries' economic structure, future work should take a second look at the data used and expand the sample of countries to be easily able to generalize for Africa. In the same vein, data used for the analysis in chapter 4 cover the period 1990-2012. The FDI landscape has significantly changed in Africa since 2012 with the entry of China as a dominant source of FDI to the continent, which may change the elasticity of FDI to changes in corporate tax rates. Future research may examine the possibility to expand the time dimension of the analysis over the year 2012 for testing the robustness of the findings of this chapter to the consideration raised above.

Furthermore, as the highest proportion of FDI inflows to Africa is oriented towards natural resource sectors, it would be interesting to test the robustness of our results using FDI in natural resource sectors as the dependent variable. To be consistent in the analysis, such approach will accordingly require using corporate tax rate applied for mining and/or petroleum projects instead of the standard statutory corporate tax rate. While data on corporate tax rate applied to mining companies for 14 African countries can be collected from Laporte (2017), data on FDI in natural resources sector in Africa are difficult to collect for many countries over long period.

[62] Clark and Klemm (2015) draw attention on issues which may arise from the attempt to calculate effective tax rates and the difficulties related to the interpretation of effective tax rates in international context, with cross border investments.

In fact, to our knowledge, the International Trade Center and the UNCTAD are the only ones that provide data on FDI in natural resources sectors, but these datasets cover a very limited number of African countries making them somewhat unusable for the purpose of the present study. OECD provides data on FDI in natural resources sectors only for its member countries whereas no African country is currently member of this international organization. Future research will pursue tracking data on FDI in natural resources sector for African economies to take into consideration these issues.

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