Assessing the impact of tax administration reforms in Sub-Saharan Africa

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Abstract

This proposal investigates the impact of adopting tax reforms such as the Value Added Tax (VAT), the Large Taxpayers Unit (LTU), and the Semi-Autonomous Revenue Agency (SARA) on tax revenue performance revenues in Sub-Saharan Africa. Despite the increasing adoption of these reforms, the literature on tax reforms effectiveness in Sub-Saharan is controversial. This proposal adds to the debate by using an Ordinary Least Square Fixed effect model controlling for countries and years fixed effects as well as a set of relevant covariates. We use a panel dataset of 46 countries from 1980 to 2013 and show that, in contrast to existing findings, there is no robust evidence that the three tax reforms increased tax collection performance in Sub-Saharan Africa. We find that controlling for time fixed effects and relevant covariates removes the statistical significance of all the tax reforms. Therefore, we conclude that there is little statistical robustness to support a significance of these reforms on tax collection in Sub-Saharan Africa.

Keywords: Tax reforms, Tax collection performance, Ordinary Least Square Fixed effect model, Sub-Saharan Africa, VAT, LUT, SARA.

JEL Classification : H2, N47, O23

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0. Introduction

The government's level of intervention in the economy for addressing market failures promote better economic environment and social welfare critically depends on its ability to collect taxes. Tax resources are therefore the main source of revenue for most of the governments around the world. While conveying efforts to collect taxes, the consensus in tax policy theories suggests that the government should limit the hurting of incentives from economic agents. In other words, the tax policy should be efficient by minimizing the deadweight loss associated in order to promote economic development. However, the collection of tax involves many challenges, especially in developing economies. In fact, developing economies face larger challenges related to tax evasion, corruption, weak institutions, macroeconomic vulnerabilities, political instabilities, among others, which make the collection of taxes harder.

In effort to address these challenges while meeting the equity and efficiency, available data suggest that Sub-Saharan African countries have been increasingly adopting tax reforms to improve their tax collections. Among these, the adoption of the Value Added Tax, the Semi-Autonomous Revenue Authority, and the Large Taxpayer Unit received particular attention. Over 46 countries in Sub-Saharan Africa, 42 (92%) have adopted at least one tax reform.

However, the existent literature lacks econometrical approaches to establishing the true causal effect of these tax reforms on the tax revenues in Sub-Saharan Africa. Some studies were limited to descriptive analysis (Bua, 2013, Kloeden, 2011). Others use relatively better approaches but the results are mixed especially for developing countries where even negative effects are found. (Kidd and Crandall, 2006, Talierco, 2012, Fjeldstad and Moore, 2009, Keen and Lockwood, 2007). In effort to contribute to the debate, a recent paper by Dom (2017) implemented a dynamic model to assess the impact of SARA on tax revenues. However, the study failed to provide evidence for

a significant impact from this particular reform. At any case, the research has most of the time been inconclusive regarding Sub-Saharan African countries.

This research uses the study by Ebeke et al. (2016) to re-examine the impact of the three tax reforms on non-resource tax revenues. The underlying study used a panel data of 41 countries from 1980 to 2010. It implemented the propensity score matching and the synthetic control method. The authors argued that the three reforms were significant in improving tax collection in Sub-Saharan Africa. However, the authors did not indicate how the weights used to construct the synthetic controls were estimated. Using the same dataset, the authors implemented an OLS fixed effect model and found the same results (Ebeke et al., 2014). However, the regressions did not include time-effect effects, leaving room for potential sources of time-variant omitted variable bias and lead to misleading results.

For these reasons, instead of replicating the propensity score matching and the synthetic control method, our proposal relies on the Ordinary Least Squares Fixed effect model. We base our main results on a new dataset that we constructed from a broader set of sources in order to address the inconsistencies. It consists of 46 countries, from 1980 to 2013. Unlike the results from Ebeke et al. (2016), our research fails to find systematic evidence that either the VAT, the SARA or the LTU contributed to increasing government tax revenues in Sub-Saharan Africa. Further, we also found that among these reforms, the SARA presents more signs of effectiveness. We conclude that the main source of the difference comes from controlling for the year-fixed effects, which Ebeke et al. (2014 and 2016) did not take into account. To this extent, our findings are similar to the ones by Dom (2017), Keen and Lockwood (2007), Fjeldstad and Moore, (2009).

The proposal is organized as follows: in the first section, we present the existent relevant research we found regarding the underlying topic. The second section provides details and

motivation on the methodology used. The third section presents the key descriptive statistics and the sources of data we are using. Finally, we present the key results in section four. Further, we discuss different specifications of the OLS fixed effects model including the replication of OLS model by Ebeke et al. (2014). We also briefly discuss potential reasons for these findings.

I. Literature review on Tax reforms in Sub-Saharan Africa

The design of tax systems is crucial in determining the ability for the government to raise tax revenue in an efficient and equitable way. Since the early 1980s, many African countries successively adopted a bunch of tax reforms. Mainly supported by the IMF and the World Bank since the 1990s, these countries performed a large number of tax reforms to increase the efficiency of revenue collection, fight corruption within tax administration and lower administration and compliance costs. Three of the most important of them were the Value Added Tax (VAT), the Large Tax Units (LTU), and the Semi-Autonomous Revenue Authority (SARA).

However, there is not sufficient empirical assessment of their impacts across these countries. In fact, even though there are several detailed descriptive studies on the topic, such the one by Fossat and Bua (2013) and Kloeden (2011), all of them lack rigorous econometrical approaches to establishing separate and interactive impact of those reforms. Moreover, little is known about the interactions between these three tax reforms or the likelihood of adopting one additional tax reform given an existent one. Data

availability (panel data) and time variation in pre and post reforms resource tax collection relative to GDP allows usage of different econometric method to establish reliable impact estimation of those reforms on tax collection. For this reason, this proposal aims to contribute to informing the policymakers about the performance of these reforms in Sub-Saharan Africa for the period considered. In the following lines, we present some of the existing research we found discussing the theories for why the three reforms can contribute to higher tax revenue, among other benefits. Their limits are also discussed.

Revenue authorities

In an aim to design more efficient tax authority, many countries have introduced revenue authorities. In the literature, with respect to their design, common name for these authorities are "unified semi-autonomous body" or "semi-autonomous revenue authority" or just revenue authority (RA). Kidd and Crandall (2006) define RA as "a governance model for revenue administration where the traditional ministry of finance departments (tax and usually customs administrations) are established as an organization or agency with a degree of autonomy from government and independence from standard public service policies". Besides the goal of increasing government's revenues, the motivation of establishing RA are "(i) signaling political autonomy; (ii) creating managerial autonomy; and (iii) facilitating reform of tax administration generally" (Kidd and Crandall, 2006, 12). The benefits from RA could come once fried from Ministries of finance, especially in areas of employment, remuneration, procurement allowing the tax officials to perform their jobs more effectively, raising more taxes at lower cost (Moore, 2014). Additional benefit stated by Moore (2014) is the willingness from taxpayers to reveal their financial statements to RA, rather than Ministries of finance, trying to escape political capture and pressure.

There have been several studies to estimate the efficiency and performance of RA around the globe. Taliercio (2004), presented comparative analytical approach in six case studies across Latin America and sub-Saharan Africa, in an attempt to examine differences in design, performances, and sustainability of different RA in selected countries. His concluding remarks indicate that more autonomous RA improves

agency performance, enables organizational reforms to increase performance and they are "more adept at increasing performance than the less autonomous ones", depending on the quality of personnel and proper design (Taliercio, 2004). The main limit of this study is that it does not use robust econometric techniques to establish causality due to data limitation but rather descriptive analysis, and it is limited to just six countries. Similar to these studies, Kidd and Crandall, indicate several such (referring to Mann, 2004; Delay, Devas and Hubbard, 1999; Gray and Chapman, 2001; Di John and Putzel, 2005, among others) that conclude that more autonomy indicates better performance. However, they also indicate that these studies lack analytical models from which isolate the impact of RA on tax collection can be made. Summarizing above mentioned studies, Kidd and Crandall criticize previously done research on the matter of RA efficiency for their ways of measuring autonomy (propose using scoring system rather than quantitatively one), data limitation in scope of pre and post RA establishment, and as mentioned establishing and isolating causality (Kidd and Crandall, 2006).

Fjeldstad and Moore (2009), referring to a large number of tax reforms in Sub-Saharan Africa, mainly to the establishment of semi-autonomous revenue authorities (SARAs), contrast previous findings by stating that "there is little sign that the creation of revenue agencies has actually increased public revenues" (Fjeldstad and Moore, 2009). He adds that SARAs facilitated a range of reforms for tax assessing and collecting, but however indicate risk related to this reform in terms of decreased "synchronization of tax collection and tax policy" (Fjeldstad and Moore, 2009).

Large Taxpayer Units

Large taxpayer units (LTUs) were initially adopted as substitutes for revenue authorities, though later they were proposed as complements to RAs or adoption of VAT. The idea about LTUs is monitoring of large taxpayers "through auditing, registration, tax accounting, collections and taxpayer service provision covering more than one type of tax" (McCarten, 2004). The main rationale for LTUs are: improvement in large taxpayer's compliance and "pilot to test administration reforms later extended to the

rest of the taxpayers"; tax reforms support such as VAT in countries with weak enforcement power of tax authorities, improvement in business environment signaling to foreign investors transparency and confidence in fair assessment and audit (McCarten, 2004). As further stated by McCarten, LTU performs these roles through: "(i) reorganizing from a tax to a functional structure, (ii) reducing the potential for corruption by automating and restructuring control systems, (iii) strengthening the audit function, (iv) changing attitudes of officials toward taxpayers; and (v) simplifying and reducing paper handling through appropriate use of information technology" (McCarten, 2004). Kidd (2010) emphasizes that the main benefits of the LTU are those from specialization, since it can "capitalize on this structure by building on the core knowledge and expertise it has grouped together" for the largest taxpayers, that in most African countries contribute above 70% of total revenue collected (Kloeden, 2011). Furthermore, Kidd (2010) states several additional advantages to a function-based organization for tax collection: improved compliance results, the simplicity of tax collection and tax compliance, improved resource management, increase in tax officers' integrity.

In the same article, McCarten notes the study of Dos Santos in 1994, in which it is reported that the LTU system can improve tax collection but rather in the short to medium term. The main problems might arise and cause inefficiency-causing that firms downsize or prevent growth above the threshold that would result in their eligibility for LTU. Caution raised by this issue is presented in Juan Toro[§] et al., 2002, that emphasizes the need for LTUs` practices to be integrated into more general tax administration including the small and medium taxpayer, preventing that LTU is portrayed as a "parallel tax administration" (Juan Toro et al., 2002).

The Value-Added Tax

[§] Juan Toro R. Katherine Baer, and Olivier p. Benon (2002). "Improving Large Taxpayers` Compliance: A Review of Country Experience", Occasional Paper 215. International Monetary Fund

The VAT is of particular interest because of its advantages. First, its major economic advantage is the elimination of cascading associated with the turnover tax. For this reason, in the absence of any form of exemptions, the effective VAT tax rate is equal to the statutory rate, which is important in the efficiency point of view. Second, the VAT has "self-enforcement" benefits associated with the credit-invoice method, the most used around the world. This feature should have positive effects on the overall revenue mobilized by the government. In fact, firms subject to tax have to exhibit their invoices in order to benefit credit from the tax they already paid to the firms operating above them on the chain. In this sense, the VAT: (i) moderates the incentive to evade in order to benefit from the credits, (ii) facilitates the detection of fraud by allowing the tax officers to exploit conflicts between firms trying to evade. Furthermore, in developing countries, adoption of the VAT is seen as "the central element in a program of modernizing tax administration, developing the use of methods of self-assessment whose generalization is expected ultimately to ease administration and compliance in relation to other taxes too" (Keen and Lockwood[**], 2007).

However, neither this tax is without pitfalls. Brocken chain in the production line can also introduce an unequal tax rate among goods (with similar elasticities), zero rating of export and in the overall design of VAT (threshold, exemptions, reduced tax rates) might introduce even higher tax avoidance (fraudulent claims for tax refund). Uncertainty regarding the way in which implementing VAT can influence tax system efficiency, in difference to SARA and LTU, have been empirically evaluated and here are main findings. Keen and Lockwood, 2007, use panel data of 143 countries observed over 25 years to estimate a "recursive two-equation system" regarding VAT adoption decision as well as the impact of VAT on collected revenue. In standardized tax effort equation, using a dummy for VAT presence the effect of VAT on tax collection is positive but moderate (a long run increase of 4.5. percent on total revenue to GDP). Adding country fixed effects changes the picture and the effect turns to be negative. They find

[**] Keen Michael and Ben Lockwood, 2007, "The Value-Added Tax: Its Causes and Consequences", IMF Working Paper, WP/07/183

positive revenue gains from VAT in high-income and more open (in terms of trade) countries compared to negative effects on revenue in low-income ones indicating that efficiency of VAT depends on "ability to administer and comply with the tax" (Keen and Lockwood, 2007). Aiming to shed some light on the sign of this impact, Keen and Lockwood try to predict revenue effects in countries in their sample, indicating only suggestive evidence that VAT in the majority of countries improves effectiveness of raising revenue, however, results are mixed in sub-Saharan African countries. Their explanation why in sub-Saharan African countries results are mixed is that possibly revenue gain from VAT was undermined by a decrease in relying on other taxes, especially tariffs.

Regarding the effectiveness of VAT in sub-Saharan African countries, several studies have been conducted, but mostly on the single country level. Onaolapo et al. (2013), evaluates the contribution of VAT to revenue generation in Nigeria, using stepwise regression analysis††. Using this method, their main findings are that VAT has a significant statistical effect on revenue generation in Nigeria. Wawire, 2011, in his research tries to resolve determinants of VAT revenue in Kenya. Using time series analysis, he finds that "determinants of VAT revenue include GDP, institutional, demographic, and structural features of the economy", but also that "VAT revenues respond with lags to changes in their respective tax bases" (Wawire, 2011). The second means that past level of GDP, the level of imports and exports have a significant influence on the current levels of VAT revenues.

II. Methodology

In order to assess the impact of the VAT, SARA and LTU on the tax revenue in Sub-Saharan Africa, our main results rely on the Ordinary Least Squares Fixed effects model. We first re-examine the study by Ebeke et al. (2016) which primarily used the synthetic control method and the propensity score matching method to answer the same research question. However,

†† Stepwise regression analysis explained on page 24. Onaolapo et al. (2013)

because of insufficient information on how the authors implemented their core impact evaluation methodology, we limit the replication exercise on the Fixed effect model the authors presented in a different presentation available online (Ebeke et al., 2014). Besides the replication, we extend the analysis using different dataset and including more controls.

Ebeke et al. study (2016)

The authors utilize two empirical methods to assess the impact of the three tax reforms on non-resource revenue as a percent of GDP. The first identification strategy is the propensity score matching (PSM) and the second one is the synthetic control method (SCM). For both methods, they use a panel of 41 Sub-Saharan countries from 1980 to 2010. Their study concludes that the VAT and the SARA had a positive and large effect on the non-resource government revenues, whereas the LTU is not found having a significant effect on the same outcome.

The authors used the PSM for the purpose of finding combined effects of the three reforms. They computed the probability of adopting each of the reforms (VAT, LTU or SARA) in a given country for each year based on a set of country characteristics and other economic conditions. Then, they use the computed probabilities to construct control groups, by corresponding countries who adopted the reforms with those who did not. With such created counterfactual, the effect of reforms is extracted from the difference between treatment and control group in the non-resource tax to GDP. The PSM (following Rosenbaum and Rubin, 1983) results suggest that the VAT increased the non-resource revenue by 2 percentage points of GDP, whereas the SARA did increase the non-resource revenue by 4 percentage points of GDP. Using this method, they also found that the both the VAT and the SARA together increased the non-resource revenue by 4.5 to 6.5 percentage points of the GDP. Finally, the combined effect of the three reforms came out to

have a smaller effect of 1.2 to 2.4 percentage points of GDP. However, the authors ignored the panel nature of the data. In fact, they only implemented the cross-sectional comparison between countries with each of the reforms and matched the countries that did not. Therefore, time-invariant characteristics, which are characteristics that were changing in the same way over time, were omitted. Finally, the authors did not justify the use of non-resource lagged variable, which otherwise seems less relevant.

Further, the authors rely on the SCM to take into account the time dynamics effects of the reforms on the outcome of interest. The SCM is similar to the difference-in-differences method. It constructs the weighted average of the control units that are the most similar to the treatment group prior to the treatment (Athey et al., 2017). It has the advantage of removing the bias of time-variant and country-specific characteristics. Further, the other advantage is that the counterfactual is estimated based on a weighted average of changes in the outcome in possible control countries, where the weights are selected such that the pre-treatment trends are similar. They found same and significant results: the non-resource tax revenue was found higher during the years after the adoption of the VAT and SARA. The LTU was not found positively affecting the non-resource tax revenue. "However, it is difficult to assess the robustness of the SCM results since important pre-treatment matching information is missing as well as several key sensitivity tests, which are vital for SCM" (Dom Roel, 2017). Also, the authors did not indicate how the weights used to construct the synthetic controls were estimated. For these reasons, we cannot replicate this method.

On the other hand, the author also implemented a Fixed effects model which was not included in the paper, yet available online as a PowerPoint presentation (Ebeke et al., 2014). They estimated a fixed effects model assessing the impact of VAT, LTU and SARA on the non-hydrocarbon tax revenues to GDP ratio. They controlled only for country fixed effect and

additional control variables including the Lagged IMF arrangement dummy, the Trade openness, the Resource rents to GDP ratio, the Agriculture value added to GDP, and the Aid to GDP. They first ran the fixed effect model with standard errors, controlling for all variables except the IMF arrangement and other reforms. They found a significant effect for VAT (1.015 percentage point), LTU (0.644 percentage point) and SARA (2.158 percentage points). Further, they run the same model including other reforms and the IMF arrangement. They found that only VAT and SARA had a significant effect with respectively 1.489 and 1.509 percentage points. On their regressions, almost all the control variables were significant, except Aid to GDP ratio and Trade openness when they control for IMF arrangement. However, the regressions did not include time-effect effects, leaving room for potential sources of time-variant omitted variable bias.

Ordinary Least Squares (OLS) fixed effects

Our proposal builds its main results using the OLS fixed effect model on panel data. The model estimates the causal effect of adopting any of the three reforms by running the difference over time in the tax revenues, between the countries who adopted the reforms, compared to those who did not. It produces similar results to classical difference-in-differences estimates. The advantage of the OLS fixed effect model resides in the minimization of omitted variable bias, since it controls for country and years fixed effects while allowing for other controls that can potentially cause biases. As discussed earlier, all the results in Ebeke et al. (2016) were based on estimates only taking into account the cross-sectional aspect, without the controlling for time-

variant characteristics. The OLS fixed effect model will address this issue. The reduced form of the OLS equation is given by:

$$y_{it} = \alpha_i + \alpha_t + B_1 T_{it} + \delta X_{it} + \varepsilon_{it} \qquad (1)$$

In this equation, y_{it}, our main dependent variable is the total non-resource tax revenue to GDP, observed annually for every country. The non-resource data is preferred to the overall government revenue in order to avoid large fluctuations triggered by natural resources sectors. Many African countries experienced significant increase in their natural resources sectors because of favorable commodity prices coupled with the liberalization of capital flows as well as the liberalization of the sector, which was mostly dominated by State Owned Enterprises after the independence periods. We alternatively use different measures of tax resources such as the total tax resources to discuss the potential differences in the results.

α_i is the country fixed effect constructed as a dummy variable for each country. We include it to control for any unobservable time-invariant characteristic across countries that can affect the government revenues and bias the estimated effect of the tax reform. For example, the government in a country with high level of moral would likely collect more revenue even in the absence of the tax reform.

α_t is the time fixed effect, computing a dummy variable for each year. We include this to control for unobservable characteristics that change over time similarly across countries. For example, the international financial crisis in 2008 that affected every country's ability to raise tax.

T_{it} is the treatment. We use separate dummies for the existence a VAT, a LTU, or a SARA for a given period (year). The combined effect will be estimated by interacting concerned tax reform or administration. For the individual effect of the tax reforms, we will we will control for the

remaining reforms. For example, when we estimate the effect of the VAT, we will control for the LTU

$\boldsymbol{\beta_1}$ is the coefficient for the estimated causal effect of the tax reform on the non-resource tax revenue. It captures the difference in the change tax revenues, between countries who adopted the reforms and those who did not, over time.

$\boldsymbol{X_{it}}$ is the vector of covariates. The idea is that we want to control for relevant variables capturing observable time-varying country-specific characteristics that are correlated with the treatment and affect the outcome of interest, therefore can be important source of omitted variable bias. Besides the control used in Ebeke et al., we will control for: (i) the real GDP per capita, (ii) a variable for civil conflicts. The increase in tax revenue can be associated with an overall economic recovery in a country that also implements tax reforms. Further, after civil conflicts and wars, a government will likely implement reforms. In this sense, the civil conflicts can be correlated with the adoption of tax reforms, and also affect the level of government revenue. (iii) a variable for quality of institutions. As discussed in the literature review, good institutions enhance the positive effects of tax systems. For example, the finding by Wawire (2011) shows that institutions have large impact on success of VAT reforms. Hence, among two countries adopting a given tax reform, the one with the best institutions will more likely collect higher tax revenues. (iv) a variable capturing the natural resource rents. We supported earlier the idea of using the non-resource tax revenues in order to leave out the major influence of the natural resource sectors on the tax revenues. However, given the difficulty that may be involved while trying to disentangle the resources with the non-resource revenue, we control for the natural resource rents.

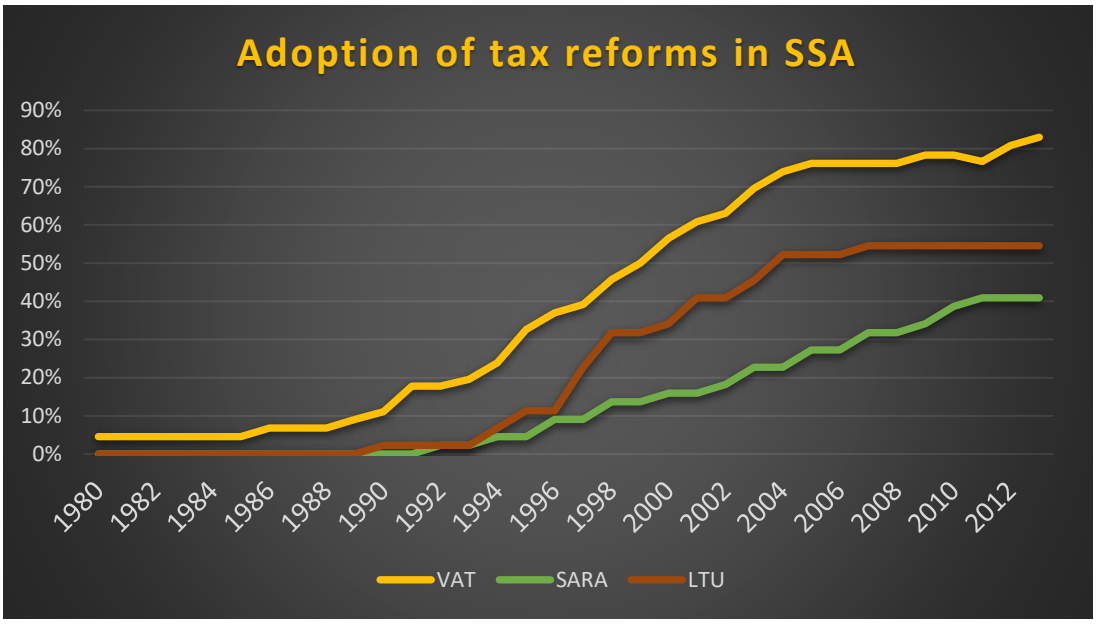
III. Data

In order to assess the impact of the selected tax reforms on the revenues, our main dataset is a panel of 46 Sub-Saharan African countries over the period from 1980 to 2013 from which we excluded South Sudan because of data limitations. This dataset expands from the data used by Ebeke et al. (2016), which included 41 Sub-Saharan African countries over the period from 1980 to 2010. We focus our results on the broader dataset, though we also discuss the results from the narrower dataset. We constructed a new dataset to address several challenges from the dataset used by Ebeke et al. (2016).

First, confronting the data sources with actual data in Ebeke et al. (2016), we noticed several inconsistencies related to the exact year of adoption of the tax reforms and the mismatches between the operational and the legal date of creation (especially for SARA reforms). For this reason, we constructed the VAT variable from Crowe Horwath International (2016). The SARA was constructed from Dom (2017), and the LTU from Baer (2002), Fossat and Bua (2013) as well as from IMF Staff Reports (2005, 2012, 2003).

According to this dataset, the sequence of adoption of tax reforms is as presented in the graph 1. The graph presents the proportion of countries having the each of the reforms, from 1980 to 2013. It shows that, while all the tax reforms have been increasingly adopted in Sub-Saharan Africa, the VAT has been the most popular tax reform. A sharp increase has been observed from the late 1980s, moving the proportion of countries having the VAT from less than 10% to almost 85%, corresponding to 39 countries over 46. Keen and Lockwood (2007) found that the adoption of VAT reforms was significantly determined by the participation of countries in IMF programs, the trade openness, the size of the agriculture sector.

Graph 1. Adoption of Tax reforms in sub-Saharan Africa



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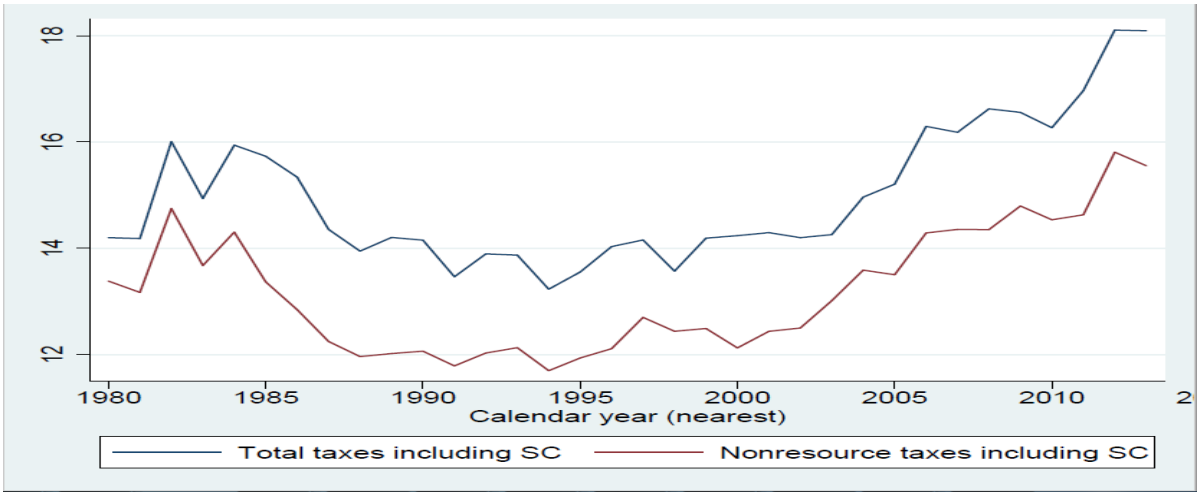
Both the SARA and LTU also had similar patterns over time, with a sharp increase since the late 1980s. In our sample, only five countries did not adopt any of the reforms. These are Angola, Sâo Tomé and Principe, Seychelles, Swaziland, and Guinea-Bissau. Only four countries (8.6%) of the countries adopted all three reforms, whereas the remaining had alternatively two other reforms. These are Burundi, Kenya, South Africa and Ethiopia.

Second, the measurement of many variables is not clear from Ebeke et al. (2016). For example, countries like Ghana changed the method of computing the GDP over time. Since our main dependent variable is expressed as a ratio to GDP, the dataset in Ebeke et al. (2016) does not precise whether this kind of change is taken into account. Further, little is known about the construction of the 'non-resource tax revenue'. For these reasons, we rather rely on the International Centre for Tax and Development`s Government Revenue Dataset (ICTD GRD) for the total and the non-resource tax revenue as a percentage of GDP, as well as the GDP. we use the most recent version of the dataset (June 2016). For all the countries in sub-Saharan Africa, the data

is from Central or Budgetary Central Government, except for Ethiopia, Nigeria and South Africa for which General Government data is preferred.

Looking at the pattern of non-resource revenues in Sub-Saharan Africa on graph 2, we notice a quite parallel relationship between the total and the non-resource tax revenues. While the major adoptions of tax reforms happened between the late 1980s and the 2000s, this period is characterized by an almost stagnant level of revenues on average, both for resource and non-resource sectors. However, the gap between the total and non-resource taxes had been increasing, tough it remains relatively small on average. The rise after 2000 might be explained by many factors, such as the reforms we are assessing, or the booming in the mining sector, the trade, or other economic opportunities.

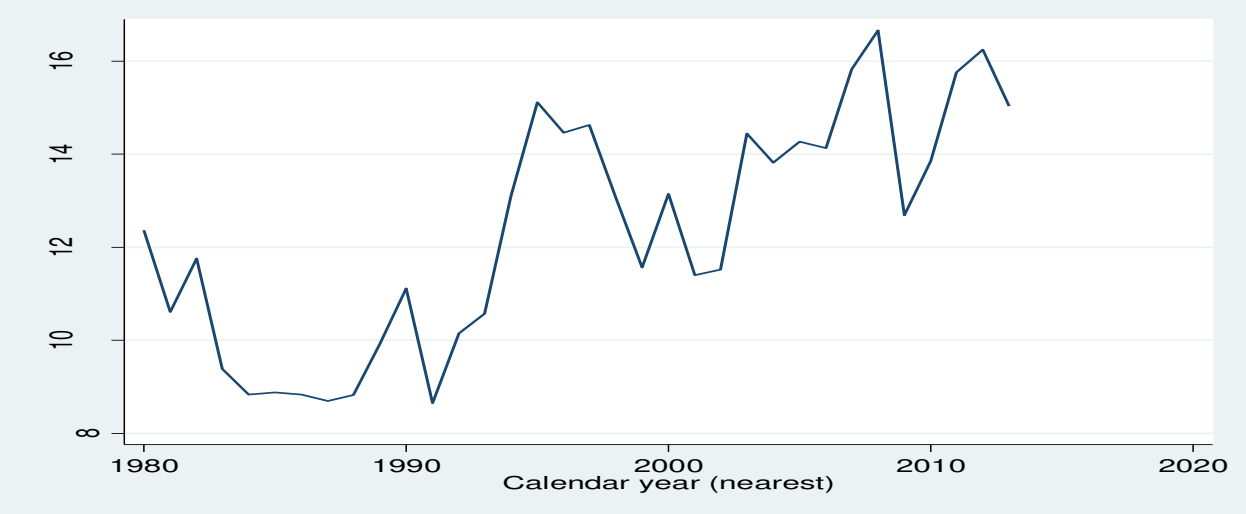
Graph 2 Average of total and non-resource taxes including social contributions



Nonetheless, the overall non-resources revenues increased over time. We expected a significant difference between total and non-resource tax, though the actual difference is pretty small (1.6% on average). The non-resource revenues on average increased from 13.381 percent of GDP in 1980 to 15.8073 percent of GDP in 2012, which represents 2.43 percentage points increase. On the other hand, the total tax revenue including the social contributions increased by 3.908 percentage points (from 14.198 in 1980 to 18.106 in 2012). The graphs 2 shows the evolution of both variables for individual countries. For many countries, the non-resource and the resource revenues have almost same levels. Outliers are observed for Angola, Botswana, and Congo. In these countries, the total taxes are way above the non-resource taxes. Further, Lesotho has the highest average tax resource to GDP ratio on average (42%, which reached 62% in 2009). Lesotho only adopted VAT and SARA in 2003. The country does not have LTU. Whereas, the lowest tax including social contributions were observed in DRC in 1994 (0.6%) as well as the whole period up to and 2000 (1% on average). Uganda also had very low tax collection in 1981 (0.97%).

From the World Development Indicator data, we use the variable 'Natural resources rent' to address potential mismeasurement errors involved while separating the total to the non-resource tax revenues. In fact, the adoption of tax reforms significantly increased during the period from the late 1990s to early 2000. This period is also associated with "booming" natural sector (graph 3) regarding the favorable commodity prices and liberalization of capital flows (Andrew Warner, 2015). However, given the difficulty that may be involved while trying to disentangle the resources with the non-resource revenue, we control for the natural resource rents.

Graph 3 Total natural resources rents



Regarding the other explanatory variables in our model, we include the variables in Ebeke et al. (2016) as well as other measures for institutional quality and stability. The variables from Ebeke et al. (2016) include: Age dependency ratio, AID as percent of GNI, Agricultural value added as percent of GDP, Total natural resources rents (% of GDP) and trade openness (total exports and imports as percent of GDP) are taken from World Development Indicators (WDI) of World Bank dataset. Demographic data (lnPopulation) is taken from World Economic Outlook Database (2016). The IMF arrangements dummy variable taken from IMF Financial Data Query Tool.[‡‡] The dummy takes the value 1 for the year in which country had an IMF Program.

As mentioned above, we added controls for the quality of institutions and government stability. To control for conflicts, we use the variable 'IHSConflict' constructed from the Uppsala dataset (UCDP Armed Conflict Dataset version 4-2016). It is the inverse hyperbolic sine function of the total number of conflict casualties (deaths) within one year, for each country reported. The Quality of institutions variable is constructed from the International Country Risk Guide (ICRG). It is the averaged value of normalized indexes (Bureaucracy quality index, Corruption index,

[‡‡] IMF Arrangements dataset. URL: https://www.imf.org/external/np/fin/tad/query.aspx [Assessed May 10, 2017]

Democratic accountability index, Ethnic tensions index, External conflict index, Government stability index, Internal conflict index, Investment profile index, Law and order index, Military in politics index, Religion in politic index, and Socioeconomic conditions index). Since the indexes had different scales, we normalized them per year to ease the interpretation of coefficient estimates. We averaged the indexes to avoid having controls highly correlated each other. The data from ICRG only covers 31 sub-Saharan countries for the time horizon from 1984-2013. These countries are Angola, Botswana, Burkina Faso, Cameroon, Congo, Cote d'Ivoire, Ethiopia, Gabon, Gambia, Guinea, Guinea-Bissau, Kenya, Malawi, Madagascar, Mali, Mozambique, Namibia, Niger, Nigeria, Senegal, Sierra Leonne, South Africa, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. We use the logarithm of GDP per Capita in constant 2010 US$ to control for the level of economic activity. (from World Bank dataset).

Table (a) is presenting summary statistics for the set of explanatory variables. We noticed important variations in sample countries. For example, Equatorial Guinea, after the discovery and exploitation of vast oil reserves in the 1990s, became one of the fastest growing countries in the world with on average 70% GDP growth between 1996 and 2001.

Aid as a percent of GNI was related to the Rwandan genocide, reaching almost 95% in 1994. Age dependency ratio presents the ratio of three age groups of countries population: dependent population (age 0-14 and 64-plus) relative to working population (age 15-64), as defined by World Bank. Higher numbers indicate a larger level of age-related dependency in the country`s population. Modest age dependency ratio is as expected in smaller countries like Mauritius (total population in 2015 was 1.2 million) and Seychelles (total population in 2015 was 93 thousand).

Table (a). Summary statistics

Variable	Mean	Std. Dev.	Min	Max	Observations	Countries
Revenue including social contributions	22.59	11.38	0.73	72.57	1178	45
Taxes including social contributions	14.97	9.07	0.60	62.83	1293	45
Taxes including social contributions	13.21	7.98	0.60	62.83	1285	45
Age dependency ratio	90.31	12.57	40.9	112.98	1496	46
Aid (% of GNI)	12.66	12.98	-0.25	181.19	1419	46
Agriculture value added	28.13	15.28	0.89	72.03	1349	45
Total natural resources rent (% of GDP)	12.48	12.88	0.00	89.00	1360	46
Trade openness	74.56	49.07	6.32	531.74	1367	45
ln(RGPC)	6.39	1.05	4.60	10.27	1460	46
GDP growth	3.91	7.85	-41.9	147.7	1460	46
LnPopulation	1.61	1.60	-2.76	5.13	1457	46
Average quality of institututions	0.00	0.63	-1.97	1.60	883	31
Conflict deaths	1132.45	18467.27	0.00	501958.0	758	31
IHSConflict	2.55	3.09	0.00	13.82	758	31

Regarding the newly added explanatory variables, lowest quality of institutions was in Sudan in 1990, whereas Namibia in 1997, and in newest years (2008-2009) have the highest quality of institutions. Variable IHSConflict has the largest value of 13.82 for the year of the Rwandan genocide.

Relying on agriculture is the highest in Uganda, above 70% in the 1980s, whereas in Equatorial Guiney agriculture value added in percent of GDP is less than 1% with the largest natural resource rent is 89% of GDP. Trade openness, as total exports and imports relative to GDP, was measured as largest in the 1990s in oil exporting country Equatorial Guinea, in early 1980s Uganda was the least open to trade with total exports and imports to GDP of 6%.

According to the demographic growth, Seychelles, as stated before, are the smallest country with a total population below 100 thousand, whereas Nigeria is the country with the

population above 150 million. Population growth in last 15 years had been on average 5% in Nigeria, so the population from 68 million in 1980 to 174 million in 2013.

IV. Results

Our results focus on the extended dataset presented in the earlier section. However, we first replicate the fixed effects estimation results by Ebeke et al. (2014). The purpose of the replication is to compare our results with the ones in Ebeke et al. (2014) and examine whether we have the same results. After re-running their fixed effect estimation, we are including controls for additional potential omitted variable bias. More specifically, we include the year fixed effects, more controls and run the model using the robust standard errors.

Table 1: Replication of Fixed effects estimation results by Ebeke et al. (2014)

Non-resource tax revenues, % of GDP	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects
VAT	0.405			0.0474	0.000592
	(0.247)			(0.284)	(0.289)
LTU		0.261		0.126	0.150
		(0.257)		(0.285)	(0.288)
SARA			1.621***	1.582***	1.642***
			(0.365)	(0.381)	(0.389)
lagIMF Arrangements					0.291
					(0.207)
Trade_openness	0.00307	0.00412	0.00431	0.00381	0.00701
	(0.00592)	(0.00587)	(0.00578)	(0.00588)	(0.00594)
Total natural resource rent	-0.0481**	-0.0479**	-0.0446**	-0.0469**	-0.0499***
	(0.0190)	(0.0192)	(0.0187)	(0.0191)	(0.0191)
Ln(RGPC)	1.266***	1.365***	1.129***	1.099***	1.168***
	(0.273)	(0.263)	(0.265)	(0.274)	(0.276)
AID_to_GNI	-0.0101	-0.00909	-0.0149	-0.0142	-0.0150
	(0.0130)	(0.0130)	(0.0129)	(0.0130)	(0.0130)
Agricultyre_value_added_to_GDP	-0.0989***	-0.102***	-0.0867***	-0.0857***	-0.0804***
	(0.0180)	(0.0179)	(0.0180)	(0.0182)	(0.0184)
Observations	983	983	983	983	951

R-squared	0.112	0.110	0.127	0.128	0.135
Number of Country1	39	39	39	39	39
Country FE	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO

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

In effort to replicate results by Ebeke et al. (2014) where they present fixed effects estimation results, where individually all tax reforms have positive (statistically significant) impact on Non-hydrocarbon tax revenues (to GDP), additionally controlling for other reforms only VAT and SARA continue to have positive impact with statistical significance at level of 1%. Using the same approach, and same control variables, on the new data set the researchers find similar (though smaller impact) of SARA implementation.

We replicate the same specifications, though we find different results. First, only the SARA is found significant under all the three specifications with slightly smaller coefficients. Controlling for other variables, SARA has approximately 1.6 percentage points positive impact on non-resource tax revenues. Second, the IMF arrangement control variable is not significant, whereas the natural resource rent to GDP is always found significant and negative like the results in Ebeke et al. Similar patterns are observed in the Agriculture value added to GDP and AID to GNI coefficient.

We expect that the differences in the outcomes are mainly driven by the measurement of variables. For example, the outcome of interest used in Ebeke et al. (2014) for this particular regression is the non-hydrocarbon tax revenues to GDP ratio. The authors do not specify what the variable is capturing exactly. Therefore, it is not clear how it is related to the non-resource tax revenues used in Ebeke et al. (2016). Furthermore, the IMF arrangement dummy variable might have been constructed differently than we did. However, we alternatively used three different

specifications of the IMF arrangement dummy variable (all PRGT programs, all GRA programs, and all programs), still, the results are different. Finally, in our estimate, we are using the Aid-to-GNI ratio that Ebeke et al. used in their study in 2016. Yet, the Fixed effects model uses the Aid-to-GDP coefficient. However, we do not expect these results to capture the true causal effect of the reforms since they do not take into account the year fixed effect as the data is on panel, they also are using standard errors instead of robust errors.

We extend the fixed effects model by controlling for year fixed effects, adding controls for quality of institutions and using robust errors estimates. Table 2 presents the impacts of individual reforms on the non-resource tax revenue.

Table 2: Effect of the individual reforms on non-resource tax revenue

VARIABLES	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects	(7) Fixed Effects	(8) Fixed Effects	(9) Fixed Effects
VAT	1.284*	-0.0781	-0.465						
	(0.684)	(0.856)	(0.518)						
LTU				1.065	-0.609	-0.613			
				(0.681)	(1.139)	(0.603)			
SARA							2.698***	1.720	1.219
							(0.870)	(1.076)	(0.721)
Observations	1,248	1,248	605	1,248	1,248	605	1,248	1,248	605
R-squared	0.025	0.081	0.271	0.011	0.083	0.272	0.053	0.097	0.280
Number of Countries	41	41	27	41	41	27	41	41	27
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES

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

Note: The table reports different regressions taking separately the VAT, the LTU and the SARA as a unique dependent variable. Controls do not include other reforms.

It appears from these regressions that, without controlling for neither year fixed effect or the control variables, the VAT and the SARA show positive and significant effect on the non-resources tax revenues. That can relate to Ebeke et al. (2014) findings. According to the Table 2, the adoption the VAT led to a 1.28 percentage points increase on average in the non-resource tax revenue. Whereas, the implementation of SARAs led to a 2.698 percentage points increase on average. The coefficient on LTU is not found statistically significant. However, once we control for time-fixed effects, none of the reforms is significant. Further, when we add controls, only the SARA is found to have a positive effect though it is statistically not significant. The VAT and LTU coefficient are no longer statistically significant and turn negative.

Expanding the Fixed effect regression using the new data set

Our main findings from the OLS fixed effects using the expanded dataset are summarized in table 3. In order to allow comparability between estimates from different specifications, we restrict our sample from 46 countries to only the 31 countries for which we have data on the quality of institutions index. Further, we only retain the covariates with statistically significant effect. Finally, we exclude one outlier country, Zimbabwe. Zimbabwe experienced economic crisis after the establishment of SARA in 2004. The non-resource taxes decreased from 32% in 2004 to 2% approximately in 2008.

In column (1), we run the country and time fixed effects, but we do not control for our covariates, except other tax reforms. We find that all the tax reforms have a positive effect on the non-resource

tax revenues. Though, only the coefficient on SARA is statistically significant. According to this particular finding, the SARA has positive 1.531 percentage points effect on the non-resource revenues. From columns (2) to (6), we add our main controls, the IMF arrangement (both PRGT and GRA programs), the GDP per capita, the quality of institutions, the value added from agriculture, and the total natural resource rent. However, we find that none of the tax reforms remains significant. The coefficients on VAT and SARA remain positive, whereas the coefficient on LTU turns negative.

Table 3. Determinants of nonrecourse tax revenue

VARIABLES	(1)	(2)	(3)	(4)	(6)
Non-resource tax revenue including social contributions	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects
VAT	0.853	0.250			0.168
	(0.701)	(0.689)			(0.653)
LTU	0.240		-0.413		-0.299
	(0.675)		(0.636)		(0.589)
SARA	1.531**			1.295	1.242
	(0.726)			(0.857)	(0.806)
IMF Arrangements ALL		0.582**	0.544**	0.551**	0.549**
		(0.239)	(0.225)	(0.217)	(0.237)
Ln(RGPC)		-2.232**	-2.331**	-2.482**	-2.570***
		(1.013)	(1.000)	(0.973)	(0.928)
AVERAGE quality INSTITUTIONS		1.808***	1.783***	1.669**	1.607**
		(0.612)	(0.616)	(0.641)	(0.624)
AGRI value added (%GDP)		-0.0588**	-0.0619**	-0.0577*	-0.0590*
		(0.0282)	(0.0260)	(0.0307)	(0.0305)
Total natural resources rent		-0.0917**	-0.0921**	-0.0863**	-0.0866**
		(0.0422)	(0.0405)	(0.0400)	(0.0395)

Observations	802	666	666	666	666
Number of id	30	29	29	29	29
R-squared	0.294	0.428	0.430	0.443	0.445
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

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

Looking at the control variables, the IMF arrangement is constantly significant. Controlling for IMF arrangement can be both good and problematic. It can be good if the IMF arrangement is correlated with the adoption of any of the reforms, and at the same time affecting the level of non-resource taxes. This kind of story makes sense to the extent that the adoption of the tax reform might be part of diverse macroeconomic reforms required by the IMF as a conditionality for a financial intervention. Because of the presence of a program with the IMF, countries might improve their macroeconomic stability, which might lead to higher level of economic activity, and broaden the tax base, allowing the tax reforms to have more impact on tax revenue collection. On the other hand, if the tax reforms are the channels through which the IMF arrangement affects the tax revenue, then controlling for the IMF arrangement would not be good. In conclusion, the tax reforms themselves will not have led to an increase in the non-resource revenues in either case. However, in the table A.3 (Appendix), we run regression excluding the IMF arrangement, we find similar results.

The total natural resource rent is found significant and always negative when the dependent variable is non-resource tax revenue. It is defined as the sum of oil rents, natural gas rents, coal rents, mineral and forest rents. We controlled for this variable because we expected that separating the total and non-resource revenue can be controversial. However, given the difficulty that may be involved while trying to disentangle the resources with the non-resource revenue, we control for the natural resource rents. The negative coefficient might be indicating signs of "Dutch disease".

Andrew Warner (2015) provided evidence for Dutch disease theory which argues that booms in resource sectors are usually associated with the slowing down of non-resource GDP. He found "no country in which (non-resource) growth per-person has been statistically significantly higher during the boom years." Andrew Warner (2015, p.1).

We also controlled for the quality of institutions. The coefficients are always significant, meaning that the quality of institutions matter. The quality of institutions is determinant in explaining the government's ability to collect taxes. In fact, no matter which tax reform is implemented, a corrupted, unstable and low capacity administration will undermine its potential benefits for increasing the tax revenues. Therefore, the tax reforms cannot have expected effect if the administration is highly corrupted. We present the results controlling and not controlling for the quality of institutions, the coefficients on the tax reforms are still not significant, except for the SARA when we restrict the sample to countries with available data on institutions. The table 4 shows that controlling for year fixed effect, only the quality of institutions kills the significance on the SARA. Though, using the larger sample, the SARA equally loses the significance (table A.9)

Table 4 Impact of tax reforms on the non-resource taxes, using the restricted data set

Non-resource tax revenues including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects
VAT	0.853	0.931	0.939	0.875	0.497	0.168
	(0.701)	(0.692)	(0.674)	(0.714)	(0.771)	(0.653)
LTU	0.240	0.335	0.297	-0.308	-0.615	-0.299
	(0.675)	(0.672)	(0.698)	(0.646)	(0.656)	(0.589)
SARA	1.531**	1.517**	1.599**	1.570**	1.541*	1.242
	(0.726)	(0.729)	(0.719)	(0.736)	(0.784)	(0.806)
IMF Arrangements		0.818**	0.857**	0.702**	0.575**	0.549**
		(0.375)	(0.372)	(0.332)	(0.270)	(0.237)
Ln(RGPC)			0.0166	-1.442*	-2.412**	-2.570***
			(0.808)	(0.788)	(0.974)	(0.928)
AGRI value added				-0.0572*	-0.0661**	-0.0590*
(%GDP)				(0.0300)	(0.0299)	(0.0305)
Total natural					-0.0843*	-0.0866**

resource rent					(0.0439)	(0.0395)
Quality of institutions						1.607** (0.624)
Observations	802	802	798	728	666	666
Number of Country1	30	30	30	29	29	29
R-squared	0.294	0.310	0.313	0.347	0.403	0.445
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

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

However, the quality of Institutions can be a bad control since the construction of quality of institution indexes can be influenced by the adoption of tax reforms. Most of the indexes are based on observation and qualitative interviews. In this sense, when a country adopts one of the reforms, especially the SARA, its related institution index can improve. For this reason, controlling for the quality of institutions might be the only reason that removes the significance of the coefficient on SARA as seen on table 4. Therefore, it might not be that the SARA reform did not help, but the SARA might have been included in the perception of institutions quality.

Referring to our main table (table 3), we find that the logarithm of GDP per capita is significant but negative. We expect that the same patterns observed in the total natural resources rent might be also explaining the negative signs. However, we found that the same variable has a significant and positive effect on the total resource tax, whereas it does not have a significant effect on the non-resource tax revenues. Furthermore, we do not find statistically significant coefficient on the GDP covariate when we use larger samples (For example in table A.3). Finally, we find negative and significant coefficients on agriculture value added as a percent of GDP. Relying on the findings by Keen and Lockwood (2007), large agriculture sectors are associated with lower tax revenues. The tax collection is harder under agriculture sector because of its rudimentary features in most of developing countries.

Alternative results

We ran many different specifications of the model to assess the robustness of our findings. The alternative results confirm our main findings that the tax reforms effects in tax revenues in Sub-Saharan Africa are ambiguous. We first re-estimated the effect of individual tax reforms without any controls, including and excluding the time fixed-effect (Table 5). We used the largest dataset, without excluding any country. We found that only controlling for the country fixed effect and not the time fixed effect, the LTU, and SARA are significant. Otherwise, adding the year fixed effects, all the coefficients are not significant.

Table 5. Individual impact of tax reforms on nonrecourse tax revenue including social contributions

Non-resource taxes including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects
VAT	0.985	0.354				
	(0.756)	(0.889)				
LTU			1.043*	0.248		
			(0.557)	(1.175)		
SARA					2.810**	2.130
					(1.103)	(1.279)
Observations	1,288	1,288	1,288	1,288	1,288	1,288
Number of Country1	46	46	46	46	46	46
R-squared	0.014	0.090	0.012	0.089	0.053	0.111
Country FE	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES

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

In the table A.3 (Appendix), we add more covariates: the trade openness, the Aid to GNI ratio, the Age dependency ratio, the logarithm of the population and the Conflict. We find that, without controlling for any covariate but controlling for other tax reforms, only SARA is significant.

Adding up all the controls removes the significance effects on all the tax reforms. In addition, the VAT and LTU turn negative.

Alternatively, we run the same specifications, using different measures of the dependent variable (Table 6). We use the Total tax revenues, the taxes on goods and services, the indirect taxes, the taxes on corporations and other enterprises, and the taxes on international trade and transactions.

Table 6. Impact of tax reforms on different tax revenues using fixed effect method

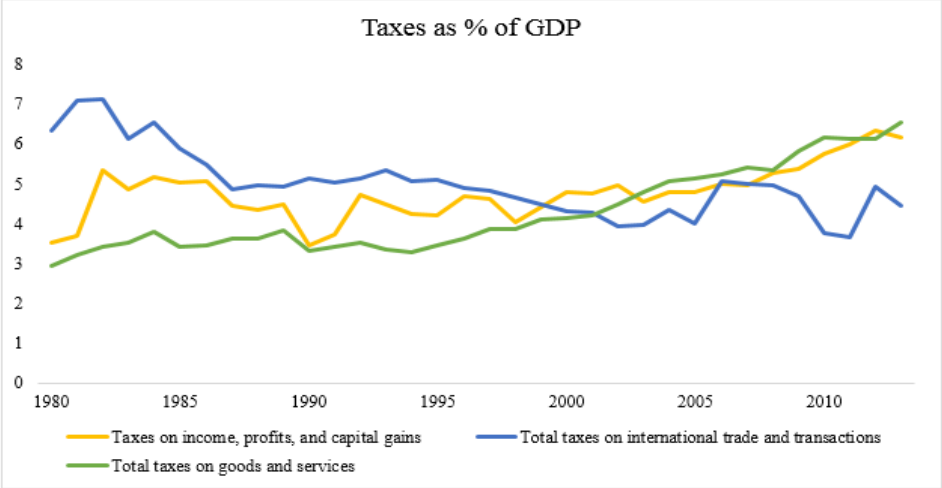
VARIABLES	(1) Total taxes	(2) Taxes on goods and services	(3) Indirect taxes	(4) Taxes on corporations and other enterprises	(5) Taxes on international trade and transactions
VAT	-2.981***	0.110	0.244	-0.0391	-0.199
	(1.066)	(0.497)	(0.522)	(0.156)	(0.403)
LTU	0.439	0.259	0.312	0.269	0.260
	(1.074)	(0.365)	(0.448)	(0.187)	(0.351)
SARA	-0.823	0.00796	0.261	-0.441	-0.0609
	(1.076)	(0.509)	(0.701)	(0.336)	(0.620)
IMF Arrangements ALL	0.430	0.272	0.427***	0.261**	0.000276
	(0.360)	(0.173)	(0.139)	(0.106)	(0.205)
Ln(RGPC)	-1.377	-0.125	-0.510	0.833*	-0.476
	(1.731)	(0.623)	(0.978)	(0.486)	(0.562)
AVERAGE quality INSTITUTIONS	2.410***	0.502	1.292***	0.420***	0.589*
	(0.781)	(0.297)	(0.366)	(0.140)	(0.337)
AGRI value added (%GDP)	-0.140***	-0.0316*	-0.0171	0.00432	0.0139
	(0.0403)	(0.0184)	(0.0247)	(0.0102)	(0.0237)
Total natural resources rent	-0.0287	-0.0336**	-0.0466	0.0311	-0.0258
	(0.127)	(0.0162)	(0.0295)	(0.0197)	(0.0242)

Observations	676	597	610	383	613
Number of id	29	30	30	27	30
R-squared	0.240	0.347	0.245	0.310	0.078
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

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

Basically, the results are mostly the same, except one major change. We find a negative and significant effect of VAT on the total taxes. This is related to the findings by Keen and Lockwood (2007) who argued that in Sub-Saharan Africa, the results on the effectiveness of the VAT are mixed possibly because of the decrease in the reliance on other taxes, especially the border taxes (tariffs). The graph 3 below supports the idea.

Graph 3: Taxes as percent of GDP in SSA from 1980 to 2010



Again using the total tax revenues, the table A.4 in Appendix show the negative and significant impact of VAT on the total tax revenues when we control for our covariates, including the IMF arrangements and the quality of institutions. We also re-run the same specification as the one in Ebeke et al. (2014) (Table A.5 in Appendix). However, Ebeke et al. use standard errors, not robust standard errors, and they are limited to only country fixed effects. Once including for time fixed

effects and using robust standard errors, all the tax reforms lose their significant impact on non-resource tax revenue.

Finally, we present some tables using the Ebeke et al. dataset, which basically presents the same results regarding the effect of tax reforms in Sub-Saharan Africa. However, the variations are limited. For example, interacting LTU and SARA only provides two observations. These include interactions between the three reforms to test whether any tax reform works better when it is combined with another one (Table A.6). For this purpose, we constructed mutually exclusive coefficients of every tax reform. By mutually exclusive, we mean, for example for the VAT, we assign the dummy equals 1 only if the country only adopted the VAT and no other reform. We find no significant effect for any interaction, though the SARA is the only reform with a positive coefficient. These results do not meet the one in Ebeke et al. (2016) who presented positive and significant effects when the VAT is combined with the SARA.

Further thoughts

On the following lines, we briefly discuss the possible reasons that might have undermined the potential benefits from adopting the tax reforms discussed in this proposal. We expect that the potential benefits of the VAT could have been undermined by institutional, macroeconomic and political economy obstacles. These might include the tax policy (tax form or tax administration tax form or tax administration the country is switching from), the granting of tax exemptions, the VAT tax rates, the proportion of the VAT tax base compare to the total tax base, which is dependent on the characteristics of the economy, the level of tax evasion, among others.

We expect that the tax system the country is switching from might matter. This determines the theoretical added-value of the tax reform itself. For example, the VAT might only be good for

efficiency point of view but not necessarily on the revenue aspect. For example, holding constant the tax base, a country using turnover tax might end up collecting more revenue than another country that relies on the VAT, since the effective tax rate of turnover tax is larger than the one on the VAT.

On the other hand, the LTU and the SARA, which are tax administration reforms, should better deal with political leverage and institutional capacities (for example by allowing well-payed employees and managerial autonomy for SARA). However, for the LTU, it might be the case that the desired skills related to specialization were already existent or were not significantly improved due to lack of technological, infrastructural, training or managerial capacities. Also, the LTU might only have led to improved compliance rather than actual increase in total revenues (Ebeke et al., 2016). Regarding the SARA, as discussed earlier it might be the case that the SARA helped to increase the performance of tax collection, but as it is part of the institutional quality assessment. Otherwise, the establishment of the SARA does not always guarantee the freeing of tax collection from the political leverage, nor an improved administration in terms of efficiency.

Further, under the VAT, the granting of exemptions or the use of zero tax rating can end up lowering the tax resources. The choice of the tax rates might also matter. In addition, as long as the VAT tax base is not enlarged, the VAT itself might not lead to significant increase in the tax revenues. For example, countries experiencing significant natural resource booms might rely less on the non-resource sector for tax collection. We saw that in Equatorial Guinea, the boom in oil sector shrunk the non-resource ratio from 27 to 3% of GDP. Further, we found that the goods and service tax represented 28% of the total taxes on average. In fact, if the VAT base remains limited, no significant results should be expected. Also, as discussed in the paper, the IMF arrangement might have led to more relevant reforms that improve best the tax resources. Even

though the quality of institutions improved on average over the period (average index went from 3.83 to 4.51), countries with high level of corruption and institutional capacity might not be able to take real advantage of the VAT. Finally, the administration of refunds under the VAT can trigger more tax evasion. For example, if the government lacks the ability to certify the tax credits, the accumulation of tax refunds can create incentives to evade the tax and undermine the ability to raise the tax.

In conclusion, our main control variables: the quality of institutions (including management capacities, political leverage, tax policy) and the size of the tax base determined by the overall macroeconomic conditions, such as the GDP and the share of the non-resource sector are crucial.

V. Conclusion

The motivation for this paper came from the interest to isolate the impact of tax reforms on revenue collection. Many developing countries suffer from corrupt, poorly design and ineffective tax systems. IMF programs helped many developing countries, especially sub-Saharan African countries to establish tax reforms that would allow self-enforcement like the VAT for tax collection to decrease tax avoidance, or more independent tax authority (SARA) or specialized office (LTU) in order to gain from specialization, tax officers' selection and remuneration. Even though the number of such reforms does not lack, the conclusive empirical evaluation of the true impact of those does.

One of the studies that presented the positive statistically significant impact of VAT and SARA are those of Ebeke et al. (2014 and 2016) in which they are using several different methods, all proving the same results. In order to potentially find the same results, we use the OLS country and time fixed effects (robust standard errors) firstly on the same panel data as Ebeke at al. (2016),

later on, an expanded panel dataset using better data, as well as more countries and years. Using the non-resource tax revenues as the dependent variable, we found no robust evidence that the tax reforms significantly affected the revenue collection. The tax reforms mostly lose their significance and turn negative once we control for time-fixed effects and further when we include more covariates. Though, the SARA showed consistent positive coefficients and was significant when we do not control for the quality of institutions within a restricted sample size. Our findings, tested on two-panel datasets, and different types of taxes, controlling for different explanatory variables, excluding outliers, remain fundamentally the same.

In conclusion, in Sub-Saharan African countries where many other reforms, natural resources findings, political and economic turbulences continuously happen, the impact of tax reforms by our findings remains ambiguous. In fact, we expect that the potential benefits of the VAT could have been undermined by institutional, macroeconomic and political economy obstacles. These might include the tax policy (tax form or tax administration the country is switching from), the granting of tax exemptions, the VAT tax rates, the proportion of the VAT tax base compare to the total tax base, which is dependent on the characteristics of the economy, the level of tax evasion, among others.

Future studies could include a more rigorous analysis of possible obstacles to the ambiguous effects of these reforms. Further, a broader dataset allowing for more variation for analyzing the interactions between the tax reforms could also be explored in future studies. Similarly, adding controls for the region fixed-effect can also inform more on the dynamics in Sub-Saharan Africa regarding the underlying research question. This can still be valuable even though it might just reduce the variations in the sample and limit the statistical power.

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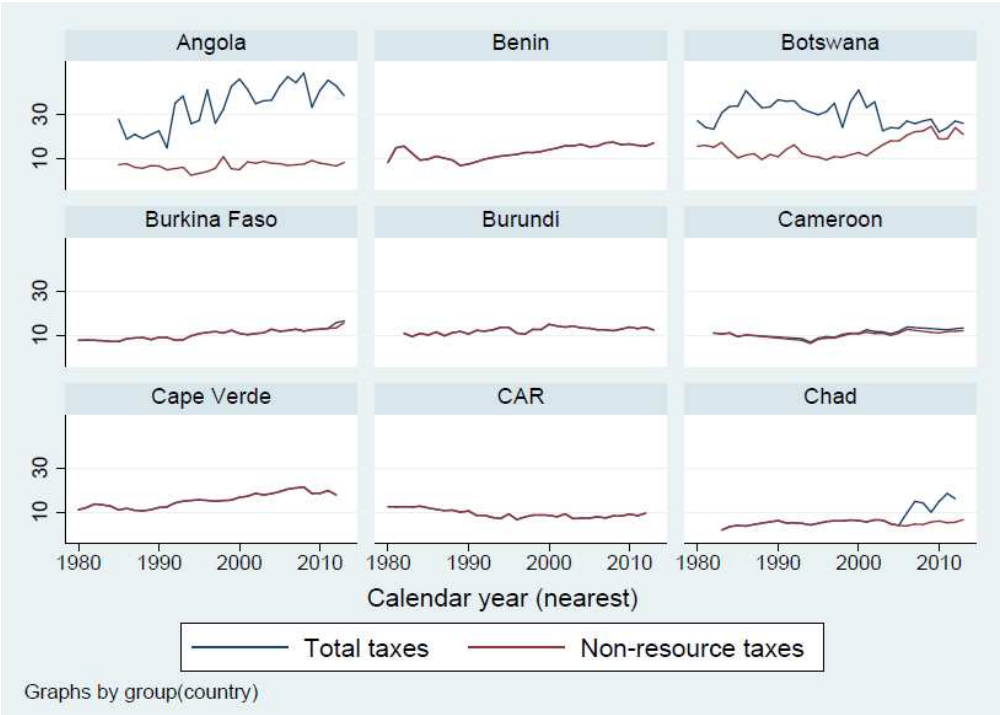
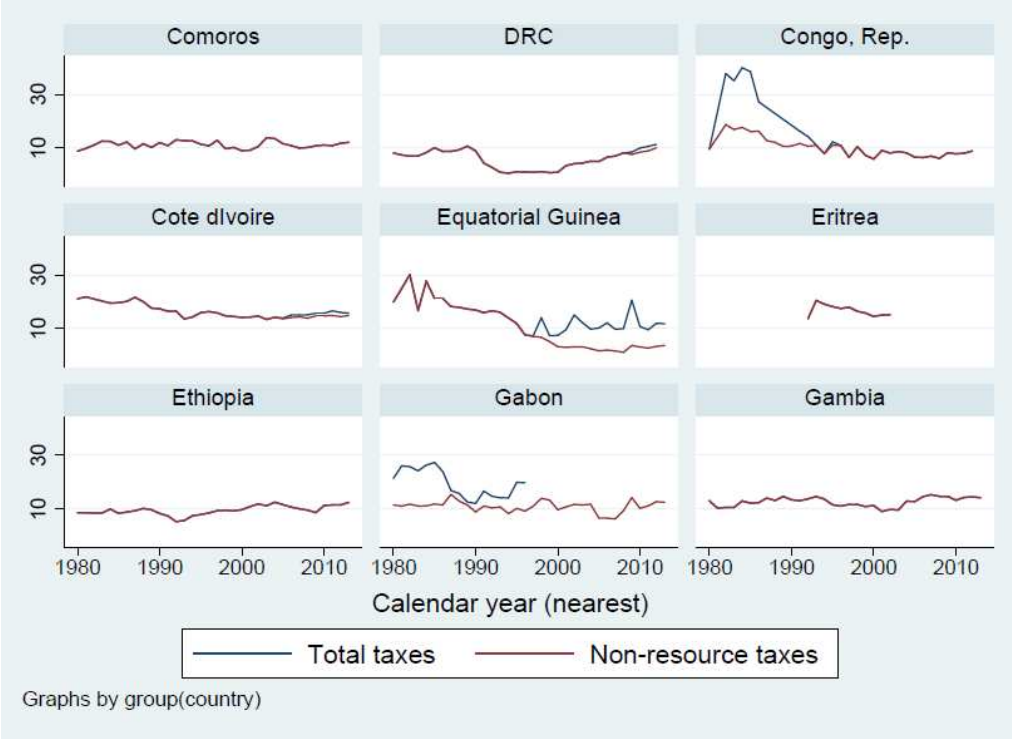
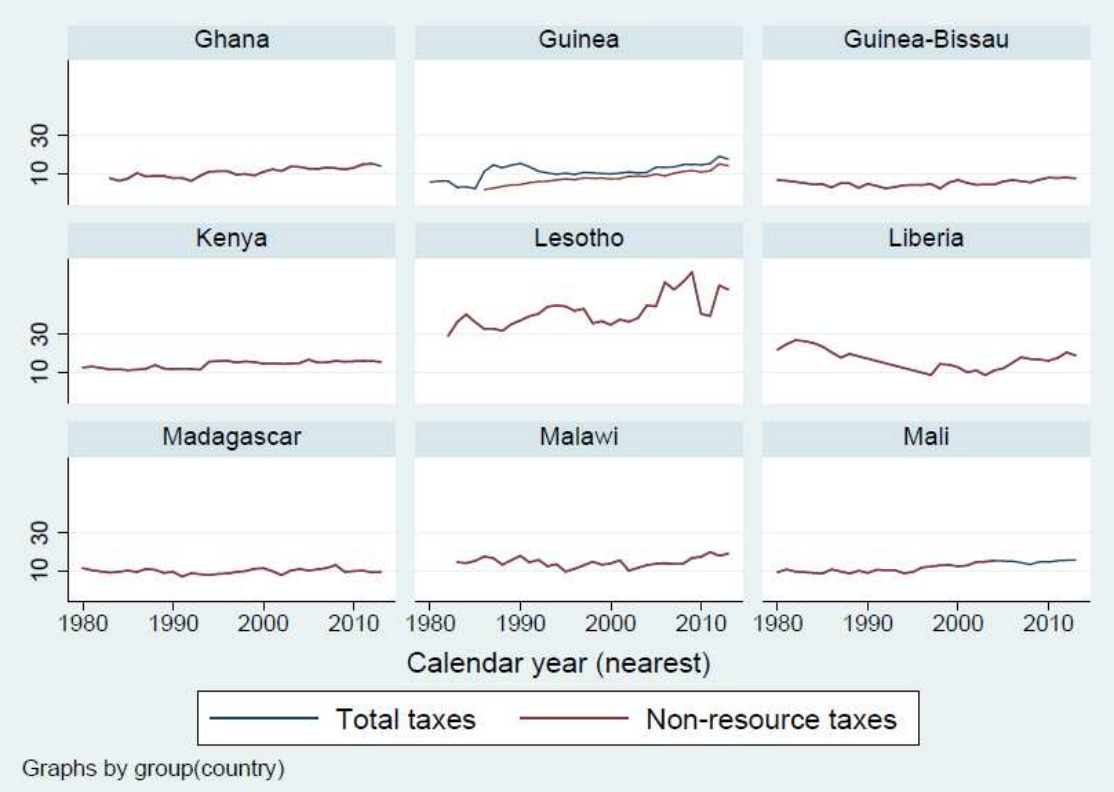
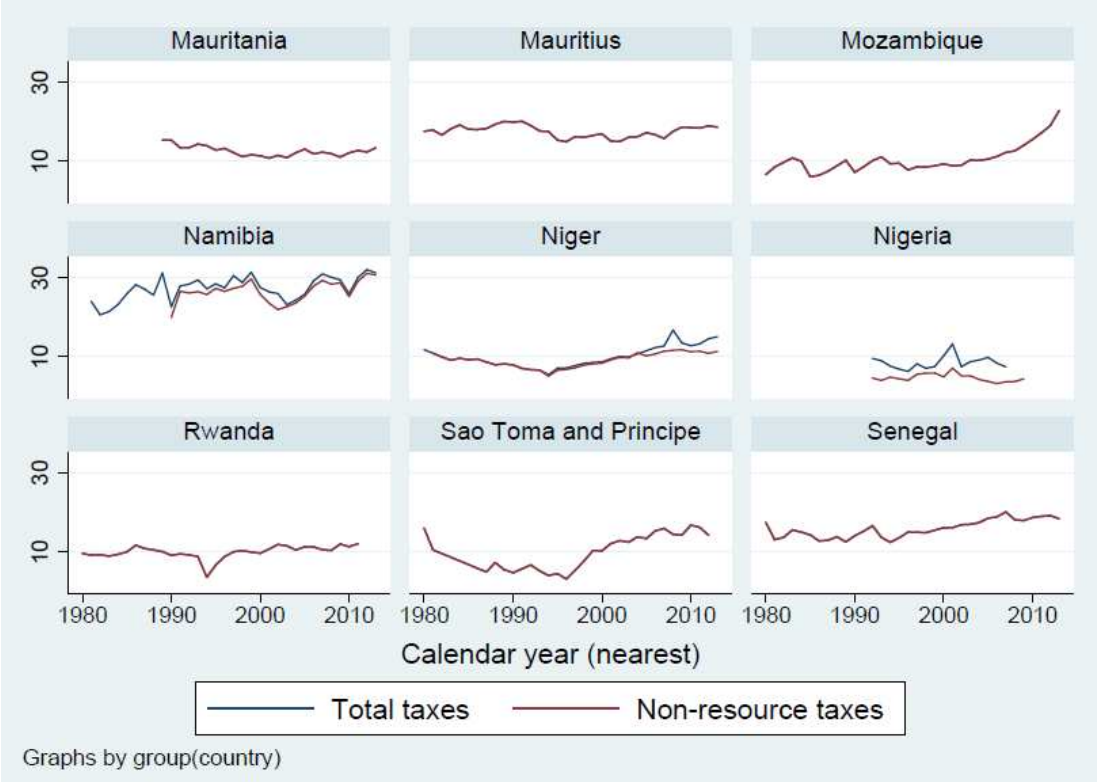
Appendix

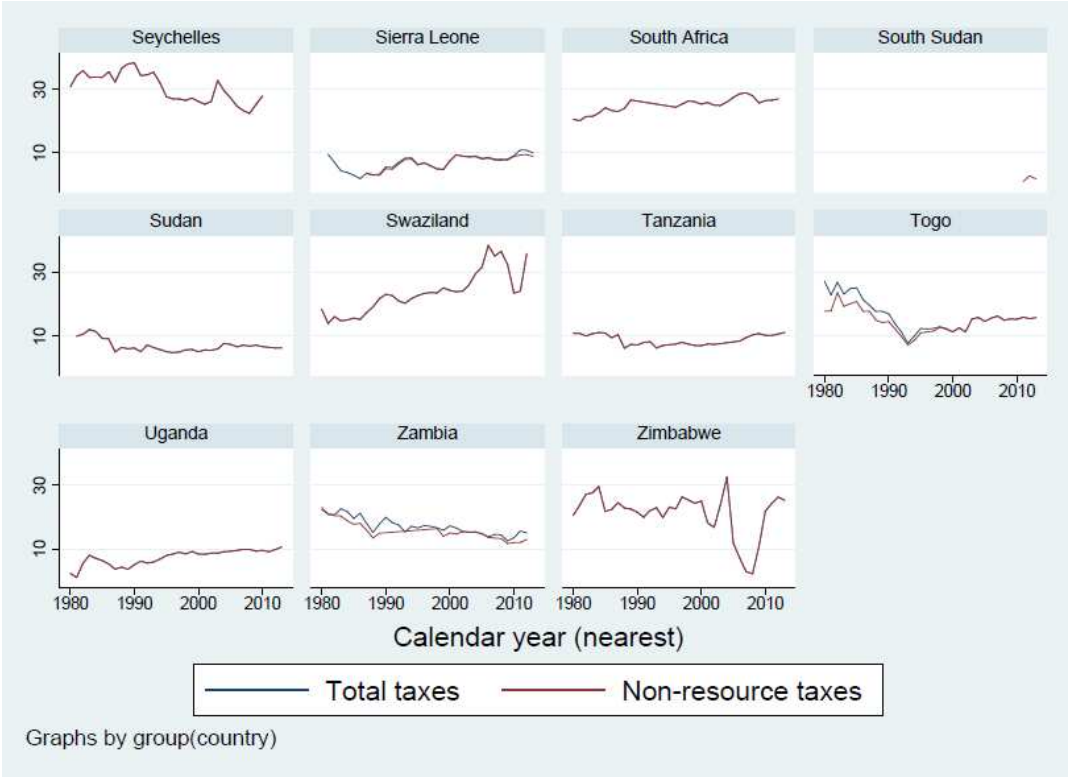
1. Tables on Total and non-resource tax revenues per country from 1980 to 2010




Comoros
DRC
Congo, Rep.
Cote dIvoire
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
10
30
1980
1990
2000
2010
Calendar year (nearest)
Total taxes
Non-resource taxes
Graphs by group(country)


Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
10 30
1980
1990
2000
2010
Calendar year (nearest)
Total taxes
Non-resource taxes
Graphs by group(country)


Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Rwanda
Sao Toma and Principe
Senegal
10
30
1980
1990
2000
2010
Calendar year (nearest)
Total taxes
Non-resource taxes
Graphs by group(country)


Seychelles
Sierra Leone
South Africa
South Sudan
Sudan
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe
10
30
1980
1990
2000
2010
Calendar year (nearest)
Total taxes
Non-resource taxes
Graphs by group(country)

2. Alternative regression outputs

Table A.3. Impact of tax reforms on nonrecourse tax revenue including social contributions controlling for additional variables

VARIABLES Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects
VAT_New	-0.167	-0.134	-0.342	-0.343
	(0.783)	(0.668)	(0.910)	(0.806)
LTU_New	0.728	-0.456	-0.0377	0.497
	(1.205)	(0.486)	(0.831)	(0.868)
SARA_New	2.356*	1.113	0.754	0.337
	(1.286)	(1.017)	(1.405)	(1.302)
IMF Arrangements		0.841**	0.356	
		(0.320)	(0.283)	
Trade openness		-0.00700	0.00759	
		(0.0175)	(0.0256)	
AGRI value added		-0.0773**	-0.0176	
		(0.0301)	(0.0337)	
AID		-0.00510	0.0255	
		(0.0203)	(0.0202)	
Age dependency ratio		-0.00623	-0.0864	
		(0.0549)	(0.0653)	
LnPopulation		4.587	8.031	
		(3.473)	(5.350)	
Quality of Instit			2.440***	2.439***
			(0.612)	(0.756)
Ln(RGPC)			0.310	0.211
			(2.415)	(1.667)
HIS(Conflict)			0.0720	0.0836
			(0.0601)	(0.0552)
Observations	1,288	1,030	502	540
Number of id	46	42	24	24
R-squared	0.114	0.207	0.347	0.326
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

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

Table A.4. Impact of tax reforms on total tax revenue

VARIABLES Total tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects	(7) Fixed Effects
VAT	-1.799	-1.699	-1.793	-2.051	-2.536**	-3.108**	-2.981***
	(1.408)	(1.374)	(1.304)	(1.291)	(1.088)	(1.130)	(1.066)
LTU							0.439
							(1.074)
SARA							-0.823
							(1.076)
IMF Arrangements		1.128**	0.949**	0.754*	0.553	0.411	0.430
ALL		(0.516)	(0.450)	(0.440)	(0.421)	(0.364)	(0.360)
Ln(RGPC)			1.688	1.192	-1.277	-1.538	-1.377
			(1.316)	(1.290)	(1.436)	(1.726)	(1.731)
AVERAGE quality				1.946**	2.223***	2.327***	2.410***
INSTITUTIONS				(0.750)	(0.722)	(0.816)	(0.781)
AGRI value added					-0.140***	-0.141***	-0.140***
(%GDP)					(0.0471)	(0.0397)	(0.0403)
Total natural resources						-0.0240	-0.0287
rent						(0.125)	(0.127)
Observations	812	812	806	806	740	676	676
Number of id	31	31	31	31	29	29	29
R-squared	0.131	0.144	0.166	0.196	0.221	0.234	0.240
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

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

Table A.5. Replication of Fixed Effects methods done by Ebeke et al. (2014) on new dataset

VARIABLES Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects
VAT	0.313			-0.0942	-0.133	-0.0338
	(0.230)			(0.269)	(0.272)	(0.728)
LTU		0.374		0.395	0.346	0.0732
		(0.234)		(0.263)	(0.265)	(0.703)
SARA			1.262***	1.286***	1.368***	0.931
			(0.353)	(0.370)	(0.372)	(1.123)
Lagged IMF arrangement, dummy					0.635***	0.740**
					(0.205)	(0.326)
Trade openness	0.0120**	0.0121**	0.0134**	0.0127**	0.0122**	0.00175
	(0.00548)	(0.00545)	(0.00539)	(0.00546)	(0.00548)	(0.0209)
Total natural resources rent (%GDP)	-0.0822***	-0.0846***	-0.0781***	-0.0819***	-0.0845***	-0.100**
	(0.0158)	(0.0159)	(0.0156)	(0.0159)	(0.0161)	(0.0390)
Ln(RGDP PC)	1.738***	1.766***	1.551***	1.499***	1.526***	0.689
	(0.243)	(0.235)	(0.243)	(0.250)	(0.252)	(1.384)
AGRI value added (%GDP)	-0.0792***	-0.0799***	-0.0710***	-0.0694***	-0.0704***	-0.0747**
	(0.0164)	(0.0163)	(0.0165)	(0.0165)	(0.0168)	(0.0292)
AID (%GDP)	-0.00578	-0.00493	-0.00693	-0.00533	-0.0114	-0.00231
	(0.0127)	(0.0127)	(0.0126)	(0.0126)	(0.0128)	(0.0192)
Observations	978	978	978	978	960	960
Number of id	42	42	42	42	42	42
R-squared	0.164	0.165	0.174	0.176	0.182	0.237
Country FE	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO	YES
Errors	Standard	Standard	Standard	Standard	Standard	Robust

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

Table A.6: Impact of Interacted mutually exclusive tax reforms on Non-resource tax revenue including social contributions

Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects
VAT-EX	-0.843					
	(1.106)					
LTU-EX		-0.150				
		(1.452)				
SARA-EX			0.537			
			(1.268)			
VAR-LTU-EX				-1.383		
				(1.101)		
VAT-SARA-EX					-1.193	
					(2.035)	
VAT-LTU-SARA-EX						-0.0781
						(1.857)
IMF Arrangements	0.966*	0.636	0.579	0.804	0.673	0.638
	(0.538)	(0.613)	(0.605)	(0.586)	(0.597)	(0.578)
Ln(RGPC)	1.012	0.921	1.167	4.107**	0.518	0.585
	(1.016)	(1.755)	(1.553)	(1.917)	(1.317)	(1.580)
Age_Dependency_Ratios	-0.0451	0.00865	0.0251	0.126	-0.0364	-0.0376
	(0.0644)	(0.0901)	(0.0885)	(0.104)	(0.0705)	(0.0684)
AID_to_GNI	0.0232	0.0266	0.0425	0.0683	0.0201	0.0211
	(0.0325)	(0.0425)	(0.0421)	(0.0407)	(0.0367)	(0.0414)
Agricultyre_value_added_to_GDP	-0.151**	-0.261***	-0.265***	-0.105	-0.254***	-0.239***
	(0.0654)	(0.0765)	(0.0849)	(0.112)	(0.0833)	(0.0732)
Trade_openness	-0.0214	-0.0244	-0.0245	0.00456	-0.0144	-0.0290
	(0.0406)	(0.0413)	(0.0413)	(0.0421)	(0.0358)	(0.0410)
Observations	638	511	515	651	577	522
Number of Country1	38	32	33	35	34	33
R-squared	0.161	0.150	0.158	0.235	0.152	0.181
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Standard errors in parentheses

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

Table A.7 Effect of the individual reforms on non-resource tax revenue

Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects	(7) Fixed Effects	(8) Fixed Effects	(9) Fixed Effects
VAT	1.284*	-0.0781	-0.465						
	(0.684)	(0.856)	(0.518)						
LTU				1.065	-0.609	-0.613			
				(0.681)	(1.139)	(0.603)			
SARA							2.698***	1.720	1.219
							(0.870)	(1.076)	(0.721)
Observations	1,248	1,248	605	1,248	1,248	605	1,248	1,248	605
R-squared	0.025	0.081	0.271	0.011	0.083	0.272	0.053	0.097	0.280
Number of Countries	41	41	27	41	41	27	41	41	27
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
*** p<0.01, ** p<0.05, * p<0.1
Note: The table reports different regressions taking separately the VAT, the LTU and the SARA as a unique dependent variable. Controls do not include other reforms.

Table A.8: Effect of separate reforms on total tax revenues.

Total Tax revenues including s.cont	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects	(7) Fixed Effects	(8) Fixed Effects	(9) Fixed Effects
VAT	2.599***	0.0456	-1.138*						
	(0.723)	(0.879)	(0.639)						
LTU				2.042***	-1.167	-0.236			
				(0.751)	(1.076)	(0.611)			
SARA							2.659***	-0.159	0.860
							(0.832)	(1.046)	(0.686)
Observations	1,248	1,248	605	1,248	1,248	605	1,248	1,248	605
R-squared	0.063	0.161	0.342	0.026	0.166	0.336	0.032	0.161	0.338
Nb of Countr	41	41	27	41	41	27	41	41	27
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes

Robust standard errors in parentheses

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

Note: The table reports different regressions taking separately the VAT, the LTU and the SARA as a unique dependent variable. Controls do not include other reforms.

Table A.9 : Effect of tax, controlling for other reforms on non-resource tax revenue.

Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects
VAT	0.313	-0.308	-0.320	-0.485	-0.445
	(0.725)	(0.740)	(0.677)	(0.486)	(0.562)
SARA	2.375***	1.724	0.960	1.208	1.688**
	(0.826)	(1.066)	(0.824)	(0.751)	(0.645)
LTU	0.438	-0.313	-0.586	-0.553	-0.233
	(0.729)	(1.133)	(0.435)	(0.565)	(0.493)
IMF Arrangements			0.985***	0.612*	0.590*
			(0.349)	(0.311)	(0.327)
Ln(RGPC)			0.275	-1.311	0.393
			(0.893)	(1.385)	(0.802)
Age_Dependency_Ratios			0.00728	-0.0108	-0.0205
			(0.0504)	(0.0477)	(0.0390)
AID_to_GNI			-0.00594	0.0248	0.0142
			(0.0279)	(0.0172)	(0.0208)
Total natural resource rent			-0.0671	-0.130***	-0.119***
			(0.0502)	(0.0340)	(0.0425)
Agricultyre_value_added_to_GDP			-0.0950**	-0.0451	-0.0202
			(0.0414)	(0.0333)	(0.0293)
Trade_openness			-0.0103	0.00658	0.0254
			(0.0252)	(0.0225)	(0.0236)
lnPopulation			-1.844	-0.987	2.049
			(4.918)	(7.509)	(2.077)
Quality of institutions				1.137**	0.862***
				(0.425)	(0.306)
Observations	1,248	1,248	605	605	605
R-squared	0.057	0.098	0.201	0.284	0.209
Number of Country1	41	41	27	27	27
Country FE	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	NO
Controls	NO	NO	YES	YES	YES

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

Table A.10: Effect of tax, controlling for other reforms on total tax revenue.

Total tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects
VAT	1.959**	0.218	-0.720	-1.156*	-0.584
	(0.827)	(0.811)	(0.760)	(0.642)	(0.594)
SARA	1.160	-0.421	0.736	0.889	0.935
	(0.863)	(1.041)	(0.714)	(0.681)	(0.585)
LTU	0.616	-1.254	-0.587	-0.178	0.483
	(0.795)	(1.066)	(0.493)	(0.590)	(0.588)
IMF Arrangements			1.086**	1.277**	1.299***
			(0.433)	(0.478)	(0.418)
Ln(RGPC)			4.317***	4.485**	2.977**
			(1.026)	(1.751)	(1.186)
Age_Dependency_Ratios			0.0354	0.0727	0.0489
			(0.0534)	(0.0622)	(0.0439)
AID_to_GNI			0.0250	0.0453*	0.00687
			(0.0244)	(0.0229)	(0.0240)
Total natural resource rent			0.193***	0.188**	0.124
			(0.0551)	(0.0896)	(0.0845)
Agricultyre_value_added_to_GDP			-0.0533	-0.0100	-0.0472
			(0.0536)	(0.0307)	(0.0304)
Trade_openness			0.0128	0.0807***	0.0815***
			(0.0318)	(0.0198)	(0.0217)
LnPopulation			5.861	2.047	-0.476
			(5.391)	(7.099)	(2.402)
Quality of institutions				0.830*	0.769**
				(0.410)	(0.289)
Observations	1,248	1,248	979	605	605
R-squared	0.069	0.167	0.270	0.344	0.269
Number of Country1	41	41	39	27	27
Country FE	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	YES	NO
Controls	NO	NO	YES	YES	YES

Robust standard errors in parentheses

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

Table A.11: Restricting the sample to countries with available data, non-resource revenues

Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects	(6) Fixed Effects	(7) Fixed Effects
VAT	-0.0702	-0.471					-0.502
	(0.769)	(0.531)					(0.503)
LTU			-0.491	-0.491			-0.393
			(0.581)	(0.581)			(0.531)
SARA					1.268	1.268	1.264
					(0.760)	(0.760)	(0.776)
IMF Arrangements	0.793	0.609*	0.616*	0.616*	0.665*	0.665*	0.604*
	(0.471)	(0.325)	(0.334)	(0.334)	(0.336)	(0.336)	(0.333)
Ln(RGPC)	-0.586	-1.453	-1.542	-1.542	-1.354	-1.354	-1.414
	(1.246)	(1.314)	(1.394)	(1.394)	(1.335)	(1.335)	(1.361)
Age_Dependency_Ratios	0.00279	-0.0156	-0.0139	-0.0139	-0.00323	-0.00323	-0.00445
	(0.0536)	(0.0608)	(0.0622)	(0.0622)	(0.0504)	(0.0504)	(0.0497)
AID_to_GNI	0.0226	0.0272	0.0269	0.0269	0.0194	0.0194	0.0231
	(0.0216)	(0.0174)	(0.0177)	(0.0177)	(0.0186)	(0.0186)	(0.0174)
Total natural resource rent	-0.160***	-0.140***	-0.137***	-0.137***	-0.141***	-0.141***	-0.136***
	(0.0499)	(0.0354)	(0.0374)	(0.0374)	(0.0353)	(0.0353)	(0.0335)
Agricultyre_value_added_to_GDP	-0.0938*	-0.0586	-0.0545	-0.0545	-0.0383	-0.0383	-0.0416
	(0.0494)	(0.0344)	(0.0334)	(0.0334)	(0.0313)	(0.0313)	(0.0341)
Trade_openness	0.00850	-0.00443	-0.00501	-0.00501	0.00146	0.00146	0.00139
	(0.0280)	(0.0267)	(0.0264)	(0.0264)	(0.0262)	(0.0262)	(0.0252)
LnPopulation	-8.422	-3.766	-2.379	-2.379	-1.940	-1.940	-1.061
	(6.589)	(6.654)	(7.231)	(7.231)	(7.360)	(7.360)	(7.483)
	(4.899)	(5.480)	(5.881)	(5.881)	(6.140)	(6.140)	(6.008)
Quality of institutions		1.145***	1.085***	1.085***	1.036**	1.036**	1.096**
		(0.360)	(0.355)	(0.355)	(0.387)	(0.387)	(0.414)
Observations	654	578	578	578	578	578	578
R-squared	0.245	0.261	0.261	0.261	0.271	0.271	0.275
Number of Country1	26	26	26	26	26	26	26
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses

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

Table A.12: Excluding and including IMF arrangement and quality of institutions on Non-resource revenues

Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects
VAT	-0.168	-0.126	-0.583	-0.502
	(0.765)	(0.726)	(0.521)	(0.503)
LTU	-0.450	-0.325	-0.470	-0.393
	(0.542)	(0.513)	(0.541)	(0.531)
SARA	1.565*	1.663**	1.236	1.264
	(0.861)	(0.800)	(0.812)	(0.776)
IMF Arrangements		0.834*		0.604*
		(0.463)		(0.333)
Quality of institutions			1.173**	1.096**
			(0.436)	(0.414)
Ln(RGPC)	-0.436	-0.515	-1.423	-1.414
	(1.369)	(1.279)	(1.360)	(1.361)
Age_Dependency_Ratios	0.0297	0.0203	-0.00249	-0.00445
	(0.0443)	(0.0444)	(0.0487)	(0.0497)
AID_to_GNI	0.0237	0.0153	0.0295	0.0231
	(0.0207)	(0.0200)	(0.0182)	(0.0174)
Total natural resource rent	-0.141**	-0.151***	-0.132***	-0.136***
	(0.0514)	(0.0462)	(0.0351)	(0.0335)
Agricultyre_value_added_to_GDP	-0.0694	-0.0706	-0.0389	-0.0416
	(0.0452)	(0.0428)	(0.0354)	(0.0341)
Trade_openness	0.0129	0.0152	0.000491	0.00139
	(0.0261)	(0.0264)	(0.0248)	(0.0252)
LnPopulation	-5.563	-5.683	-0.790	-1.061
	(6.309)	(6.309)	(7.472)	(7.483)
	(4.655)	(4.739)	(6.032)	(6.008)
Observations	654	654	578	578
R-squared	0.251	0.264	0.268	0.275
Number of Country1	26	26	26	26
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

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

Table A.13: Quality of institutions, IMF arrangements on Total tax revenues

Total tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects
VAT	-0.982	-0.926	-1.250	-1.074
	(0.965)	(0.900)	(0.739)	(0.640)
LTU	-0.801	-0.633	-0.540	-0.374
	(0.576)	(0.533)	(0.646)	(0.615)
SARA	1.093	1.224	0.783	0.841
	(0.791)	(0.744)	(0.806)	(0.742)
IMF Arrangements		1.116*		1.301**
		(0.592)		(0.498)
Quality of institutions			1.058**	0.892**
			(0.449)	(0.428)
Ln(RGPC)	5.662***	5.556***	4.533**	4.551**
	(1.481)	(1.460)	(1.730)	(1.748)
Age_Dependency_Ratios	0.0367	0.0240	0.0677	0.0635
	(0.0480)	(0.0487)	(0.0627)	(0.0639)
AID_to_GNI	0.0548**	0.0435*	0.0604**	0.0466*
	(0.0226)	(0.0239)	(0.0250)	(0.0227)
Total natural resource rent	0.174*	0.160*	0.195**	0.187**
	(0.0857)	(0.0811)	(0.0901)	(0.0905)
Agricultyre_value_added_to_GDP	-0.0571	-0.0586	-0.00687	-0.0126
	(0.0466)	(0.0444)	(0.0351)	(0.0335)
Trade_openness	0.0907***	0.0938***	0.0891***	0.0910***
	(0.0216)	(0.0214)	(0.0206)	(0.0203)
lnPopulation	1.511	1.351	2.880	2.297
	(6.070)	(6.358)	(7.140)	(7.296)
	(4.237)	(4.694)	(5.310)	(5.409)
Observations	654	654	578	578
R-squared	0.295	0.306	0.325	0.341
Number of Country1	26	26	26	26
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Controls	YES	YES	YES	YES

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

Table A.15: Impact of tax reforms on Non-resource tax revenue including social contributions, without controlling for LnGDP per capita

Non-resource tax revenue including social contributions	(1) Fixed Effects	(2) Fixed Effects	(3) Fixed Effects	(4) Fixed Effects	(5) Fixed Effects
VAT	0.853	0.142			0.0531
	(0.701)	(0.773)			(0.748)
LTU	0.240		-0.0458		0.0717
	(0.675)		(0.655)		(0.596)
SARA	1.531**			0.932	0.938
	(0.726)			(0.944)	(0.859)
IMF Arrangements		0.592**	0.580***	0.574***	0.581**
		(0.224)	(0.205)	(0.203)	(0.217)
Quality of		1.625**	1.639***	1.503**	1.507**
institutions		(0.621)	(0.592)	(0.608)	(0.585)
AGRI value added		-0.0443*	-0.0450*	-0.0422	-0.0417
(%GDP)		(0.0260)	(0.0241)	(0.0277)	(0.0278)
Total natural		-0.0613	-0.0613	-0.0548	-0.0549
resource rent		(0.0435)	(0.0424)	(0.0428)	(0.0434)
Observations	802	666	666	666	666
Number of Country1	30	29	29	29	29
R-squared	0.294	0.395	0.394	0.403	0.403
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

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