CREDIT Research Paper

No. 17/01

Semi-Autonomous Revenue Authorities in Sub-Saharan Africa:

Silver Bullet or White Elephant

by

Roel Dom

Abstract

Semi-autonomous revenue authorities (SARAs) have been at the centre of tax administration reform in Sub-Saharan Africa for the last 30 years. Nevertheless, the revenue effect of this reform remains highly debated (Ahlerup et al., 2015; Ebeke et al., 2016; Fjeldstad and Moore, 2009; Sarr, 2016; Von Haldenwang et al., 2014). This paper adds to the debate by controlling for the dynamics in tax revenue, which otherwise confound the effect of SARAs on tax revenue. Using a panel dataset of 46 countries over the period 1980-2012 and accounting for revenue dynamics, we show that, in contrast to previous findings, there is no robust evidence that SARAs have increased revenue performance in Sub-Saharan Africa. These findings are supported by an instrumental variable estimation which relies on donor influence. When broadening our scope, we fail to find any effect from SARAs on tax effort, revenue volatility and corruption. We, thus, conclude that there is little statistical support for a systematic relationship between semi-autonomous revenue authorities and tax capacity in Sub-Saharan-Africa.

JEL Classification: H2, O23, O55

Keywords: semi-autonomous revenue authority, Sub-Saharan Africa, tax administration, tax reform

Centre for Research in Economic Development and International Trade, University of Nottingham

CREDIT Research Paper

No. 17/01

Semi-Autonomous Revenue Authorities in Sub-Saharan Africa:

Silver Bullet or White Elephant

by

Roel Dom

The Author

Roel Dom is a PhD student at the Schools of Economics and Politics, University of Nottingham, roel.dom@nottingham.ac.uk

Acknowledgements

I would like to thank Professor Oliver Morrissey, Professor Anja Neundorf and numerous seminar participants for comments and discussions. This work was supported by the Economic and Social Research Council [grant number RS1146] and the Overseas Development Institute.

Research Papers at www.nottingham.ac.uk/economics/credit/

1 Introduction

From Carl Shoup's mission to Japan in the 1950s to the Financing for Development conference in 2015, increasing domestic resource mobilisation has been a key objective of international efforts to boost economic development. This has crystallised in the emergence of a global tax reform agenda[1] (Bird, 2013; Fjeldstad and Moore, 2008; Stewart, 2003). Nevertheless, despite these efforts, domestic resource mobilisation and taxation in particular remain severely constrained in much of the developing world, especially in Sub-Saharan Africa (Keen and Mansour, 2010b). In order to improve administrative capacity and increase tax revenues, tax administrations have been moved out of ministries of finance and into semi-autonomous revenue authorities (SARAs). However, after almost three decades the net effect of semi-autonomous revenue authorities on tax revenue is still unclear.

This paper re-evaluates the revenue gains from semi-autonomous revenue authorities in Sub-Saharan Africa (SSA) relying on a panel of 46 countries between 1980 and 2012. In line with the IMF, we define a SARA as "a governance regime for an organisation engaged in revenue administration that provides for more autonomy than that afforded a normal department in a ministry" (Kidd and Crandall, 2006, p.12). But we extent it by imposing that it integrates customs and tax operations[2]. Our interest, thus, lies with single-purpose or unified semi-autonomous revenue authorities. We test the revenue effect of SARAs using dynamic panel methods to, for the first time, account for revenue dynamics. Because the overall pattern might mask compositional shifts, we not only examine the impact on total tax revenue, but we also decompose the overall effect by looking at the main individual taxes, i.e. direct, goods & services, and trade taxation. Contrary to earlier studies, our results fail to provide any evidence for a systematic relationship between the presence of a semi-autonomous revenue authority and total tax revenue in SSA. Nevertheless, there is suggestive evidence that the SARA reform have shifted revenue from trade taxes to revenue from taxes on goods and services. This suggests that SARAs might have facilitated the spread of the global tax reform agenda.

Our work here fits in with an emerging empirical literature on the SARA reform. Early case studies concluded that experiences worldwide had been "impressive", increasing revenue by 4 to 10% (Jenkins et al., 2000). However, the initial increase was often not sustained and not necessarily caused by the SARAs (Devas et al., 2001; Fjeldstad and Moore, 2008, 2009). Compar-

[1]This refers to the global shift in taxation which has taken place since the 1980s. Its main characteristics are (1) a move away from trade taxes, (2) increased reliance on VAT and (3) an emphasis on broad-based low rate taxes.

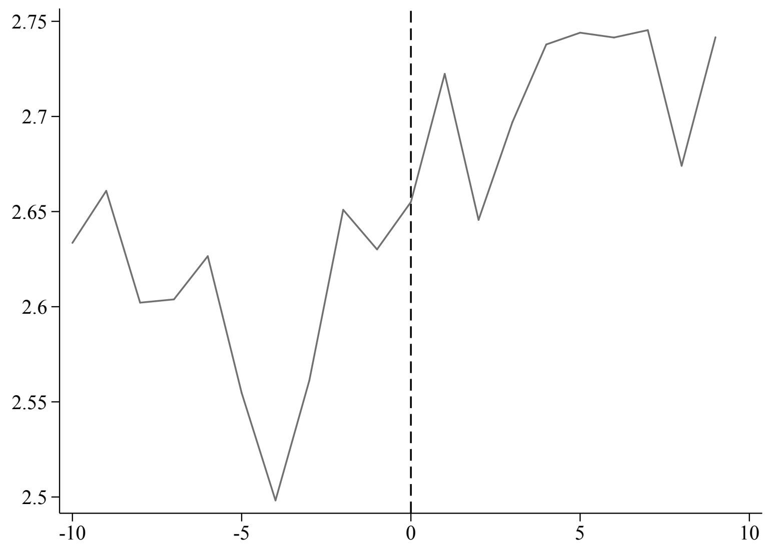
[2]This is more restrictive than the original definition by Kidd and Crandall (2006), who do not require the functional integration of customs and tax departments. However, all African SARAs now integrate these functions. Moreover, it will provide us with more analytical clarity, often lacking in existing studies, when deciding whether and when a country implemented a SARA.

ative case studies stress the importance of the political context for SARA performance, underlining legitimacy and interest group dynamics (Di John, 2010; Mann, 2004; Von Soest, 2008). Econometric assessments were long considered infeasible (see Kidd and Crandall, 2006). To our knowledge, Taliercio (2004) was the first to use regression techniques to study the SARA reform, but he did not cover their revenue effect. Using a fixed-effects model,Von Haldenwang et al. (2014) (HSG henceforth) show that Peruvian municipalities with a SARA collect more tax revenue than municipalities without. Our paper is closest to Ahlerup et al. (2015) (ABB henceforth), who use a fixed-effects model to look at experiences across Africa. They conclude that on average the introduction of a SARA leads to higher revenues in the short term, but the effect diminishes over time. Two recent papers look at the issue using synthetic control methods (SCM). While Ebeke et al. (2016) find a postive average treatment effect, Sarr (2016)'s results suggest considerable cross-country heterogeneity. 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 (see Ferman et al., 2016). Taken together, the existing literature is inconclusive. At best, there seems to be evidence for an initial, but unsustained increase in revenue.

When trying to estimate the revenue effect of the SARA reform, the existing literature faces four challenges which we will address. First, existing measures of SARAs are often plagued by measurement error, resulting in situations where countries are coded as having a SARA whereas in reality there is no such institution present. Except for Sarr (2016), all studies rely on secondary literature which itself remains vague about its sources. This leads to serious discrepancies in reported establishment years. For example, as documented in Table A.1 in the Appendix, certain studies assume that Ghana has continuously had a SARA since the late 1980s. However, in the 1980s Ghana had three separate semi-autonomous revenue administrations; one for customs, one for domestic taxation, and one for policy and oversight. Moreover, their autonomy was reversed as they were brought back into the ministry of finance in 1991, before being legally re-instated in 1998 and operationally in 2001 (Prichard, 2009; Von Soest, 2008). Full integration of the three authorities only came about in 2009 (GRA, 2009). These histories are often overlooked by existing studies. We overcome this by being precise and transparent about our SARA definition and by relying on primary data sources for our coding.

Second and related to the first, with the exception of Mann (2004), no study makes the distinction between the legal and operational establishment of a SARA, despite the existence of significant gaps between the adoption of the relevant legislation and the start of operations in some cases. We recognise this possibility, and exploit additional data sources to ensure that

Figure 1: Tax ratio relative to the introduction of a SARA



Notes: Figure 1 shows the averaged tax-to-GDP-ratio in logs of countries which adopted a SARA, and this from ten years before to ten years after the introduction of a SARA. The data was reshaped and centred, so that the introduction of a SARA in all countries takes place in year 0.

our SARA measure captures operational establishment.

Third, as shown in Figure 1, the introduction of a SARA appears to be preceded by a temporary drop in the tax-to-GDP-ratio[3]. This negative pre-treatment shock could indicate two things. Either individuals are pre-empting the introduction of a revenue authority by decreasing their compliance. This seems unlikely given the temporary nature of the dip and the uncertainty that is usually associated with the timing of these reforms. Alternatively, a negative shock to revenue could prompt the government to embark on tax reform, as it did in Ethiopia (Mascagni, 2016). In either case, if this pattern is specific to the reformers, then such a pre-treatment dip in the dependent variable makes the treatment and control groups incomparable before treatment and leads to an overestimation of the coefficient on the treatment variable in standard models (Ashenfelter, 1978; Heckman and Smith, 1999). Thus, to obtain reliable estimates these dynamics need to be considered. Synthetic control methods are not well suited to deal with this, since they face several issues when including pre-intervention outcomes as predictors (Kaul et al., 2016). Instead, this concern motivates our choice for dy-

[3]Similar graphs are given for direct taxes, taxes on goods & services and trade taxes in Figure A.1 in the Appendix. A brief examination suggests that this dip in total tax revenue stems from negative shocks to revenue collected from direct taxes and from taxes on goods & services. However, both began to recover *before* the SARA was introduced. Trade taxation seems to have started trending downward more quickly after the introduction of the SARAs.

namic panel methods.

Fourth, even when accounting for the dynamics of tax revenue, we cannot be completely certain that the introduction of a SARA is not correlated with unobserved economic factors, potentially leading to omitted variable bias. Therefore, we instrument the presence of a SARA. We develop an instrument based on donor influence. The identification strategy builds on the observation that SARAs are often established under pressure from particular donors, notably the UK, and are less likely under other donors, e.g. France. Hence, we exploit the exogenous variation in the share of international aid coming from these donors to proxy for their agenda setting power. The underlying assumption is that these aid shares affect the presence of a SARA, but do not have a direct effect on tax-to-GDP-ratios, conditional on a number of controls. This strategy leads to results similar to our baseline findings.

In the final part of the paper we test the robustness of our results by widening our analysis to alternative measures of tax capacity, such as tax effort and revenue volatility. In addition, we look at the impact on corruption, which is one of the channels through which SARAs are said to affect revenue performance. This strategy allows us to assess alternative performance measures. Nevertheless, the core of the paper remains restricted to the revenue effect of SARAs. Reassuringly, these additional tests all confirm our initial conclusion; SARAs, at least on average, appear to have done little to increase tax capacity across Sub-Saharan Africa.

The rest of this paper continues as follows. The next section provides more background on the rise of the semi-autonomous revenue authority and discusses its theoretical justification. The construction of our SARA variable as well as a description of the revenue data is provided in Section 3. Section 4 introduces the dynamic and instrumental frameworks used in the subsequent empirical analyses. Our baseline results are presented in Section 5, while the alternative outcome measures are discussed in Section 6. Section 7 concludes this paper.

2 The Rise of the Semi-Autonomous Revenue Authority

The rise of the semi-autonomous revenue authority coincided with a broader shift in international development away from a policy and towards a governance focused agenda. By the end of the 1980s, it became increasingly clear that structural adjustment programs were not having their desired effects (e.g. Killick, 1996; Mkandawire, 1988). In response, the academic and policy mainstream started exploring reasons for this failure, and in particular the role played by institutions and governance (e.g. Acemoglu et al., 2001; Rodrik et al., 2002). A new consensus arose which concluded not that previous policy advice had been wrong, but rather that the necessary preconditions for successful implementation were not in place. The failure of previous rounds of tax policy reform was blamed on reasons internal to developing countries (Dollar and Svensson, 2000). What was supposedly missing was good governance (Kaufmann et al., 1999; World Bank, 1992). Taxation was found to be constrained by weak administrations plagued by a lack of technical understanding, mostly because of political corruption and patronage (Flatters and Macleod, 1995; Ghura, 1998; Jenkins, 1994). This neo-patrimonialism was argued to be an issue particularly in Africa (Chabal and Daloz, 1999; Van de Walle, 2001; Zolberg, 1967), and could be fixed by breaking "the personalistic bonds between a ruler (patron) and his staff (clients), strengthening more impersonal, contractual norms" (Kelsall, 2011, p.77). Tax collection was subsequently ring-fenced from political interference, by placing the tax administration, traditionally located within the ministry of finance, under a semi-autonomous revenue authority.

The SARA reform reflects the New Public Management (NPM) approach to public administration, which was pioneered in the Anglo-Saxon world following calls to downsize government (Aucoin, 1990; Fjeldstad and Moore, 2009). NPM asserts that public administration can be made more effective and efficient, and less costly, if it is run like a business (Hood, 1991). One example is HR policy. Public administrations in developing countries often pay extremely low salaries, pushing talent into the private sector and leaving the administration vulnerable to corruption. Allowing the SARA to set up its own HR policies is argued to address these issues (Chand and Moene, 1999; Van Rijckeghem and Weder, 2001). In addition and flowing from the seminal work by Kydland and Prescott (1977), separating policy and implementation functions is believed to increase policy credibility. By granting autonomy to a revenue authority, politicians put taxation beyond their immediate control and demonstrate a credible commitment to a fair (i.e. less discretionary) tax system, which in turn should boost compliance. Toma and Toma (1992)'s theoretical findings show that, at least in theory, tax collection could be made more efficient when privatised, especially in developing countries.

Not surprisingly, one of the - if not *the* - key characteristics of the SARA reform has thus been the ability of the administration to operate independently from the executive power (Kidd and Crandall, 2006). This is achieved by granting the SARA autonomy with regard to funding, budgeting, financial and HR policies, as well as by giving them a separate legal form[4]. Although the specifics vary, the degree of similarity across countries is astonishing (ITD, 2010). While some question whether SARAs can ever be autonomous enough to convince taxpayers (Joshi and Ayee, 2009), case study evidence from Latin America and Uganda does seem to suggest that it matters (Taliercio, 2004; Von Soest, 2008). However, the autonomy label can

[4]To an extent this mimics the move towards independent central banks, with that difference that SARAs do not have any tax policy responsibilities.

disguise the fact that the SARA is actually answerable to a single person, often the president (Fjeldstad and Moore, 2008). Hence, taxing powers might be centralised instead of ring-fenced from politics. Finally, too much autonomy without accountability has been observed to lead to the harassment of taxpayers, undermining the legitimacy of the institution (Therkildsen, 2004).

Alternatively, establishing a SARA may demonstrate a willingness and a window of opportunity to pursue broader reform to both domestic and international audiences. A survey of revenue administrations confirms that the "need for a catalyst to launch broader reforms" was an additional reason, after raising revenue, to establish a SARA (Kidd and Crandall, 2006, p.26). SARAs are indeed often accompanied by efforts to, for example, modernise IT systems, introduce taxpayer identification numbers or integrate tax and customs administrations in order to rationalise their support services. All African SARAs now combine tax and customs functions (ITD, 2010). However, according to the IMF: "the disruption of instituting a RA [Revenue Authority] often delayed reforming core tax administration functions (IMF, 2011, p.20)." While these nuts and bolts reforms are likely important, their impact remains under-researched.

There exists, nevertheless, also scepticism about the revenue potential of the SARA reform, as it supposedly fails to take into account both the inherent political nature of taxation and local realities.

Although the SARA reform is meant to insulate the administration from politics, this independence could undermine its longer-term political sustainability and therefore its effectiveness. This becomes clear if one interprets the tax system as the equilibrium outcome of a bargaining process driven by political and societal forces, as for example Bird et al. (2008), Di John and Putzel (2009), Prichard (2016) or Von Schiller (2016) do. According to Khan (1995), institutional performance is conditional on its fit with the prevailing political balance of power (or political settlement). Following this reasoning, the SARA reform will only be effective when its implications do not pose a threat to this underlying balance of power. However, this is by no means guaranteed. The introduction of a semi-autonomous revenue authority explicitly reduces the discretionary power of the government, and of the minister of finance in particular, possibly creating tensions and jealousy. This could impact performance since it depends on good working relations between both institutions. Therkildsen (2004) argues that this is what came to undermine the Uganda Revenue Authority. However, SARAs can overcome these pressures if they manage to become part of the equilibrium. In Zambia, for instance, the revenue authority stripped the ruling party of some of its tools to build political support, but politicians did not dare to kill the goose that laid the golden egg (Von Soest, 2006).

The second critique takes issue with the one-size-fits-all nature of the SARA reform, which fails to take into account crucial local conditions[5]. Mkandawire (2009), for instance, argues that institutions are embedded in complex social relations, and that the question should thus be: which institutions are appropriate given a particular context? By proposing a one-size-fits-all solution, which Evans (2004) labels institutional mono-cropping, the SARA reform remains blind to this sensitivity, leading to "square pegs for round holes" (Andrews, 2013). According to Pritchett et al. (2013) this risks to result in isomorphic mimicry, i.e. the formal adoption of the institution but lacking the actual functions. Moreover, the insistence on idealised blueprints potentially crowds out the emergence of possibly better adapted home-grown alternatives. To an extent this applies to the SARA reform since it spread across Sub-Saharan Africa as part of the broader NPM shift in public administration driven by the international financial institutions and the UK's DfID in particular (Fjeldstad and Moore, 2008, 2009; Mahon, 2004). Moreover, while no SARA is exactly the same, the emphasis on (regional) benchmarking and the influence of a core group of international tax professionals have resulted in remarkably similar organisational structures across SSA (ITD, 2010; Lemgruber Viol et al., 2015). However, the question whether it has been more than a "square peg for a round whole" remains unanswered.

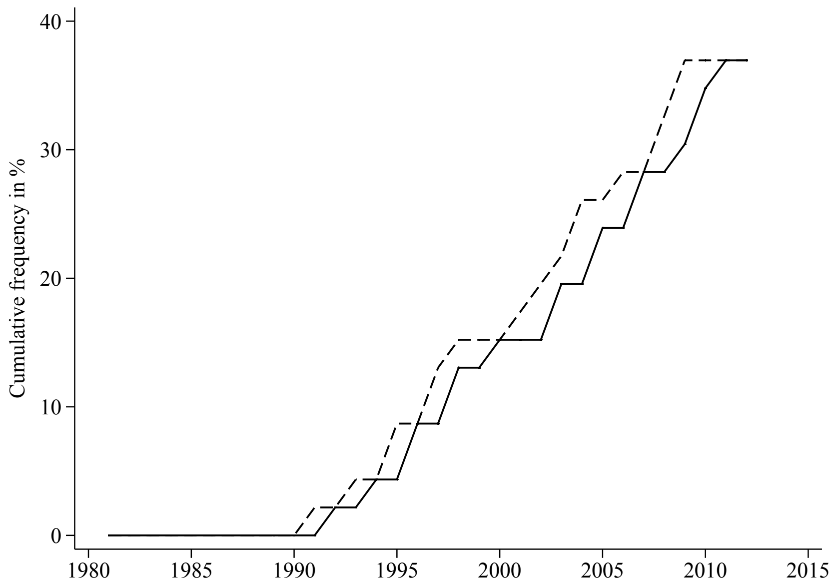
3 Data

For our analysis of the revenue effect of SARAs we use an unbalanced panel dataset covering 46 Sub-Saharan African countries over the period 1980-2012. We exclude only South Sudan and Somalia because of data limitations, as well as Zimbabwe because of a small number of extremely influential observations[6]. Out of these 46 countries 17 established a semi-autonomous revenue authority during the period under consideration[7].

As discussed above, the existing empirical literature is vague on its coding of revenue administrations. Hence, to achieve reproducibility, we attempt to be more transparent and precise about how we classify revenue administrations. We consider as a SARA, revenue administrations that have a degree of autonomy from the executive and integrate both the customs and tax functions, i.e. unified semi-autonomous revenue authorities. This means, for instance, that we do not consider Ghana to have had a SARA before 2009 for the reasons discussed earlier. Neither do we, for example, consider Ethiopia to have had a SARA before 2009, because

[5]To the extent that these local conditions involve politics, it relates to the previous position.
[6]Almost immediately after establishing the Zimbabwe Revenue Authority economic crisis struck Zimbabwe, leading to a collapse in the tax ratio. Including Zimbabwe into the sample unfairly biases our estimation towards a null-result.
[7]Liberia adopted its SARA's establishment act in 2013, which became operational in 2014. So it falls outside of our panel.

Figure 2: Spread of SARA reform



Notes: Figure 2 illustrates the spread of the SARA reform, measured as the percentage of countries in the sample which have a SARA in a given year. The dotted line represents legal creation, while the full line captures operational establishment.

of similar reasons (Mascagni, 2016). In line with Mann (2004), it is further recognised that there might exist significant gaps between the legal creation and the operational start of new revenue administrations. Operational establishment is the main variable of interest, as we are arguably interested in the effect the actual institutional change has had. Two separate dichotomous variables are thus coded. One captures legal presence, i.e. the SARA establishment act has been adopted by parliament, the other one the operational presence of the new organisation. For this study the former is instrumental for the coding of the latter. These dummies tell us whether a SARA was (legally or operationally) present in any given country at any given point in time. Information on the legal creation is obtained from the official establishment acts. When these are unavailable secondary literature is consulted. The operational establishment is inferred from case studies and media reports. If little information is found, then the coding of operational establishment depends on the legal creation. Generally, if the SARA is established before the 30th of June, then the operational dummy takes value one in the same year. In case it is created after June 30th, the operational dummy takes the value one starting from the next year. This is in line with the conversion of macro data from fiscal years to calendar years. Table A.2 in the Appendix provides an overview of the dates and their sources, while Table A.1 compares dates across existing empirical studies.

The spread of the SARA reform between 1980 and 2012 is shown in Figure 2. It clearly illustrates the rise of the SARA model from the early 1990s onwards. It also shows that the legal creation often preceded operational establishment, and that at times there were serious lags. In the late 2000s about 40% of SSA countries had legally created a SARA, while it was operational in just over 30% of countries. Liberia adopted and implemented the SARA reform in 2013-2014 and thus falls outside our sample. Other countries such as South Sudan are currently considering the creation of a SARA.

The main dependent variable is government tax revenue as a percentage of GDP which is obtained from the International Centre for Tax and Development's Government Revenue Dataset (ICTD GRD), version June 2016 (Prichard et al., 2014). This dataset has become the go-to revenue dataset for developing countries. While not without issues, its coverage, scope and consistency outperform the available alternatives, leading to a re-assessment of some of the existing research on taxation and development (Prichard, 2016). The ICTD GRD provides detailed information on various individual taxes as a share of GDP at both the central and general government level. In this paper we focus on the general government and retain the main tax categories: total tax revenue (excluding social contributions, but including resource tax revenue), direct tax revenue (excluding social contributions, but including resource tax revenue), tax revenue from goods and services and international trade tax revenue. We drop the observations that are flagged as "Data not credible" or "Data is of questionable analytical comparability". This results in a loss of 25 observations, affecting Benin, Equatorial Guinea, Liberia and Namibia.

Figure 3 plots the time series of total tax revenue for our sample of 46 countries, split into two groups: SARA-adopters and non-adopters. The figure illustrates the stylised fact that revenue mobilisation in Sub-Saharan Africa remains low (Keen and Mansour, 2010b,a). Nevertheless, there seems to be an upward trend since the mid-2000s. More interesting to our argument; it shows that SARA adopters have, on average, a higher tax ratio than non-adopters. However, this divergence occurred before the rise of the SARA in SSA. This pattern should caution us against over-relying on between group comparisons, as it might induce a bias in favour of SARAs. This observation further strengthens our belief that revenue dynamics are important in the analysis of the SARA reform.

For some parts of our analysis we rely on additional variables. When accounting for potential confounding factors, we include a vector of control variables, $X_{i,t}$, which consists of: per capita GDP, agriculture value-added, the share of exports and imports in GDP, the share of the population living in urban areas, dependency shares of the elderly and the young, foreign aid, a democracy index, and dummies for whether or not the country has a mid-term or short-

Figure 3: Average tax revenue

Notes: Figure 3 shows the evolution of the averaged tax-to-GDP-ratio for countries which adopted a SARA and countries that did not, respectively the full line and the dotted line.

term IMF programme in place. All of these are standard controls variables in the taxation literature (e.g. Gupta, 2007; Keen and Lockwood, 2010; Morrissey et al., 2016). For our instrumental variable estimation we use data on aid flows from donor i to recipient j in combination with information on total aid flowing to country j to calculate the relative shares. In the final section, where we look at corruption, we will employ the new Varieties of Democracy dataset to obtain disaggregated measures of corruption. The precise definitions and sources of all the variables used in this paper are found in Table A.3 in the Appendix, while summary statistics can be found in Table A.4. As is common when working with macro data, we will use the log transformation of all continuous variables in our estimations to prevent the results from being biased by outliers.

4 Methodology

The existing empirical literature imposes a strict exogeneity assumption on the relationship between SARAs and revenue. That is, it assumes that the presence of a SARA is unrelated with past and future revenue collection, formally:

$$E(d_{i,h}\epsilon_{i,t}) = 0 \quad \text{for} \quad h = 1, 2, ...T \ , t = 1, 2, ..., T \tag{1}$$

where $\epsilon_{i,t}$ is the idiosyncratic error, $d_{i,h}$ is the treatment dummy in year h in country i. As discussed before, our concern is that this is unlikely to be true as past revenue might influence the decision to adopt a SARA. Given Figure 1, the introduction of a SARA is likely negatively correlated with past tax revenue. The omission of lagged revenue from the model will therefore bias upwards the coefficient on the SARA dummy[8]. Hence, accounting for these dynamics should bring down the SARA coefficient. Throughout the rest of this paper we will deploy different methods to address this selection problem which will result in a re-assessment of the impact which SARAs have had on tax revenues in SSA.

4.1 Dynamic Models

The core of our paper is built around three dynamic panel models which take into account the dynamic nature of the relationship between SARAs and tax revenue. The key identifying assumption is:

$$E(\epsilon_{i,t}|y_{i,t-h}, d_{i,t}, \alpha_i, \delta_t) = 0 \quad \text{for} \quad h = 1, 2, ..., t \tag{2}$$

where $y_{i,t-h}$ is the past tax ratio. The methodological focus of this paper is therefore close to Acemoglu et al. (2014), who examine the impact of democracy on economic development. In the field of taxation, we are methodologically closest to Keen and Lockwood (2010) who estimate the impact of VAT, captured by a treatment dummy, on revenue in a dynamic setup. We will for now assume, but later test, that tax revenue follows a stationary process, ensuring that the estimators are consistent and well-behaved.

Our first dynamic model is the standard within estimator:

$$y_{i,t} = \beta d_{i,t} + \gamma_h y_{i,t-h} + \alpha_i + \delta_t + t \times \alpha_i + \epsilon_{i,t} \tag{3}$$

where the dependent variable is the log of tax revenue as a share of GDP in country i at time t, and $d_{i,t}$ is the dichotomous variable capturing the operational presence of a semi-autonomous revenue authority in country i at time t. This is similar to the approach used to test VAT's

[8]To put this formally, we follow but slightly modify (Cameron and Trivedi, 2005, p.56), and suppose that we have the following regression equation which for simplicity is limited to two periods:

$$y^j_{i,t} = \alpha + \alpha_1 d_t + \alpha^1 d^j + \beta d^j_t + \epsilon^j_{i,t} \quad \text{for} \quad i = 1, ..., N, t = 0, 1$$

where j is the treatment/control group superscript, $d^j = 1$ if j equals 1 and $d^j = 0$ otherwise, $d^j_t = 1$ if both j and t equal 1 and $d^j_t = 0$ otherwise, and $\epsilon^j_{i,t}$ is zero-mean constant variance error term, except for $\epsilon^1_{i,0} < 0$. Using first differences, the estimated impact therefore is:

$$(y^1_{i,1} - y^1_{i,0}) - (y^0_{i,1} - y^0_{i,0}) = \beta + (\epsilon^1_{i,1} - \epsilon^1_{i,0}) - (\epsilon^0_{i,1} - \epsilon^0_{i,0})$$

In this case $E(\epsilon^0_{i,1} - \epsilon^0_{i,0}) = 0$, but $E(\epsilon^1_{i,1} - \epsilon^1_{i,0}) > 0$, since $\epsilon^1_{i,0} < 0$, therefore the sample average of $(y^1_{i,1} - y^1_{i,0}) - (y^0_{i,1} - y^0_{i,0})$ will overestimate the true β.

effect in Keen and Lockwood (2010). In a variation, the SARA reform is captured by a set of dummies which correspond to the time relative to the introduction of the authority, similar to the approach taken in ABB and HSG. This addresses the concern that strict exogeneity of the treatment fails due to persistence in the reform (Wooldridge, 2010). The vector α_i denotes a full set of country fixed effects, while δ_t is a full set of year effects. Country-specific linear time trends are included as well, $t \times \alpha_i$.

However, the within estimator is not asymptotically consistent and contains an asymptotic bias of order $1/T$, known as Nickell Bias (Nickell, 1981). This bias becomes negligible if $T \to \infty$, i.e. if we have a long panel. We believe that this bias should be small in our estimates, since in our sample each country is, on average, observed 31.5 times. However, using Monte Carlo simulations, Judson and Owen (1999) find that even with $T = 30$, the bias in γ might reach 20%. Nevertheless, the estimate would still have the correct sign and, more importantly for our purposes, the bias in β should be relatively small. Hence, the within estimator will be our baseline model.

A natural next step is the GMM estimator which addresses the Nickell bias. GMM estimators produce consistent estimates for dynamic panel models for finite T. Moreover, they deal with simultaneity and omitted variable bias as regressors are "internally" instrumented by their lags. Arellano and Bond (1991) proposed the initial GMM estimator which is based on differencing equation 3. Current changes are then instrumented by past levels. However, this difference GMM performs poorly when past levels are weak predictors of future changes (Blundell and Bond, 1998). This is a concern to us because the SARA dummy variable is a persistent process. On the other hand, past changes in the SARA dummy do convey reasonable information about its present level. Therefore, the system GMM designed by Blundell and Bond (1998), building on Arellano and Bover (1995), seems more appropriate. Instead of differencing the regressors to get rid of the fixed effects, it differences the instruments to make them exogenous to the fixed effects. The underlying moment conditions are:

$$E(\Delta w_{i,t-h} \times (\alpha_i + \epsilon_{i,t})) = 0 \quad \text{for each} \quad t \geq 2, h \geq 1 \tag{4}$$

where $w_{i,t-h}$ are the instruments. Validity depends on the assumption that changes in the instruments are uncorrelated with the fixed effects and that the error terms are not serially correlated. Both can be tested. The former implies a restriction on the relationship between the unobserved effect α_i and the deviation of the initial condition $y_{i,1}$ from the long-run expected value (Soderbom et al., 2015). Given that there is nothing special about the first value in our sample, i.e. tax ratios in 1980, we expect this assumption to hold. Nevertheless, we will report the Hansen-J test, which tests the overall validity of the instruments, as well as the difference-in-Hansen test. The presence of serial correlation in the residuals will also be tested. While $\Delta\epsilon_{i,t}$ is likely to be first-order correlated (AR1), it should not be second-order correlated (AR2).

GMM estimators were originally developed with small T panels in mind; with large T there is a danger of instrument proliferation. It is therefore sensible to restrict the number of instruments to avoid over-fitting and biasing the results, as well as to avoid weakening the Hansen tests (Roodman, 2009). We will not include country-specific time trends in the GMM estimations. In addition, we collapse the columns of the instrument matrix and restrict the number of lags by setting $h = \{2, 3\}$, corresponding to Second, which corresponds to the single moment condition:

$$E(\Delta w_{i,t-h} \times (\alpha_i + \epsilon_{i,t})) = 0 \quad \text{for} \quad h = \{2, 3\} \tag{5}$$

Using this condition, we perform a two-step GMM estimation which is more efficient in case of heteroscedasticity in the error term. Additionally, we apply Windmeijer (2005) finite sample correction, else we would risk downward biased standard errors.

Finally, we employ a Common Correlated Effects Mean Group estimator (CCEMG). As mentioned before, the system GMM works well for relatively small T panels usually associated with micro-panels. When dealing with macro-panels, which often involve $T > 15$, GMM runs into problems because of instrument proliferation. Moreover, GMM assumes parameter homogeneity, cross-section independence and stationarity. These first two assumptions can be relaxed if we move to macro-panel methods known as panel time-series, and in particular to mean group estimators (Pesaran and Smith, 1995). The stationarity assumption remains in place, but we will test for it. Empirical examples of CCEMG can be found in, for instance, Eberhardt and Teal (2013) or in McNabb and LeMay-Boucher (2014) who apply it to taxation and development.

Mean group estimators treat the panel as a large system of time-series equations, which are estimated individually and subsequently aggregated. The first benefit is that the treatment effect is allowed to vary across countries, referred to as parameter heterogeneity. A particularly important advantage over GMM is that if the true effect of SARAs is heterogeneous across countries, then assuming a common effect implies that the error term contains $(\beta_i - \beta)SARA_{i,t}$, which by assumption will be correlated with the instrument in a system GMM (Soderbom et al., 2015). Thus, system GMM fails to solve the endogeneity problem in case of heterogeneous treatment effects. Additionally, CCEMG estimators recognise that error terms might have a multi-factor structure. That is, in addition to country-specific and time-specific unobservables, there can also be time-specific unobservables which affect different countries differently. This leads to cross-section dependence due to common factors. Restructuring equation 3 gives:

$$y_{i,t} = \beta_i d_{i,t} + \gamma_{i,h} y_{i,t-h} + u_{i,t} \tag{6}$$

with:

$$u_{i,t} = \alpha_i + \mu_i f_t + \epsilon_{i,t} \tag{7}$$

where f_t is an unobserved common factor and μ_i a heterogeneous factor loading. In the previous models common time shocks were assumed to affect countries in an identical way through the time dummies. In this specification the effect of time-specific shocks is allowed to differ across countries. Failing to control for this would lead to inconsistent and biased estimates, but by introducing cross-section means of the dependent and independent variables into the estimation this can be accounted for (Pesaran, 2006). The original model was recently extended to allow for lagged dependent variables (Chudik and Pesaran, 2015). When a single lagged dependent variable is included the estimator will gain consistency if $\sqrt[3]{T}$ lags of the cross-section means are added :

$$y_{i,t} = \beta_i d_{i,t} + \gamma_{i,h} y_{i,t-h} + \sum_{l=0}^{p} \delta_{i,h} \bar{z}_{t-h} + \alpha_i + t_i + \epsilon_{i,t} \tag{8}$$

where $\bar{z}_t = (\bar{y}_{t-h}, \bar{x}_t)$, p the number of lags (which in our case will be 3, given that $T = 31.5$) and t_i a country-specific trend. We will formally test for cross-section dependence (CD) using Pesaran (2004)'s test.

4.2 Instrumental Variable Approach

In this section we introduce our instrumental variable (IV) approach to deal with time-varying omitted variables which may simultaneously affect the presence of a SARA and revenue collection. The motivation for our IV strategy builds on the observation that SARAs are often established under severe pressure from specific donors. Given the nature of the SARA reform, i.e. based in NPM and seen as the privatisation of revenue collection (Jenkins, 1994), it has often been linked with an Anglo-Saxon approach to public sector reform. Case study evidence suggests that in particular the UK and the IMF have championed NPM, and the SARA reform in particular, in the developing world (Andrews, 2013; Boston, 2011; Fjeldstad and Moore, 2009; Mkandawire, 2009). This is in contrast to for example France which has traditionally favoured more centralist policies (Schedler and Proeller, 2002). Caulfield (2006) finds that although France supported parts of the NPM agenda in Sub-Saharan Africa, and in particular the privatisation of public utilities, the UK focussed more heavily on the establishment of executive agencies, of which a SARA is one, reflecting trends in Whitehall. The observation that there are hardly any SARAs in francophone Africa lends further support to this argument. We examine this more fully when we get to the IV estimation, but the assumption is that in countries where the UK has relatively more agenda setting power, proxied by its share of aid in total aid, the establishment of a SARA is more likely. In contrast, countries where France is a more important donor should be relatively less likely to adopt a SARA. On the condition that the relative shares of UK and French aid are (conditionally) unrelated to a country's tax ratio, other than through the revenue reform, this is an attractive source of exogenous variation.

As applied in Adams et al. (2009), we follow a three-step procedure described by Wooldridge (2010, p.939), but we adapt it to our panel data structure by including the Chamberlain-Mundlak device to account for country-fixed effects (Chamberlain, 1982; Mundlak, 1978). This means that (i) we estimate a binary response model (e.g. probit) of $d_{i,t}$ on $z_{i,t}$ and a set of controls $x_{i,t}$, (ii) we compute the fitted probabilities $\hat{p}$, and (iii) estimate β using a two-stage least squares model with $\hat{p}$ as an instrument for the presence of a SARA. In effect, this leads us to a three step procedure, which differs from the "pseudo-IV" procedure of running an OLS regression of y on $\hat{p}$ and x. In contrast to the latter, the usual 2SLS standard errors are still asymptotically valid (Wooldridge, 2010, p.939). Moreover, the approach takes the binary nature of the endogenous variable into account. This gives the following probit model:

$$Pr(d_{i,t} = 1 | z_{i,t}, x_{i,t}, \bar{z}_i, \bar{x}_i) = \Phi(\theta_0 + \theta_1 UKAidShare_{i,t} + \theta_2 FrAidShare_{i,t} + \phi x_{i,t} + \pi \bar{z}_i + \sigma \bar{x}_i) \quad (9)$$

where $\Phi(-)$ is the cumulative distribution function for a standardised normal random variable, $x_{i,t}$ is a vector of control variables which includes total net aid received by country i as well as the identity of the ex-colonial power, the presence of a short- or mid-term IMF programme and a linear time trend. In addition, the means of the explanatory variables, $\bar{z}_i$ and $\bar{x}_i$, are included. The fitted probabilities, $\hat{p}$, are then used in a standard 2SLS:

$$\begin{aligned} y_{i,t} = & \quad \beta d_{i,t} + \gamma_{1,h} y_{i,t-h} + \mu_1 x_{i,t} + \alpha_i + \delta_t + t \times \alpha_i + \epsilon_{i,t} \\ d_{i,t} = & \quad \pi \hat{p}_{i,t} + \gamma_{2,h} y_{i,t-h} + \mu_2 x_{i,t} + \alpha_i + \delta_t + t \times \alpha_i + u_{i,t} \end{aligned} \quad (10)$$

The justification for the exclusion restriction is that conditional on lagged tax revenue, total aid received, IMF programmes, country and year fixed effects, as well as country-specific time trends, the agenda setting power of the UK and France, proxied by the value of their aid relative to the total amount received, has no direct effect on the tax ratio of country i at time t, formally:

$$E(\epsilon_{i,t} z_{i,t}) = 0 \tag{11}$$

While there is an extensive literature on the relationship between total foreign aid and domestic resource mobilisation (e.g. Clist, 2016; Morrissey et al., 2014; Morrissey, 2015), it is rather unlikely that individual donors affect tax revenues other than through the reforms they support. Conversely, the donor community as a whole might be moved by DRM issues, as illustrated in the recent Addis Ababa Action Agenda (UN, 2015), but we account for this by controlling for total aid. We are not aware of reasons why the UK and France would have a particular (and opposing) interest in DRM. Moreover, it must be stressed that we are working with relative shares and not absolute levels. Nevertheless, it might be the case that these donors support additional public sector reforms which potentially affect taxation. Following Ahlerup et al. (2015), we control for this by including variables for short and mid-term IMF programmes since these programmes are usually the basis of any form of public sector reform in developing countries.

5 Results

The core of this paper revolves around the question whether semi-autonomous revenue authorities have been able to increase the tax-to-GDP-ratio across Sub-Saharan Africa. In this section we present and discuss our core findings. Before turning to the dynamic models, we briefly review the existing static models. Then we check our baseline findings with an instrumental variable estimation. We end this section with a number of sensitivity checks.

5.1 Static Model

Before presenting the results of the dynamic models, we re-examine the static selection on unobservables models as found in ABB[9] and HSG. This exercise has a double purpose. We first illustrate that we are able to replicate the results found in previous studies despite slightly different definitions and an updated dataset. Second, we show that once we include controls for additional unobservable effects, i.e. country-time trends and lead dummies, the results from the static models change significantly. When included, the results from the static models are in line with what we will find once we turn to the dynamic models.

[9] We would like to express our appreciation to the authors for making their code and dataset available.

Following ABB, the econometric model is similar to equation 3, but does not include the lagged dependent variable:

$$y_{i,t} = \rho_h x_{i,t+h} + \beta_h x_{i,t-h} + \alpha_i + \delta_t + t \times \alpha_i + \epsilon_{i,t} \tag{12}$$

where $y_{i,t}$ is the dependent variable which is the tax-to-GDP-ratio. Following ABB it excludes both social security contributions and natural resource revenues. The SARA reform is captured in this equation by a set of dummies which correspond to the time since the introduction of the authority. That is, we have a dummy which takes the value one during the first two years after the reform, another one for years three through five after the implementation of the reform, one for years six through ten and one for plus ten years. We also restrict our sample to the one used by ABB, i.e. we drop Equatorial Guinea and Cape Verde in addition to Zimbabwe. As in their paper robust standard errors are used, which allow for arbitrary serial correlation. In addition, we include lead dummies for years one to two, and three through five before the introduction of a semi-autonomous revenue authority. These capture the effect of *future* policy changes or anticipatory effects. Following Angrist and Pischke (2009), this can be thought of as a test for causality in the spirit of Granger (1969) in the (restricted) sense that causes happen before consequences[10]. The model tests whether past $x_{i,t}$ predicts $y_{i,t}$ while future $x_{i,t}$ does not. If $x_{i,t}$ causes $y_{i,t}$ but not vice versa, then the lead dummies should not matter, as we do not expect the SARA to affect revenue before it is established.

Table 1 summarises our findings. The model in column I is the same as the one found in ABB. It does not include country-specific time trends or lead variables. The resulting coefficients on the SARA dummies are similar to the ones obtained by ABB. They indicate that the effect of SARAs, while increasing the tax ratio in the short-term, weakens over time. In the second column we introduce the country-specific linear time trends. They are motivated by the fact that macro-economic series tend to trend over time, while recognising that these trends might differ across countries. The Wald test for joint significance provides strong support for their inclusion. When included, both the size and the significance of the SARA effect diminish, suggesting that previous estimates overestimated the effect of SARAs because of (omitted) revenue trends across SSA.

[10]This test has been used by Autor (2003) to study the effects of employment protection in the U.S.

Table 1: Static models with Granger-type test

	I	II	III
SARA, years 5-3 before			-1.117*
			(0.583)
SARA, years 2-1 before			-1.006
			(0.742)
SARA, years 1-2	1.685***	0.958*	0.021
	(0.437)	(0.527)	(0.698)
SARA, years 3-5	2.689***	1.945***	0.792
	(0.871)	(0.710)	(0.864)
SARA, years 6-10	2.281***	1.756*	0.269
	(0.873)	(0.975)	(1.189)
SARA, years >10	1.046	1.133	-0.852
	(0.655)	(1.170)	(1.449)
N	1195	1195	1195
Groups	44	44	44
R-sq	0.033	0.019	0.027
Country/Year	No	Yes	Yes

Notes: The table reports estimates from a regression of total tax revenue on a set of dummies capturing the effect of a SARA, and this before, during and after the implementation of the reform. Column I replicates the baseline model by Ahlerup et al. (2015). Column II adds country-specific time trends. Column III introduces the pre-treatment dummies. All models include country and year fixed effects. Robust standard errors in parentheses. ***p $\leq$ 0.01, **p $\leq$ 0.05, *p $\leq$ 0.1.

In column III we introduce the lead variables. Once we control for pre-treatment effects, the estimates on the post-treatment dummies further decrease and become statistically insignificant. In contrast, the dummy variable for the period five to three years before the introduction of a SARA appears to have a (weakly) significant and negative effect. Taken together with our discussion of Figure 1, there is thus evidence of a negative correlation between pre-SARA revenue collection and the subsequent presence of a SARA. Multiple interpretations are possible, either there is a sort of anticipation effect present or we might be picking up a reverse causality issue. We think that the former is rather unlikely due to the brevity of the effect and because of the uncertainty which usually accompanies these reforms. The latter seems, therefore, more plausible, i.e. because governments experience a negative shock to revenue, they embark on tax reform. Failing to control for this, previous studies are possibly picking up a recovery effect as opposed to a causal effect from revenue authorities.

5.2 Dynamic Models

Briefly reiterating our core motivation; the hypothesis is that lagged tax revenue is an omitted variable in static models, since the true model is dynamic in nature. Given Figure 1 and the findings in section 5.1, the presence of a SARA is likely negatively correlated with past changes in tax revenue. The omission of lagged revenue from the model will therefore bias upwards the coefficient on the SARA dummy. Hence, the inclusion of the lagged tax revenue should bring down the SARA coefficient.

In Table 2 we present the results of our dynamic models specified in 4.1. We include one lag of the dependent variable. We assume that this sufficiently captures the dynamic process to control for the effect of past revenue[11]. Each panel represents a different type of tax with the relevant summary statistics and test statics included at the bottom of each panel. Glancing over the columns, in the uneven ones the SARA reform is captured by a single before/after dummy variable, which tells us whether there is a break in revenue collection after the SARA is introduced. In the even columns the SARA reform is introduced as a set of dummies capturing the time since the reform, similar to ABB and HSG. The logarithmic transformation of the dependent variable allows us to roughly interpret the coefficient on the SARA dummies as a percentage change. It should be clear from the time period under consideration, that we are, at best, studying short to mid-term impacts of SARAs, and not long-term impacts.

Columns I and II show the results from the first dynamic model, the within estimator. As noted before, caution has to be exercised when interpreting the results, as the coefficient on the lagged dependent variable is subject to a bias of order T, but the bias in the coefficient on the SARA dummy should be negligible. Nevertheless, given our fairly large T, the results should still be informative. In order to save space and highlight the most important coefficients, we do not report the fixed effects or the country-specific time trends. However, the Wald test for joint significance provides strong support for their inclusion. The reported standard errors are clustered at the country level to take into account that errors might be correlated within countries over time. While a low number of cluster could bias these errors, 46 clusters should, according to Angrist and Pischke (2009), be enough to overcome this.

Examining the first panel of Table 2, we observe that for total tax revenue the overall fit of the models is satisfactory with an adjusted R^2 value of just under 70%. The coefficient on the SARA dummy suggest a 0.3% increase in revenue after the introduction of a SARA, but it is not statistically significant. The estimates in column II point to an initial but unsustained gain of about 1% during the first two years. However, as before none of the estimates are statistically significant at standard levels. Importantly, the coefficient on lagged tax revenue, in a pattern common across all models in this paper, is sizeable suggesting significant persistence

[11] Table A.5 in the Appendix examines estimations with up to five lags. Only the first lag is consistently significant, which lends support to our assumption that tax revenue follows an AR1 process. Additionally, for total tax revenue AIC and BIC criteria are minimised when one lag of the dependent variable is included. Moreover, and as we shall see later, the inclusion of one lag is enough to deal with the possibility of serial correlation.

in tax revenue. Though, it remains well below one, indicating that there is no unit root in the empirical process for the log of the tax ratio. We will test this formally when we get to the mean group estimates.

Both models I and II fail to reject the null-hypothesis of no effect. But, when we look at the underlying tax types we notice that, while there is a similar pattern for direct taxes, there is evidence that SARAs have had an impact on revenue from taxes on goods and services. The first column suggests that SARAs have, on average, led to an 8% increase in tax revenue collected from this source. The null-hypothesis is rejected at the 5% level. The results in the second column support this interpretation and point to a sustained increase. Turning to trade taxes, the findings indicate a negative, but statistically insignificant impact, though the second column does suggest a significantly negative effect between 6 to 10 years after the reform.

Based on these first findings we are, therefore, led to the initial conclusion that semi-autonomous revenue authorities have not significantly increased total tax ratios in Sub-Saharan Africa. However, they do seem to have sped up the transition away from trade taxation and towards indirect taxation in line with global trends. For those engaged in the SARA reform this should not come as a surprise since reform and donor efforts often prioritise customs departments, which collect the bulk of the indirect taxes at the borders, over domestic tax departments. Also noteworthy, these results differ substantially from the ones obtained by ABB. In their paper, the positive effect of SARAs on total revenue seems to operate through direct taxation, barely affecting indirect taxation.

Nevertheless, because of the possibility of Nickell bias we also perform a system GMM estimation. This estimator works around the bias by instrumenting current levels by past changes. The results are given in columns III and IV. For total tax revenue, we find that the SARA dummy is positive and marginally significant at the 10% level in column III. The presence of a SARA has an impact of around 8% on the tax ratio according to the system GMM estimation. However, this effect is not unambiguous. If we look at column IV, this positive impact no longer appears significant. Moreover, we should stress that the GMM estimator does not include country-specific time trends. As illustrated above, omitting these trends upwardly biased the static estimates on total revenue. That said, for the other tax types, the system GMM results are close to the within estimates, with that difference that the significance of the effect on indirect taxes is lower (Panel C, column IV), while that of trade taxes is strengthened (Panel D, column IV).

Table 2: Dynamic estimation of the effect of SARAs on tax revenue

	Within Estimates		Sys-GMM		CCEMG	
	I	II	III	IV	V	VI
	Panel A: Total tax revenue					
SARA	0.003		0.083*		0.013	
	(0.025)		(0.047)		(0.015)	
SARA, years 1-2		0.010		0.048		0.007
		(0.019)		(0.040)		(0.025)
SARA, years 3-5		-0.008		0.034		-0.004
		(0.042)		(0.049)		(0.032)
SARA, years 6-10		-0.024		0.041		-0.005
		(0.051)		(0.048)		(0.040)
SARA, years >10		-0.033		0.025		-0.058
		(0.083)		(0.038)		(0.038)
L.Total	0.680***	0.680***	0.744***	0.849***	0.338***	0.337***
	(0.099)	(0.098)	(0.166)	(0.158)	(0.062)	(0.067)
N	1273	1273	1273	1273	1110	1110
Groups	46	46	46	46	46	46
adj. R-sq	0.692	0.691			0.370	0.392
# instr.			37	46		
M1			0.002	0.001		
M2			0.136	0.137		
Hans. p-val.			0.395	0.687		
Diff. Hans. J			0.876	0.605		
CD p-val.					0.053	0.264
	Panel B: Direct tax revenue					
SARA	0.005		0.011		-0.054	
	(0.038)		(0.042)		(0.038)	
SARA, years 1-2		0.038		0.048		0.170
		(0.035)		(0.046)		(0.188)
SARA, years 3-5		-0.016		0.009		0.123
		(0.052)		(0.041)		(0.204)
SARA, years 6-10		-0.013		0.053		-0.009
		(0.059)		(0.044)		(0.072)
SARA, years >10		0.031		0.043		0.046
		(0.091)		(0.031)		(0.036)
L.Direct	0.614***	0.613***	0.930***	0.911***	0.399***	0.438**
	(0.030)	(0.030)	(0.075)	(0.074)	(0.154)	(0.214)
N	990	990	990	990	833	833
Groups	44	44	44	44	44	44
adj. R-sq	0.743	0.743			0.903	0.909
# instr.			37	46		
M1			0.001	0.001		
M2			0.556	0.540		
Hans. p-val.			0.039	0.215		
Diff. Hans. J			0.181	0.783		
CD p-val.					0.088	0.000

Continued on next page

	Panel C: Goods & services revenue					
SARA	0.082**		0.082**		0.077	
	(0.040)		(0.039)		(0.056)	
SARA, years 1-2		0.107**		0.076		0.024
		(0.051)		(0.052)		(0.046)
SARA, years 3-5		0.100**		0.084		0.027
		(0.040)		(0.057)		(0.051)
SARA, years 6-10		0.183***		0.093*		0.054
		(0.059)		(0.056)		(0.066)
SARA, years >10		0.282***		0.081		0.046
		(0.097)		(0.054)		(0.048)
L.Goods & Services	0.628***	0.623***	0.908***	0.856***	0.154	0.137
	(0.065)	(0.063)	(0.066)	(0.079)	(0.126)	(0.127)
N	984	984	984	984	810	810
Groups	46	46	46	46	46	46
adj. R-sq	0.777	0.778			0.517	0.545
# instr.			37	46		
M1			0.000	0.000		
M2			0.577	0.619		
Hans. p-val.			0.186	0.131		
Diff. Hans. J			0.389	0.174		
CD p-val.					0.000	0.000
	Panel D: Trade tax revenue					
SARA	-0.069		-0.038		-0.013	
	(0.053)		(0.114)		(0.030)	
SARA, years 1-2		-0.039		-0.054		-0.072
		(0.051)		(0.066)		(0.046)
SARA, years 3-5		-0.093		-0.092		0.191
		(0.082)		(0.060)		(0.213)
SARA, years 6-10		-0.189*		-0.147**		0.390
		(0.112)		(0.068)		(0.358)
SARA, years >10		-0.157		-0.326***		0.479
		(0.135)		(0.109)		(0.492)
L.Trade	0.616***	0.608***	0.773***	0.710***	0.441	0.223**
	(0.045)	(0.046)	(0.103)	(0.094)	(0.281)	(0.102)
N	1037	1037	1037	1037	870	870
Groups	46	46	46	46	46	46
adj. R-sq	0.748	0.749			0.445	0.485
# instr.			37	46		
M1			0.000	0.000		
M2			0.273	0.269		
Hans. p-val.			0.016	0.451		
Diff. Hans. J			0.017	0.305		
CD p-val.					0.000	0.000

Notes: The table reports estimates of the effect of SARAs on the log of tax revenue. Panel A presents the estimates for total tax revenue; Panel B for direct tax revenue; Panel C for revenue from goods and services and Panel D for trade tax revenue. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I through IV account for country and year fixed effects. Models I, II, V and VI include country-specific time trends. Standard errors in parentheses. Models I and II include robust standard errors clustered at the country level. In models III and IV Windmeijer (2005)'s finite sample correction was applied. Whereas models V and VI were corrected for small time series bias using Jackknife corrected standard errors. ***p $\leq$ 0.01, **p $\leq$ 0.05, *p $\leq$ 0.1.

Turning to the test statistics, the system GMM relies on an instrumental variable estimation. Thus the strength of the instruments is crucial. As we mentioned before, system GMM is weakened if too many instruments are included. Therefore, we reduced the total number of instruments from 642 in the unrestricted estimation to 37 and 46 in respectively columns III and IV. Both the Hansen-J test and the Difference-in-Hansen test do not reject the null-hypothesis that our instruments are valid. Only for trade taxes in column III do both tests reject instrument validity, but when we include the set of SARA dummies they fail to reject the null without impacting the conclusions. The GMM models further hinge on the assumption of no serial correlation. The M1 and M2 tests present the p-value of a serial correlation test for respectively a first and second-order autocorrelation process. While there does seem to be first-order autocorrelation, there - crucially - is no evidence for second-order autocorrelation in any of the models.

Finally, we turn to the correlated common effects mean group models in columns V and VI. CCEMG models are more appropriate than their GMM counterparts when T becomes relatively large. They have the additional advantage that they allow us to control for cross-section dependence and heterogeneous effects. For total tax revenue, the coefficient on the SARA dummy in column V now lies between the two previous estimates, but it remains statistically indistinguishable from zero. The results in column VI revolve around zero and are never significant. Nevertheless, the findings for the different types of taxation are similar to what we found before. There is no significant effect on direct taxation, for which the estimates turn around zero. While the estimates of the effect of SARA on tax revenue from goods and services are not significant, their magnitude remains relatively stable across the different specifications at around 7 to 8%. The CCEMG fails to find any significant or consistent effect on trade taxes. However, we do have to note that despite our efforts to control for cross-sectional dependence, the CD test rejects the null-hypothesis of no cross-sectional dependence in the majority of the models. Nevertheless,the CCEMG models confirm previous findings, i.e. that there is little evidence for a systematic relationship between the presence of a SARA and improved revenue performance.

So far we have assumed that the main variables follow a stationary process. This is not a trivial assumption. The consistency of the estimators depends on it. We, therefore, formally test the stationarity assumption using two panel unit root tests. Both tests extend the standard Dickey-Fuller test to panel time-series. The null-hypothesis for both is non-stationarity in all country series, whereas the alternative is stationarity in at least some countries. However, the Maddala and Wu (1999) test does not take into account cross-section dependence, while the Pesaran (2007) allows for it. Table A.6 in the Appendix contains the results. We present alternative specifications for the inclusion of lags and trends. Overall, the null of non-stationarity is mostly rejected boosting confidence in our baseline findings.

In sum, the findings from the different dynamic models fail to provide strong support for the hypothesis that SARAs have increased total tax revenues in Sub-Saharan Africa. This contrasts with earlier findings in the literature, and could be explained by the fact that previous studies failed to control for the dynamics in revenue collection. More specifically, as we argued above, if the SARA reform is linked with a pre-treatment negative shock to revenue, then this biases the SARA dummy upwards in a static model. In fact, in that case the static models most likely pick up a recovery effect which would have occurred regardless of the SARA reform. However, there does appear to be some suggestive evidence implying that SARAs have led to a compositional shift in revenue. Our estimations consistently, though not in a statistically significant manner, indicate that SARAs have boosted revenue from direct taxes and from taxes on goods and services at the expense of trade tax revenue. The effect on direct tax revenue, while consistently positive, is, nevertheless, economically negligible. On the other hand, the shift from trade to indirect taxation, is consistent with Fjeldstad and Moore (2008)'s argument that SARAs are part of the global tax reform agenda which has emerged since the 1980s. Moreover, our findings imply that SARAs might have been instrumental in advancing this agenda.

5.3 Instrumental Variable Approach

In the preceding section we examined the revenue effect of SARAs by controlling for past revenue. In this section we recognise that we cannot exclude the possibility that there are still other time-varying factors which might confound the revenue effect of SARAs. Hence, we resort to an instrumental variable procedure to deal with this. As discussed at length in sub-section 4.2, we use a three-step procedure. The first stage of our IV estimation models the probability of the SARA reform as a function of the agenda-setting power of the UK and France in country i, proxied for by their shares of aid in total aid received by country i. The empirical model was introduced in equation 10.

We briefly discuss the results from the first stage probit model, given in Table 3. The reported coefficients are the average partial effects, which tell us what the partial effect would be if a country is randomly selected from our sample. Column I only includes the aid shares, while in column II we add in the controls. The Chamberlain-Mundlak device, i.e. the period averages of the explanatory variables, are included in column III. The predicted values from the third specification will later be used in a two-stage least squares estimation to instrument the presence of a SARA. The results shown here are merely illustrative. We will formally test the validity of the predicted probabilities as instruments when we discuss Table 4.

Table 3: Determininants of SARA presence
(Average partial effects)

	I	II	III
UK aid share	0.039***	0.023***	0.016**
	(0.009)	(0.006)	(0.007)
FR aid share	-0.047***	-0.015***	-0.000
	(0.006)	(0.005)	(0.007)
Total aid		0.025***	-0.023**
		(0.005)	(0.010)
Ex-UK Colony		0.114***	0.105***
		(0.017)	(0.019)
IMF mid-term		0.058***	0.046***
		(0.013)	(0.016)
IMF short-term		-0.077**	-0.093***
		(0.033)	(0.029)
Time Trend		0.011***	0.015***
		(0.001)	(0.001)
N	1239	1230	1230
Pseudo R-sq	0.251	0.539	0.583
Correctly specified (%)	88.1	91.4	93.1
CM device	No	No	Yes

Notes: The models report the estimated average partial effects from a probit for the presence of a semi-autonomous revenue authority. Column I reports the baseline results from a probit model with UK and French aid shares (in logs) as the independent variables. Column II adds control variables. Column III introduces the Chamberlain-Mundlak device. Robust standard errors in parentheses. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Overall, the test statistics are supportive of our model. We clearly see that the proposed instruments are both correlated with SARA presence. Moreover, their apparent relation is consistent with our intuition. The larger the UK as a donor the more likely it is that a SARA is present. More specifically, a one percentage point increase in the UK's aid share increases the probability of observing a SARA by 1.6% (column III). The more agenda setting power France has, proxied by its share of aid, the less likely is the presence of a SARA. While the signs on the proposed instruments are in line with our intuition, the significance on the contemporary French aid share disappears in column III. It is important to note that we are controlling for the identity of the former colonial power. Thus, although former UK colonies are about 10% more likely to adopt the SARA reform than French colonies, the estimates on the aid shares are picking up more than structural differences between the two. The relationship between total aid and SARA presence is interesting. After including its period average, the correlation between SARA presence and contemporary aid turns negative. This suggests that the earlier

Table 4: Instrumental variable estimation of the effect of a SARA on tax revenue

Panel A: Total tax revenue

	I	II
SARA	-0.039	-0.125
	(0.035)	(0.149)
L.Total	0.771***	0.653***
	(0.054)	(0.103)
Total aid	0.014	0.019
	(0.012)	(0.014)
IMF mid-term	0.030*	0.036*
	(0.017)	(0.021)
IMF short-term	0.054*	0.062
	(0.031)	(0.040)
N	1094	1094
Groups	46	46
Country/Year	No	Yes
LM stat., p-val.	0.00	0.01
Kleibergen-Paap F-stat	55.39	11.10

Panel C: Goods & services revenue

	I	II
SARA	-0.161	-0.003
	(0.112)	(0.184)
L.Goods & Services	0.784***	0.650***
	(0.039)	(0.061)
Total aid	-0.025	-0.011
	(0.024)	(0.027)
IMF mid-term	0.047**	0.035
	(0.020)	(0.023)
IMF short-term	0.066	0.044
	(0.053)	(0.056)
N	827	827
Groups	46	46
Country/Year	No	Yes
LM stat., p-val.	0.00	0.05
Kleibergen-Paap F-stat	18.92	5.18

Panel B: Direct tax revenue

	I	II
SARA	0.033	0.062
	(0.075)	(0.166)
L.Direct	0.808***	0.625***
	(0.040)	(0.033)
Total aid	0.000	0.009
	(0.021)	(0.028)
IMF mid-term	-0.013	-0.025
	(0.018)	(0.020)
IMF short-term	-0.020	-0.012
	(0.045)	(0.059)
N	850	850
Groups	44	44
Country/Year	No	Yes
LM stat., p-val.	0.00	0.03
Kleibergen-Paap F-stat	25.19	6.38

Panel D: Trade tax revenue

	I	II
SARA	-0.168	-0.534***
	(0.115)	(0.178)
L.Trade	0.769***	0.596***
	(0.046)	(0.055)
Total aid	-0.013	-0.000
	(0.024)	(0.028)
IMF mid-term	0.022	0.040
	(0.024)	(0.028)
IMF short-term	-0.002	-0.021
	(0.042)	(0.049)
N	872	872
Groups	46	46
Country/Year	No	Yes
LM stat., p-val.	0.00	0.04
Kleibergen-Paap F-stat	21.53	5.54

Notes: The table reports the estimates of the second stage of a two-stage least squares estimation of the effect of a SARA on tax revenue. The instrument was constructed following the three-step procedure described in the text (section 4.2) and exploits French and UK aid shares. Panel A reports the results on total tax revenue, Panel B on direct tax revenue, Panel C on revenue from goods and services taxation and Panel D on trade tax revenue. All models include country and year fixed effects. Column I excludes country-specific linear time trends, while they are included in column II. Robust standard errors in parentheses, clustered at the country level. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

observed positive correlation was driven by time-invariant factors. Accounting for this, we find that a negative correlation, suggesting that countries experiencing a significant reduction in contemporary aid are forced to invest more in domestic resource mobilisation to make up for the overall revenue shortfall. With regard to IMF programmes, medium-term programmes increase the likelihood of a SARA reform by 4.6% compared to not having an IMF programme at all, while short-term programmes appear to decrease the probability of observing a SARA. This is to be expected given the more conditional nature of mid-term IMF programmes and the IMF's reputation as a supporter of the SARA reform. Finally, the linear time trend is highly significant, which corresponds to our discussion of Figure 2.

Table 4 reports the second-stage results of our two-stage least squares estimation and this for the four different tax types. We present two specifications. Both follow equation 10, but in column I we exclude the country-specific time trends, whereas they are included in column II. We do this because the inclusion of the country-time trends significantly reduces the remaining variation. Hence, it affects the power of our instrument. This is obvious when we examine the Kleibergen-Paap F-statistic, which is the appropriate F-test when we assume heteroskedastic standard errors. In column I, the F-statistics are relatively high confirming that our instruments are strong. Their magnitude drops in column II, but they remain sufficiently large to assume that our instruments are strong enough to make meaningful inferences. Moreover, the LM-statistic, testing whether the instruments are relevant, comfortably rejects the null-hypothesis in nearly all cases. We are thus confident that our instrumental variable approach is valid.

The results for the effect on total revenue are presented in Panel A in Table 4. The SARA coefficient is estimated at -3.9% and -12.5%, suggesting SARAs have actually decreased revenue collection. However, we - again - cannot conclude that effect is statistically different from zero. Interestingly, IMF programmes seem to have had a positive impact on revenue collection. The effect is more consistent for medium-term programmes, which is in line with recent findings by Crivelli and Gupta (2016). In our model, the effect of the mid-term IMF dummy is around 3.6%, though the effect is only significant at the 10% level. Aid, in turn, does not significantly affect taxation.

Panel B looks at revenue from direct taxation. The results are roughly similar to what we found before. The coefficients are slightly larger than in the dynamic models, but again they remain statistically insignificant. IMF programmes do not seem to have impacted direct taxation. The results for revenue from goods and services in Panel C do differ with respect to what we found before. For the first time the coefficient points to a negative impact of SARAs on revenue from goods and services, but the effect is statistically indistinguishable from zero.

The impact on total tax revenue from IMF programmes seems to come from its effect on goods and services taxation. While only significant in column I the coefficient on the medium-term IMF dummy is in the same ballpark as the one for total revenue. Finally, in line with previous findings, revenue from trade taxation is negatively affected by the SARA reform. Though, the instrumental variable estimates suggest a much larger effect. According to the results in column II in Panel D revenue from trade taxation more than halves after the introduction of a SARA.

The IV results presented in this section do not provide strong evidence for a positive effect of SARAs on total tax revenues in Sub-Saharan Africa. While, statistically not significant, the IV results even suggest a negative impact, driven by a large and significant negative impact on trade tax revenue. Whereas, revenue from direct taxes appears to increase. In contrast to our earlier findings, the estimates for goods and services taxation are statistically insignificant and negative. In economic terms the estimated impact is generally larger in the IV models than in the dynamic models. Overall, these findings further strengthen our scepticism about a positive revenue impact of SARAs in Sub-Saharan Africa.

5.4 Sensitivity Checks

We perform a number of sensitivity checks to assess the robustness of the lack of a systematic relationship between the presence of a semi-autonomous revenue authority and revenue mobilisation. All of these tests are reported in the Appendix to this paper. Specifically, we show that our results are unchanged when:

(i) we recode our SARA dummies relying on the establishment dates used by Ahlerup et al. (2015) in Table A.7;

(ii) we introduce a vector of additional controls $X_{i,t}$ to the within estimator in Table A.8;

(iii) we vary the lag length in the system GMM estimation in Table A.9;

(iv) we trim the top and bottom 5% of the dependent variable for the dynamic models in Table A.10 and for the IV model in Table A.11.

6 Alternative Outcomes

In this section we broaden the scope of our analysis with a number of alternative outcome measures. Given the lack of evidence for a direct revenue impact of semi-autonomous revenue authorities, we are led to the question whether SARAs have had more indirect effects on tax capacity across Sub-Saharan Africa. However, we also acknowledge that thus far our analysis has been rather narrow in scope. While increasing revenue has been the primary objective of the reform, an IMF survey documented additional reasons for setting up a SARA, ranging from catalysing broader revenue administration reform to addressing corruption (Kidd and Crandall, 2006). Assessing the overall performance of a SARA would, thus, require us to take into account a much broader array of performance indicators[12]. This section is a first, albeit incomplete, attempt and looks at the tax effort, revenue volatility and corruption. The analyses of tax effort and volatility can be thought of as robustness checks since they represent alternative revenue performance measures. Moreover, they have been used as broader measures of the tax or fiscal capacity of a state (e.g. Baskaran and Bigsten, 2013). Corruption, on the other hand, can be seen as an intermediate outcome linking the SARA reform to revenue performance as corrupt tax administrations were one of the key elements identified as holding back revenue collection (Chand and Moene, 1997; Jenkins, 1994; Flatters and Macleod, 1995).

6.1 Tax Effort

First, we examine the impact of semi-autonomous revenue authorities on the government's tax effort. The government's tax effort can be defined as the ratio between what is actually collected and what should be collected given the economic structure of the country (Mkandawire, 2010; Baskaran and Bigsten, 2013). One of the initial motivations for the SARA reform was the observed political interference in the tax collection process, leading to a shortfall between what should be levied and what is levied. By granting tax administrations a level of autonomy, they are supposedly ring-fenced from further interference. In turn, this should lead to a more effective application of tax rules, and therefore the revenue gap should decrease, increasing the tax effort variable.

The tax effort variable is calculated as follows:

$$TaxEffort_{i,t} = \frac{Tax_{i,t}}{\widehat{Tax}_{i,t}} \quad (13)$$

$$Tax_{i,t} = \beta X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t} \quad (14)$$

where $\widehat{Tax}_{i,t}$ is the country's taxable capacity, or its predicted total tax revenue given equation 14. This predicted revenue is the result of an estimation which takes into account country, α_i, and year, δ_t, fixed-effects in addition to a vector, $X_{i,t}$, of structural economic determinants of taxation for country i in year t. Following the literature (Bird et al., 2008; Brown and Martinez-

[12]See Mann (2004) for a (non-exhaustive) list of potential performance indicators.

Vazquez, 2015; Chelliah et al., 1975; Le et al., 2012; Lotz and Morss, 1967; Mkandawire, 2010; Gupta, 2007), this vector includes import and export measures to proxy the economy's trade openness, the value-added originating from the agricultural sector in the economy, GDP per capita, demographic variables including the age dependency ratios for the young and old as well as the urbanisation rate. A ratio lower than one suggests that a particular country is not collecting as much as it potentially could, while a ratio higher than one points to a collection effort higher than what is predicted by the country's economic structure. Table A.12 in the Appendix shows how the tax effort variable evolved for every country in the sample between the 1980s and the 2010s.

We rerun the analysis presented in Table 2, but replace the dependent variable with our tax effort variable and add the static within estimator in the first two columns. An additional advantage of using the tax effort is that it allows us to flexibly include controls into our dynamic specifications. Including control variables in our baseline models was challenging because of instrument proliferation in the system GMM estimators and because of the limited number of observations in the individual time-series underlying the CCEMG estimator. As before, we log-transform the tax effort variable.

Table 5 presents the results. Note that the total number of countries has dropped to 44. We are unable to estimate the tax effort for Lesotho and Sao Tome and Principe due to missing trade data. As before, the uneven columns capture the SARA reform by a single before/after dummy variable. In the even-numbered columns the SARA reform is introduced as a set of dummies capturing the number of years relative to the reform. The first two columns list the results from a static fixed-effects model. Columns III through VIII show the dynamic estimates. The dynamics appear to be important, with strongly significant coefficients on the lagged tax effort variable. Moreover, all the test statistics for the dynamic models support our modelling choices. Finally, across all specifications, the estimates on the SARA dummy range from -1.3%, over zero to a positive impact of 4.6%. The impact of SARAs on tax effort thus seems to turn around zero, which is confirmed by the confidence intervals. None of the SARA estimates is significantly different from zero. We are therefore given no reason to believe that SARAs have increased tax efforts. This finding is in line with our previous results and further confirms our belief that SARAs have not significantly impacted tax capacity in Sub-Saharan Africa.

Table 5: Estimation of the impact of SARAs on tax effort

	Static models		*Dynamic models*					
	Within estimates		Within estimates		Sys-GMM		CCEMG	
	I	II	III	IV	V	VI	VII	VIII
SARA	-0.026		-0.010		0.045		-0.141	
	(0.074)		(0.032)		(0.045)		(0.140)	
SARA, years 1-2		-0.041		-0.008		0.031		-0.011
		(0.062)		(0.024)		(0.038)		(0.027)
SARA, years 3-5		-0.059		-0.032		0.029		0.003
		(0.094)		(0.048)		(0.038)		(0.050)
SARA, years 6-10		-0.125		-0.058		0.043		0.045
		(0.131)		(0.054)		(0.041)		(0.060)
SARA, years >10		-0.271		-0.108		0.010		0.096
		(0.197)		(0.080)		(0.035)		(0.095)
L.Tax effort			0.696***	0.693***	0.695***	0.715***	-0.179	0.310**
			(0.086)	(0.085)	(0.103)	(0.110)	(0.456)	(0.128)
N	1188	1188	1132	1132	1132	1132	980	980
Groups	44	44	44	44	44	44	44	44
adj. R-sq	0.324	0.327	0.638	0.637			0.704	0.720
# instr.					37	46		
M1					0.000	0.000		
M2					0.038	0.037		
Hans. p-val.					0.574	0.692		
Diff. Hans. J					0.750	0.895		
CD p-val.							0.392	0.278

Notes: The table reports the estimated effect of SARAs on tax effort. Tax effort is measured as the ratio of actual tax collection over what should be collected given the economic structure of the country. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I through VI account for country and year fixed effects. Models I through IV and VII and VIII include country-specific time trends. Standard errors in parentheses. Models I through IV include robust standard errors clustered at the country level. In models V and VI Windmeijer (2005)'s finite sample correction was applied. Whereas models VII and VIII were corrected for small time series bias using Jackknife corrected standard errors. ***p $\leq$ 0.01, **p $\leq$ 0.05, *p $\leq$ 0.1.

6.2 Revenue Volatility

Next, we turn to revenue volatility. Fiscal policy is often highly dependent on the political cycle in developing countries (Shi and Svensson, 2006). According to Von Haldenwang et al. (2014), this is, with regard to taxation, often worsened by weak tax administrations. However, given their autonomy, SARAs are less influenced by the whims of government, which should result in a steady collection of tax revenue. Thus, SARAs should reduce the volatility in tax revenue.

Following Von Haldenwang et al. (2014), we define revenue volatility as the absolute percentage deviation, but from a three-year moving average instead of a quadratic trend. For every country i in each year t we measure revenue volatility as follows:

$$Vol_{i,t} = \frac{abs(Tax_{i,t} - \overline{Tax}_{i,t})}{\overline{Tax}_{i,t}} \tag{15}$$

where $Tax_{i,t}$ is the actual tax revenue collected and $\overline{Tax}_{i,t}$ is a three-year moving average, which is obtained as follows:

$$\overline{Tax}_{i,t} = \frac{1}{n}\sum_{s=1}^{n} Tax_{i,t-s} \tag{16}$$

where $n = 3$. Since we are taking absolute values of the deviations from the moving average, our outcome measure is strictly positive, with higher values indicating higher levels of volatility. In line with the rest of the paper we log-transform our volatility measure to reduce the effect from outliers.

Table 6: Estimation of the effect of SARAs on revenue volatility

	Static models				*Dynamic models*	
	Within estimates		CCEMG		Within estimates	
	I	II	III	IV	V	VI
SARA	-0.201		-0.149		-0.209	
	(0.323)		(0.134)		(0.309)	
SARA, years 1-2		-0.187		-0.151		-0.222
		(0.368)		(0.141)		(0.355)
SARA, years 3-5		-0.133		-0.148		-0.172
		(0.384)		(0.154)		(0.372)
SARA, years 6-10		-0.245		-0.219		-0.307
		(0.509)		(0.161)		(0.507)
SARA, years >10		-0.068		-0.066		-0.257
		(0.669)		(0.159)		(0.680)
L.Total tax revenue					0.087***	0.087***
					(0.032)	(0.032)
N	1164	1164	1164	1164	1110	1110
Groups	46	46	46	46	46	46
adj. R-sq	0.058	0.056	0.118	0.155	0.066	0.064
CD p-val.			0.077	0.117		

Notes: The table reports the estimates of the effect of SARAs on revenue volatility. Revenue volatility is measured as the absolute percentage deviation of total tax revenue from a three-year moving average. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I, II, V and VI account for country and year fixed effects. All models include country-specific time trends. Standard errors in parentheses. Models I, II, V and VI include robust standard errors clustered at the country level. ***p $\leq$ 0.01, **p $\leq$ 0.05, *p $\leq$ 0.1.

When assessing the impact of SARAs on volatility, we rely on similar approaches as before. We present both the static and dynamic results, but focus more on the statics since it is less clear that revenue volatility is influenced by a dynamic process. Table 6 presents our findings. Columns I to IV show the results from our preferred static models, the standard fixed-effects estimator and the static version of the mean group estimator. Despite our efforts to account for common factors, the CCEMG estimators still suffer from cross-section dependence suggesting that revenue volatility is affected by similar events across all countries (e.g. commodity prices). The final two columns introduce the dynamic within estimators. While lagged volatility is highly significant, its economic magnitude is rather small. Moreover, its inclusion does not significantly affect the coefficients on the SARA dummies, which indicates that omitting lagged volatility was not biasing the findings in the static models. Turning to the effect of SARAs, all models are consistent in suggesting that SARAs have decreased revenue volatility. However, the estimates are never statistically significant. Moreover, as the robustness checks in Table A.13 in the Appendix show, the results lose consistency when we vary the length of the moving average. Again, we are given no evidence to belief that semi-autonomous revenue authorities have boosted Africa's tax capacity.

6.3 Corruption

We end this section by looking at an intermediate variable linking the SARA reform to increased revenue, control of corruption. By the end of the 1980s service provision via the public sector was heavily questioned as a model. The civil service in developing countries was argued to suffer from severe political patronage. Analysing tax administrations, Jenkins concludes that: "In such a situation the tax administration will be perceived as being inefficient, incompetent and corrupt (...) [this] directly affects the citizens' willingness to voluntarily comply with the tax laws (Jenkins, 1994, p.76)." Modelling tax administrations after independent central banks, i.e. reducing political dependence and reforming managerial practices, especially with regard to human resources, would lower corruption, increase professionalism and ultimately result in higher revenue (Chand and Moene, 1999). Fjeldstad (2003) finds that, after the Tanzania Revenue Authority was created, corruption initially decreased and that this was accompanied by sharp growth in tax revenue. However, corruption levels rose again soon afterwards, while revenue collection fell back. Moreover, even during the initial phase corruption was still widespread.

To examine the corruption effect of SARAs we use three corruption measures from the recently released Varieties of Democracy (V-DEM) dataset, version 6.2 (Coppedge et al., 2016). It has greater coverage both across time and countries than its alternatives, going back to 1900 in some cases. The only country which is missing from the dataset is Equatorial Guinea, which leads to the inclusion of 45 countries in the analysis as opposed to 46 before. Moreover, V-DEM corruption measures can be disaggregated. So we are able to not only look at overall political corruption, but also at public sector and executive corruption (McMann et al., 2016). Precise data definitions can be found in Table A.3 in the Appendix. We examine all three indicators, but are particularly interested in the public sector corruption index. This seems the most relevant, since it explicitly attempts to get at the "use of public office for personal gain" in the bureaucracy.

Table 7: Estimation of the effect of SARAs on corruption

	Static models				*Dynamic models*			
	Within estimates		Within estimates		Sys-GMM		CCEMG	
	I	II	III	IV	V	VI	VII	VIII
	Panel A: Political corruption							
SARA	0.008		-0.006		0.010		-0.004	
	(0.022)		(0.006)		(0.008)		(0.004)	
SARA, years 1-2		0.012		-0.003		0.011		0.035
		(0.017)		(0.005)		(0.009)		(0.030)
SARA, years 3-5		-0.006		-0.009		0.010		0.005
		(0.021)		(0.007)		(0.009)		(0.010)
SARA, years 6-10		-0.036		-0.019		0.011		0.007
		(0.034)		(0.015)		(0.011)		(0.013)
SARA, years >10		-0.079		-0.019		0.012		0.037
		(0.066)		(0.017)		(0.011)		(0.037)
L.Political corruption			0.823***	0.821***	1.101***	1.090***	0.517***	0.521***
			(0.029)	(0.028)	(0.048)	(0.049)	(0.042)	(0.044)
N	1425	1425	1379	1379	1379	1379	1241	1241
Groups	45	45	45	45	45	45	45	45
adj. R-sq	0.520	0.525	0.840	0.840			0.591	0.606
# instr.					37	46		
M1					0.000	0.000		
M2					0.503	0.498		
Hans. p-val.					0.232	0.437		
Diff. Hans. J					0.702	0.421		
CD p-val.							0.355	0.957
	Panel B: Public sector corruption							
SARA	-0.012		-0.007		0.016*		-0.006	
	(0.023)		(0.009)		(0.009)		(0.008)	
SARA, years 1-2		-0.001		-0.002		-0.002		0.036
		(0.020)		(0.009)		(0.009)		(0.030)
SARA, years 3-5		-0.016		-0.008		-0.004		0.004
		(0.023)		(0.011)		(0.008)		(0.023)
SARA, years 6-10		-0.030		-0.010		-0.001		0.030
		(0.044)		(0.018)		(0.012)		(0.031)
SARA, years >10		-0.019		-0.002		-0.006		0.038
		(0.081)		(0.021)		(0.015)		(0.046)
L.Public sector corruption			0.812***	0.812***	1.095***	1.049***	0.480***	0.402***
			(0.028)	(0.028)	(0.036)	(0.055)	(0.039)	(0.065)
N	1425	1425	1379	1379	1379	1379	1241	1241
Groups	45	45	45	45	45	45	45	45
adj. R-sq	0.495	0.495	0.824	0.824			0.579	0.601
# instr.					37	46		
M1					0.000	0.000		
M2					0.801	0.770		
Hans. p-val.					0.446	0.575		
Diff. Hans. J					0.859	0.491		
CD p-val.							0.313	0.930
	Panel C: Executive corruption							
SARA	0.017		-0.002		0.022*		-0.003	
	(0.028)		(0.007)		(0.013)		(0.005)	
SARA, years 1-2		0.017		-0.000		0.000		0.009
		(0.021)		(0.005)		(0.015)		(0.008)
SARA, years 3-5		0.015		0.001		0.004		-0.009
		(0.026)		(0.007)		(0.017)		(0.013)

Continued on next page

SARA, years 6-10		-0.003		-0.014		0.000		0.001
		(0.044)		(0.020)		(0.016)		(0.010)
SARA, years >10		-0.017		-0.006		-0.019		-0.006
		(0.089)		(0.018)		(0.034)		(0.014)
L.Executive corruption			0.815***	0.815***	1.171***	1.184***	0.484***	0.483***
			(0.020)	(0.020)	(0.050)	(0.049)	(0.045)	(0.046)
N	1425	1425	1379	1379	1379	1379	1241	1241
Groups	45	45	45	45	45	45	45	45
adj. R-sq	0.492	0.492	0.824	0.824			0.600	0.624
# instr.					37	46		
M1					0.000	0.000		
M2					0.070	0.067		
Hans. p-val.					0.059	0.423		
Diff. Hans. J					0.490	0.825		
CD p-val.							0.095	0.122

Notes: The table reports the estimates of the effect of SARAs on corruption. Panel A reports the effects on political corruption, Panel B on public sector corruption and Panel C on executive corruption. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I through VI account for country and time fixed effects. Models I through IV, VII and VIII include country-specific time trends. Standard errors in parentheses. Models I through IV include robust standard errors clustered at the country level. In models V and VI Windmeijer (2005)'s finite sample correction was applied. Whereas models VII and VIII were corrected for small time series bias using Jackknife corrected standard errors. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Our assessment of corruption is similar to the revenue analysis in subsection 5.2, we regress the corruption variables on the SARA dummies in both static and dynamic models. Dynamics are likely to be important as corruption persists over time through so-called corruption networks (Fjeldstad, 2003). Moreover, variables based on perceptions of corruption are often highly correlated across years. The findings are presented in Table 7. Note that we explicitly allow for the pattern found by Fjeldstad (2003) by including a set of SARA dummies, capturing the time to the reform. Starting with Panel A, semi-autonomous revenue authorities do not seem to have reduced overall political corruption. Across the different specifications the estimates remain close to zero and are never statistically significant. When looking at the disaggregated effect on public sector, Panel B, and executive corruption, Panel C, we find similar results. The estimates are consistently close to zero and almost never statistically significant. The system GMM estimate does turn up significant at the 10% level in Panels B and C. However, the suggested 1.6% or 2.2% impact remains small. Moreover, they are positive which suggests, if anything, that SARAs are associated with an increase in corrupt practices. Overall, there is little evidence for any effect from SARAs on perceived corruption.

This section broadened the scope of our assessment of semi-autonomous revenue authorities by looking at their impact on a number of alternative indicators. The inclusion of tax effort and revenue volatility into the analysis can be interpreted as a robustness check on our baseline results. Moreover, they are informative as broader measures of the state's tax or fiscal capacity. Alternatively, control of corruption can be interpreted as an intermediate outcome connecting the SARA reform to revenue performance. The results fail to find any impact of semi-autonomous revenue authorities on either tax effort, volatility or corruption. We take this as confirmation of our baseline results and are therefore further strengthened in our belief that overall SARAs have done little to improve the tax capacity of African states.

7 Conclusion

Over the past 30 years semi-autonomous revenue authorities (SARAs) have spread across Sub-Saharan Africa in order to strengthen tax administrations. By ring-fencing tax administrations from politics and by introducing new public management practices, tax capacity was argued to be improved. Nevertheless, it has been questioned whether such a one-size-fits-all solution is really able to address the country-specific challenges which tax administrations face, most notably their politics. So far, the emerging empirical literature on the SARA reform has been inconclusive about their revenue effect. At best, it points at an initial but unsustained revenue gain. However, this existing literature fails to account for the dynamics in tax revenue, which confound the effect of SARAs on revenue collection.

This paper re-examines the revenue effect of semi-autonomous revenue authorities in Sub-Saharan Africa (SSA), taking into account revenue dynamics. Relying on the ICTD Government Revenue Dataset and detailed coding of the SARA reform, we show that static models which omit past revenue are most likely picking up a recovery effect as opposed to a causal effect. Once we control for these dynamics in a fixed-effects OLS regression, there is little statistical evidence for a systematic relationship between SARAs and total tax revenues in SSA. These results hold true in a system GMM estimation, as well as in a common correlated effects mean group estimation. Moreover, to mitigate further endogeneity concerns we develop an instrument for the presence of a SARA using donor influence, based on the observation that some donors have more actively promoted the SARA reform than others. Exploiting this instrument, we again fail to detect a positive impact of SARAs on total tax revenue. However, looking at specific taxes, we do find suggestive evidence that SARAs have contributed to a compositional shift in tax revenue. Across our estimations, the effect of SARAs on direct tax revenue is consistently positive, though economically nearly negligible. Interestingly, revenues from taxes on goods and services seem to have increased at the expense of trade taxation following the introduction of a SARA. This suggests that SARAs are not only part of the so-called global tax reform agenda, but they might also have been instrumental in its advancement. In a last step, we broaden our scope to alternative measures of tax capacity and do not find a consistent effect of SARAs on governments' tax efforts or on revenue volatility. Furthermore, corruption, one of the channels through which SARAs are argued to raise revenue, is unaffected by their presence.

Thus, the statistical evidence presented in this paper casts doubt on the causal interpretation of the positive association between semi-autonomous revenue authorities and tax capacity found in previous studies. However, this paper is limited to the average treatment effect of SARAs. It did not explore in depth possible heterogeneous or interaction effects, which might be masking the overall null-effect. Further contextualising the SARA reform in future research, therefore, has the potential to provide us with a more detailed understanding of tax administration and institutional reform in developing countries.

References

Acemoglu, D., Johnson, S., and Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review*, 91(5):1369–1401.

Acemoglu, D., Naidu, S., Restrepo, P., and Robinson, J. A. (2014). Democracy Does Cause Growth. NBER Working Paper Series 20004, National Bureau of Economic Research.

Adams, R., Almeida, H., and Ferreira, D. (2009). Understanding the Relationship Between Founder–CEOs and Firm Performance. *Journal of Empirical Finance*, 16(1):136–150.

Ahlerup, P., Baskaran, T., and Bigsten, A. (2015). Tax Innovations and Public Revenues in Sub-Saharan Africa. *The Journal of Development Studies*, 51(6):689–706.

Andrews, M. (2013). *The Limits of Institutional Reform in Development: Changing Rules for Realistic Solutions*. Cambridge University Press, Cambridge.

Angrist, J. D. and Pischke, J.-S. (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, Princeton.

Arellano, M. and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, 58(2):277–297.

Arellano, M. and Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics*, 68(1):29–51.

Ashenfelter, O. (1978). Estimating the Effect of Training Programs on Earnings. *The Review of Economics and Statistics*, 60(1):47–57.

Aucoin, P. (1990). Administrative Reform in Public Management: Paradigms, Principles, Paradoxes and Pendulums. *Governance*, 3(2):115–137.

Autor, D. H. (2003). Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing. *Journal of Labor Economics*, 21(1):1–42.

Baskaran, T. and Bigsten, A. (2013). Fiscal Capacity and the Quality of Government in Sub-Saharan Africa. *World Development*, 45:92–107.

Bird, R. M. (2013). Foreign Advice and Tax Policy in Developing Countries. Working Paper 13-07, International Center for Public Policy, Atlanta.

Bird, R. M., Martinez-Vazquez, J., and Torgler, B. (2008). Tax Effort in Developing Countries and High Income Countries: The Impact of Corruption, Voice and Accountability. *Economic Analysis and Policy*, 38(1):55–71.

Blundell, R. and Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*, 87(1):115–143.

Boston, J. (2011). Basic NPM Ideas and Their Development. *The Ashgate Research Companion to New Public Management*, pages 17–32.

Brown, L. A. and Martinez-Vazquez, J. (2015). International Debt Forgiveness: Who Gets Picked and Its Effect On The Tax Effort Of Developing Countries. Working paper, International Center for Public Policy, Atlanta.

Cameron, A. C. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press, Cambridge.

Caulfield, J. L. (2006). The Politics of Bureau Reform in Sub-Saharan Africa. *Public Administration and Development*, 26(1):15–26.

Chabal, P. and Daloz, J.-P. (1999). *Africa Works: Disorder as Political Instrument*. International African Institute in association with James Currey, London.

Chamberlain, G. (1982). Multivariate Regression Models for Panel Data. *Journal of Econometrics*, 18(1):5–46.

Chand, S. K. and Moene, K. O. (1997). Controlling Fiscal Corruption. IMF Working Paper WP/97/100, International Monetary Fund, Washington D.C.

Chand, S. K. and Moene, K. O. (1999). Controlling Fiscal Corruption. *World Development*, 27(7):1129–1140.

Chelliah, R. J., Baas, H. J., and Kelly, M. R. (1975). Tax Ratios and Tax Effort in Developing Countries, 1969-71. *IMF Staff Papers*, 22(1):187–205.

Chudik, A. and Pesaran, M. H. (2015). Common Correlated Effects Estimation of Heterogeneous Dynamic Panel Data Models with Weakly Exogenous Regressors. *Journal of Econometrics*, 188(2):393–420.

Clist, P. (2016). Foreign Aid and Domestic Taxation: Multiple Sources, One Conclusion. *Development Policy Review*, 34(3):365–383.

Coppedge, M., Gerring, J., Lindberg, S., Skaaning, S.-E., Teorell, J., Altman, D., Bernhard, M., Fish, S., Glynn, A., Hicken, A., Knutsen, C. H., Marquardt, K., McMann, K., Miri, F., Paxton, P., Pemstein, D., Staton, J., Tzelgov, E., Wang, Y.-T., and Zimmerman, B. (2016). V-Dem [Country-Year/Country-Date] Dataset v6.2. Varieties of democracy (v-dem) project.

Crivelli, E. and Gupta, S. (2016). Does Conditionality in IMF-Supported Programs Promote Revenue Reform? *International Tax and Public Finance*, 23(3):550–579.

Devas, N., Delay, S., and Hubbard, M. (2001). Revenue Authorities: Are They the Right Vehicle for Improved Tax Administration? *Public Administration and Development*, 21(3):211–222.

Di John, J. (2010). The Political Economy of Taxation and Resource Mobilization in sub-Saharan Africa. In Padayachee, V., editor, *The Political Economy of Africa*, pages 110–131. Routledge, London.

Di John, J. and Putzel, J. (2009). Political Settlements. Issues paper, International Development Department, University of Birmingham, Birmingham.

Dollar, D. and Svensson, J. (2000). What Explains the Success or Failure of Structural Adjustment Programmes? *The Economic Journal*, 110(466):894–917.

Dreher, A. (2006). IMFand Economic Growth: The Effects of Programs, Loans, and Compliance with Conditionality. *World Development*, 34(5):769–788.

Ebeke, C., Mansour, M., and Rota-Graziosi, G. (2016). The Power to Tax in Sub-Saharan Africa: LTUs, VATs, and SARAs. Études et Documents 11, CERDI, Clermont Ferrand.

Eberhardt, M. and Teal, F. (2013). No Mangoes in the Tundra: Spatial Heterogeneity in Agricultural Productivity Analysis: Spatial Heterogeneity in Agricultural Productivity Analysis. *Oxford Bulletin of Economics and Statistics*, 75(6):914–939.

Evans, P. (2004). Development as Institutional Change: The Pitfalls of Monocropping and the Potentials of Deliberation. *Studies in Comparative International Development*, 38(4):30–52.

Ferman, B., Pinto, C., and Possebom, V. (2016). Cherry Picking with Synthetic Controls. Working Paper 420, Sao Paulo School of Economics.

Fjeldstad, O.-H. (2003). Fighting Fiscal Corruption: Lessons from the Tanzania Revenue Authority. *Public Administration and Development*, 23(2):165–175.

Fjeldstad, O.-H. and Moore, M. (2008). Tax Reform and State-Building in a Globalised World. In Brautigam, D., Fjeldstad, O.-H., and Moore, M., editors, *Taxation and State-Building in Developing Countries - Capacity and Consent*. Cambridge University Press, Cambridge.

Fjeldstad, O.-H. and Moore, M. (2009). Revenue Authorities and Public Authority in Sub-Saharan Africa. *The Journal of Modern African Studies*, 47(01):1–18.

Flatters, F. and Macleod, W. B. (1995). Administrative Corruption and Taxation. *International Tax and Public Finance*, 2(3):397–417.

Ghura, D. (1998). Tax Revenue in Sub-Saharan Africa: Effects of Economic Policies and Corruption. IMF Working Paper WP/98/135, International Monetary Fund, Washington D.C.

GRA (2009). Ghana Revenue Authority Act. Act 791, The Parliament of the Republic of Ghana, Accra.

Granger, C. W. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica*, 37(3):424–438.

Gupta, A. S. (2007). Determinants of Tax Revenue Efforts in Developing Countries. IMF Working Paper WP/07/184, International Monetary Fund, Washington D.C.

Heckman, J. J. and Smith, J. J. (1999). The Pre-Programme Earnings Dip and The Determinants of Participation in a Social Programme, Implications for Simple Programme Evaluation Strategies. *The Economic Journal*, 109(457):313–348.

Hood, C. (1991). A Public Management for All Seasons? *Public Administration*, 69(1):3–19.

IMF (1999). Rwanda, Enhanced Structural Adjustment Facility. Policy framework paper, International Monetary Fund, Washington D.C.

IMF (2011). The Gambia : Poverty Reduction Strategy Paper. IMF Country Report 11/27, International Monetary Fund, Washington D.C.

IMF (2011). Revenue Mobilization in Developing Countries. Policy papers, Fiscal Affairs Department, International Monetary Fund, Washington D.C.

ITD (2010). Revenue Administration in Sub-Saharan Africa. ITD Comparative Information Series 1, International Tax Dialogue, Paris.

Jenkins, G. (1994). Modernization of Tax Administrations: Revenue Boards and Privatization as Instruments for Change. *Bulletin for International Fiscal Documentation*, February:75–81.

Jenkins, G., Kelly, R., and Khadka, R. (2000). Modernization of Tax Administration in Low-Income Countries: The Case of Nepal. CAER II Discussion Paper 68, Harvard Institute for International Development, Cambridge.

Joshi, A. and Ayee, J. (2009). Autonomy or Organisation? Reforms in the Ghanaian Internal Revenue Service. *Public Administration and Development*, 29(4):289–302.

Judson, R. A. and Owen, A. L. (1999). Estimating Dynamic Panel Data Models: A Guide for Macroeconomists. *Economics Letters*, 65(1):9–15.

Kaufmann, D., Kraay, A., and Zoido-Lobatón, P. (1999). Governance Matters. Policy Research Working Paper 2196, The World Bank, Washington D.C.

Kaul, A., Klobner, S., Pfeifer, G., and Schieler, M. (2016). Synthetic Control Methods: Never Use All Pre-Intervention Outcomes as Economic Predictors. Working paper.

Keen, M. and Lockwood, B. (2010). The Value Added Tax: Its Causes and Consequences. *Journal of Development Economics*, 92(2):138–151.

Keen, M. and Mansour, M. (2010a). Revenue Mobilisation in Sub-Saharan Africa: Challenges from Globalisation I – Trade Reform. *Development Policy Review*, 28(5):553–571.

Keen, M. and Mansour, M. (2010b). Revenue Mobilisation in Sub-Saharan Africa: Challenges from Globalisation II – Corporate Taxation. *Development Policy Review*, 28(5):573–596.

Kelsall, T. (2011). Rethinking the Relationship between Neo-patrimonialism and Economic Development in Africa. *IDS Bulletin*, 42(2):76–87.

Khan, M. (1995). State Failure in Weak States. In Harriss, J., Hunter, J., and Lewis, C. M., editors, *The New Institutional Economics and Third World Development*. Routledge, London.

Kidd, M. and Crandall, W. J. (2006). Revenue Authorities: Issues and Problems in Evaluating Their Success. IMF Working Paper WP/06/240, International Monetary Fund, Washington D.C.

Killick, T. (1996). Principals, Agents and the Limitations of BWI Conditionality. *World Economy*, 19(2):211–219.

Kydland, F. E. and Prescott, E. C. (1977). Rules Rather Than Discretion: The Inconsistency of Optimal Plans. *The Journal of Political Economy*, 85(3):473–491.

La Porta, R., Lopez-de Silanes, F., and Shleifer, A. (2008). The Economic Consequences of Legal Origins. *Journal of Economic Literature*, 46(2):285–332.

Le, T. M., Moreno-Dodson, B., and Bayraktar, N. (2012). Tax Capacity and Tax Effort: Extended Cross-Country Analysis from 1994 to 2009. Policy Research Working Paper 6252, The World Bank, Washington D.C.

Lemgruber Viol, A., Masters, A., and Cleary, D. (2015). Understanding Revenue Administration: An Initial Data Analysis Using the Revenue Administration Fiscal Information Tool. Fiscal affairs department departmental paper series, International Monetary Fund, Washington D.C.

Lotz, J. R. and Morss, E. R. (1967). Measuring "Tax Effort" in Developing Countries. *IMF Staff Papers*, 14(3):478–499.

Maddala, G. S. and Wu, S. (1999). A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bulletin of Economics and Statistics*, 61(S1):631–652.

Mahon, J. E. (2004). Causes of Tax Reform in Latin America, 1977-95. *Latin American Research Review*, 39(1):3–30.

Mann, A. (2004). Are Semi-Autonomous Revenue Authorities the Answer to Tax Administration Problems in Developing Countries. A practical guide, USAID, Washington D.C.

Mascagni, G. (2016). Aid and Taxation in Ethiopia. *The Journal of Development Studies*, 52(12):1744–1758.

McMann, K. M., Pemstein, D., Seim, B., Teorell, J., and Lindberg, S. I. (2016). Strategies of Validation: Assessing the Varieties of Democracy Corruption Data. *V-Dem Working Paper*, 23.

McNabb, K. and LeMay-Boucher, P. (2014). Tax Structures, Economic Growth And Development. ICTD Working Paper 22, International Centre for Tax and Development, Brighton.

Mkandawire, T. (1988). The Road to Crisis, Adjustment and De-Industrialisation: The African Case. *Africa Development / Afrique et Développement*, 13(1):5–31.

Mkandawire, T. (2009). Institutional Monocropping and Monotasking in Africa. In Norman, A., Botchwey, K., Stein, H., and Stiglitz, J. E., editors, *Good Growth and Governance in Africa: Rethinking Development Strategies*, pages 80–113. Oxford University Press, Oxford.

Mkandawire, T. (2010). On Tax Efforts and Colonial Heritage in Africa. *The Journal of Development Studies*, 46(10):1647–1669.

Morrissey, O. (2015). Aid and Domestic Resource Mobilization with a Focus on Sub-Saharan Africa. *Oxford Review of Economic Policy*, 31(3-4):447–461.

Morrissey, O., Prichard, W., and Torrance, S. (2014). Aid and Taxation: Exploring the Relationship Using New Data. ICTD Working Paper 21, International Centre for Tax and Development, Brighton.

Morrissey, O., Von Haldenwang, C., Von Schiller, A., Ivanyna, M., and Bordon, I. (2016). Tax Revenue Performance and Vulnerability in Developing Countries. *The Journal of Development Studies*, 52(12):1–15.

Mundlak, Y. (1978). On the Pooling of Time Series and Cross Section Data. *Econometrica*, 46(1):69–85.

Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica*, 49(6):1417–1426.

Pesaran, M. H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. IZA Discussion Paper 1240, Institute for the Study of Labor, Bonn.

Pesaran, M. H. (2006). Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure. *Econometrica*, 74(4):967–1012.

Pesaran, M. H. (2007). A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence. *Journal of Applied Econometrics*, 22(2):265–312.

Pesaran, M. H. and Smith, R. (1995). Estimating Long-Run Relationships from Dynamic Heterogeneous Panels. *Journal of Econometrics*, 68(1):79–113.

Prichard, W. (2009). The Politics of Taxation and Implications for Accountability in Ghana 1981–2008. IDS Working Papers 330, Institute for Development Studies, Brighton.

Prichard, W. (2016). Reassessing Tax and Development Research: A New Dataset, New Findings, and Lessons for Research. *World Development*, 80:48–60.

Prichard, W., Cobham, A., and Goodall, A. (2014). The ICTD Government Revenue Dataset. ICTD Working Paper 19, International Centre for Tax and Development, Brighton.

Pritchett, L., Woolcock, M., and Andrews, M. (2013). Looking Like a State: Techniques of Persistent Failure in State Capability for Implementation. *The Journal of Development Studies*, 49(1):1–18.

Rodrik, D., Subramanian, A., and Trebbi, F. (2002). Institutions Rule, The Primacy of Institutions over Integration and Geography in Economic Development. IMF Working Paper WP/02/189, International Monetary Fund, Washington D.C.

Roodman, D. (2009). A Note on the Theme of Too Many Instruments. *Oxford Bulletin of Economics and Statistics*, 71(1):135–158.

Sarr, B. (2016). Assessing Revenue Authority Performance in Developing Countries: A Synthetic Control Approach. *International Journal of Public Administration*, 39(2):146–156.

Schedler, K. and Proeller, I. (2002). The New Public Management: A Perspective From Mainland Europe. In McLaughlin, K., Osborne, S. P., and Ferlie, E., editors, *New Public Management: Current Trends and Future Prospects*. Routledge, London.

Shi, M. and Svensson, J. (2006). Political Budget Cycles: Do They Differ Across Countries and Why? *Journal of Public Economics*, 90(8):1367–1389.

Soderbom, M., Teal, F., Eberhardt, M., Quinn, S., and Zeitlin, A. (2015). *Empirical Development Economics*. Routledge, London.

Stewart, M. (2003). Global Trajectories of Tax Reform: The Discourse of Tax Reform in Developing and Transition Countries. *Harvard International Law Journal*, 44(1):139–190.

Taliercio, R. R. (2004). Administrative Reform as Credible Commitment: The Impact of Autonomy on Revenue Authority Performance in Latin America. *World Development*, 32(2):213–232.

Therkildsen, O. (2004). Autonomous Tax Administration in Sub-Saharan Africa: The Case of the Uganda Revenue Authority. *Forum for Development Studies*, 31(1):59–88.

Toma, E. F. and Toma, M. (1992). Tax Collection with Agency Costs: Private Contracting or Government Bureaucrats? *Economica*, 59(233):107–120.

UN (2015). Report of the Third International Conference on Financing for Development. Conference Report A/CONF.227/20, United Nations, Addis Ababa.

Van de Walle, N. (2001). *African Economies and the Politics of Permanent Crisis, 1979-1999*. Cambridge University Press, Cambridge.

Van Rijckeghem, C. and Weder, B. (2001). Bureaucratic Corruption and the Rate of Temptation: Do Wages in the Civil Service Affect Corruption, and by How Much? *Journal of Development Economics*, 65(2):307–331.

Von Haldenwang, C., Von Schiller, A., and Garcia, M. (2014). Tax Collection in Developing Countries – New Evidence on Semi-Autonomous Revenue Agencies (SARAs). *The Journal of Development Studies*, 50(4):541–555.

Von Schiller, A. (2016). Business Organisations, Party Systems and Tax Composition in Developing Countries: A Comparison between Colombia and Peru. *The Journal of Development Studies*, 52(12):1722–1743.

Von Soest, C. (2006). Measuring the Capability to Raise Revenue Process and Output Dimensions and Their Application to the Zambia Revenue Authority. GIGA Working Paper 35, German Institute of Global and Area Studies, Hamburg.

Von Soest, C. (2008). Donor Support for Tax Administration Reform in Africa: Experiences in Ghana, Tanzania, Uganda and Zambia. Discussion Paper 2, Deutsches Institut für Entwicklungspolitik, Bonn.

Windmeijer, F. (2005). A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators. *Journal of Econometrics*, 126(1):25–51.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, London.

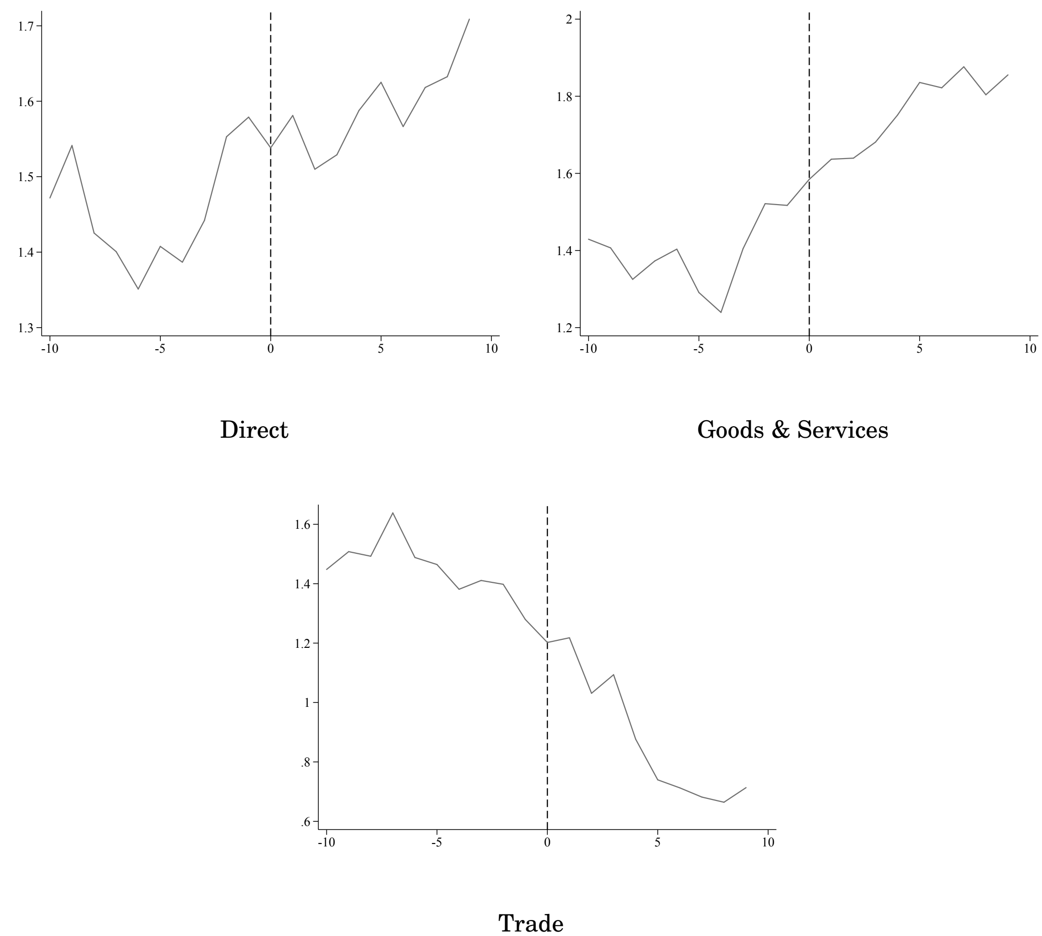
World Bank (1992). *Governance and Development*. The World Bank, Washington D.C.

Yates, D. A. (2014). Revenue Authority Begins Official Operations. *Liberian Observer*.

Zolberg, A. R. (1967). *Creating Political Order: The Party-States of West Africa*. Rand McNally & Company, Chicago.

A Appendix

Figure A.1: Tax ratio relative to the introduction of a SARA
(in % of GDP and in logs)



Notes: The figures show the averaged tax-to-GDP-ratio in logs of countries which adopted a SARA, and this from ten years before to ten years after the introduction of a SARA. The data was reshaped and centred, so that the introduction of a SARA in all countries takes place in year 0.

Table A.1: SARA creation dates in different studies

Country	Operational est.	Ebeke et al. (2016)	Sar (2016)	Ahlerup et al. (2015)	ITD (2010)	Fjeldstad & Moore (2009)	Mann (2004)
Botswana	2005	2003	n.a.	2005	2004	n.a.	2005
Burundi	2010	2010	n.a.	2010	2010	n.a.	n.a.
Ethiopia	2009	1997	1997	2002	2009	2002	2002
Gambia	2007	2005	n.a.	2005	n.a.	2005	n.a.
Ghana	2010	1985	n.a.	1985	2010	1985	1986
Kenya	1996	1996	1995	1995	1995	1995	1996
Lesotho	2003	2001	2001	2003	n.a.	2003	2003
Liberia	2014	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Malawi	2000	2000	1998	1995	2000	1995	2000
Mauritius	2005	2005	n.a.	2005	2006	2005	n.a.
Mozambique	2007	2006	n.a.	2006	n.a.	n.a.	n.a.
Rwanda	1998	1998	1997	1998	1998	1998	2000
Sierra Leone	2003	2003	n.a.	2002	2002	2002	2002
South Africa	1998	1997	1997	1997	1997	1997	1997
Swaziland	2011	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tanzania	1996	1996	1996	1996	1996	1996	1996
Uganda	1992	1992	1991	1991	n.a.	1991	1992
Zambia	1994	1994	1994	1994	1993	1994	1994
Zimbabwe	2002	2001	2001	2001	n.a.	2001	2000

Table A.2: Sources for SARA creation dates

Country	Legal est.	Operational est.	Legal source	Operat. Source*
Botswana	01/08/2004	2005	http://www.burs.org.bw	Inferred
Burundi	11/07/2009	2010	http://www.obr.bi	http://www.obr.bi
Ethiopia	14/07/2008	2009	http://www.erca.gov.et	Inferred
Gambia	Aug-04	2007	IMF (2011)	IMF (2011)
Ghana	31/12/2009	2010	http://www.gra.gov.gh	Inferred
Kenya	01/07/1995	1996	http://www.kra.go.ke	Mann (2004)
Lesotho	01/01/2001	2003	http://www.lra.org.ls	http://www.lra.org.ls
Liberia	19/09/2013	2014	Yates (2014)	Yates (2014)
Malawi	1998	2000	http://www.mra.mw/	http://www.mra.mw/
Mauritius	30/09/2004	2005	http://www.mra.mu	Inferred
Mozambique	22/03/2006	2007	http://www.at.gov.mz	http://www.at.gov.mz
Rwanda	08/11/1997	1998	http://www.rra.gov.rw	IMF (1999)
Sierra Leone	13/09/2002	2003	http://www.nra.gov.s	Inferred
South Africa	05/09/1997	1998	http://www.gov.za	Inferred
Swaziland	2008	2011	http://www.sra.org.sz	http://www.sra.org.sz
Tanzania	1995	1996	http://www.tra.go.tz	http://www.tra.go.tz
Uganda	05/09/1991	1992	https://www.ura.go.ug	Mann (2004)
Zambia	1993	1994	http://www.zambia.gov.zm	https://www.zra.org.zm
Zimbabwe	11/02/2000	2002	http://www.zimra.co.zw	http://www.zimra.co.zw

Notes: *If no specific information is available, then the operational dummy is coded as one depending on the legal establishment. Generally, legal and operational establishment years will be the same. However, if a SARA was legally established in the second half of the calendar year, then the first year of operations is considered to be the next one.

Table A.3: Variable definitions and sources

Variable Name	Definition	Source
Total taxes	Total tax revenue, excluding social contributions	ICTD GRD
Direct taxes	Total direct taxes, excluding social contributions but including resource taxes. Includes taxes on income, profits and capitals gains, taxes on payroll and workforce and taxes on property.	ICTD GRD
Taxes on goods & services	Total taxes on goods and services, which includes sales taxes and excise taxes.	ICTD GRD
Trade taxes	Total taxes on international trade, including both import and export taxes. In some cases this figure may also include VAT collected at the border, where countries consistently report revenue in this way.	ICTD GRD
Total aid	Total net bilateral aid from DAC donors, in current USD in billions	WDI
UK aid share	Net bilateral aid from UK, as a % of total net bilateral aid	WDI
FR aid share	Net bilateral aid from France, as a % of total net bilateral aid	WDI
Ex-UK Colony	Dummy variable taking the value one if the country is a former UK colony, zero otherwise.	La Porta et al. (2008)
IMF mid-term	Includes the following programmes: Extended Credit Facility, External Fund Facility, Poverty Reduction and Growth Facility, Structural Adjustment Facility	Dreher (2006), IMF MONA
IMF short-term	Includes the following programmes: Stand-by Credit Facility, Rapid Credit Facility, Exogenous Shocks Facility, Stand-By Arrangement	Dreher (2006), IMF MONA
Dep. share, old	Age dependency ratio, old (% of working-age population)	WDI
Dep. share, young	Age dependency ratio, young (% of working-age population)	WDI
Urban population	Urban population (% of total)	WDI
Democracy index	Aggregate measure of electoral democracy, scaled from 0 to 1, capturing the extent to which the ideal of electoral democracy (=1) is achieved .	V-DEM
Agriculture	Value Added, agriculture, forestry and fishing (% of GDP)	WFO
Exports	Exports of goods and services (% of GDP)	WDI
Imports	Imports of goods and services (% of GDP)	WDI
GDPPC (LCU Mil.)	GDP per capita in local currency units in millions	WDI
Political corruption	Aggregate measure of political corruption, scaled from 0 to 1 with higher values corresponding to higher levels of corruption.	V-DEM
Public sector corruption	Combined measure of public sector bribery and embezzlement, scaled from 0 to 1 with higher values corresponding to higher levels of corruption.	V-DEM
Executive corruption	Combined measure of executive bribery and embezzlement, scaled from 0 to 1 with higher values corresponding to higher levels of corruption.	V-DEM

Notes: ICTD GRD - International Centre for Tax and Development Government Revenue Dataset; WDI - World Bank Development Indicators; IMF MONA - International Monetary Fund Monitoring of Fund Arrangements; WFO - World Food Organisation; V-DEM - Varieties of Democracy.

Table A.4: Summary statistics

	Mean	Std. Dev.	Min.	Max.	N
	Panel A: Countries without SARA				
SARA	0	0	0	0	875
Total tax revenue	13.842	8.183	0.6	48.605	780
Direct tax revenue	4.291	3.845	0.122	27.83	565
Indirect tax	3.809	3.04	0	16.198	591
Trade tax revenue	4.216	3.14	0	26.242	643
Tax effort	1.05	0.845	0.066	13.697	723
Total aid	0.257	0.556	0	10.97	875
UK aid share	0.024	0.057	0	0.527	863
FR aid share	0.303	0.229	0	0.917	863
IMF mid-term	0.358	0.48	0	1	869
IMF short-term	0.124	0.329	0	1	866
Ex-UK Colony	0.135	0.342	0	1	875
Dep. share, old	6.494	1.791	3.039	12.225	875
Dep. share, young	84.103	11.412	32.306	106.452	875
Urban population	37.445	15.704	9.428	86.367	875
Democracy index	0.361	0.205	0.072	0.843	851
Agriculture	0.258	0.142	0.01	0.61	866
Exports	0.314	0.21	0.033	1.244	807
Imports	0.435	0.35	0.071	4.248	807
GDP per cap.	0.476	1.055	0	8.597	816
Political corruption	0.688	0.198	0.157	0.943	851
Public sector corruption	0.713	0.215	0.127	0.971	851
Executive corruption	0.688	0.227	0.117	0.979	851
	Panel B: Countries with SARA				
SARA	0.308	0.462	0	1	574
Total tax revenue	15.95	9.593	0.977	62.829	551
Direct tax revenue	5.926	5.457	0.188	33.429	489
Indirect tax	5.037	2.323	0.267	12.559	462
Trade tax revenue	5.51	6.822	0.194	42.123	468
Tax effort	1.002	0.418	0.163	2.837	465
Total aid	0.372	0.421	0	2.292	574
UK aid share	0.105	0.079	0	0.529	562
FR aid share	0.057	0.107	0	0.763	562
IMF mid-term	0.412	0.493	0	1	570
IMF short-term	0.088	0.283	0	1	570
Ex-UK Colony	0.777	0.417	0	1	574
Dep. share, old	5.877	1.046	3.999	11.736	574
Dep. share, young	83.414	15.515	29.325	106.686	574
Urban population	28.441	15.33	4.503	63.272	574
Democracy index	0.382	0.217	0.079	0.822	574
Agriculture	0.277	0.164	0.02	0.77	574
Exports	0.291	0.191	0.025	0.855	481
Imports	0.412	0.277	0.03	2.468	481
GDP per cap.	0.181	0.325	0	1.472	566
Political corruption	0.541	0.193	0.168	0.892	574
Public sector corruption	0.54	0.248	0.044	0.931	574
Executive corruption	0.523	0.199	0.056	0.899	574

Table A.5: Dynamic estimation of the revenue effect of SARAs with different lag lengths

	I	II	III	IV	V
	Panel A: Total tax revenue				
SARA	0.003	0.014	0.021	0.020	0.028
	(0.025)	(0.026)	(0.023)	(0.023)	(0.024)
L.Total	0.680***	0.732***	0.716***	0.688***	0.656***
	(0.099)	(0.109)	(0.113)	(0.123)	(0.133)
L2.Total		-0.036	-0.033	-0.026	-0.039
		(0.040)	(0.038)	(0.045)	(0.038)
L3.Total			0.029	0.107*	0.124**
			(0.046)	(0.063)	(0.057)
L4.Total				-0.104**	-0.096
				(0.041)	(0.066)
L5.Total					-0.014
					(0.046)
N	1273	1218	1164	1110	1056
Groups	46	46	46	46	46
adj. R-sq	0.692	0.696	0.689	0.674	0.659
AIC	-1022.94	-1014.81	-987.91	-950.78	-942.29
BIC	-858.17	-851.45	-831.06	-790.39	-788.46
	Panel B: Direct tax revenue				
SARA	0.005	0.021	0.016	0.010	0.024
	(0.038)	(0.038)	(0.040)	(0.045)	(0.052)
L.Direct	0.614***	0.611***	0.604***	0.544***	0.479***
	(0.030)	(0.055)	(0.067)	(0.066)	(0.073)
L2.Direct		-0.031	-0.033	-0.005	-0.084*
		(0.050)	(0.050)	(0.054)	(0.045)
L3.Direct			-0.064	-0.102	-0.031
			(0.042)	(0.083)	(0.053)
L4.Direct				0.007	0.001
				(0.061)	(0.068)
L5.Direct					-0.053
					(0.089)
N	990	933	878	824	772
Groups	44	44	44	44	44
adj. R-sq	0.743	0.738	0.728	0.703	0.689
AIC	-289.70	-335.70	-373.16	-392.80	-514.78
BIC	-132.97	-180.87	-225.06	-246.66	-366.01
	Panel C: Goods & services revenue				
SARA	0.082**	0.079*	0.071	0.074	0.078
	(0.040)	(0.043)	(0.047)	(0.050)	(0.054)
L.Goods & Services	0.628***	0.582***	0.547***	0.525***	0.491***
	(0.065)	(0.079)	(0.063)	(0.069)	(0.062)
L2.Goods & Services		0.031	0.050	0.025	-0.022
		(0.070)	(0.066)	(0.071)	(0.050)
L3.Goods & Services			-0.027	0.044	0.044

Continued on next page

			(0.038)	(0.031)	(0.054)
L4.Goods & Services				-0.045*	-0.060
				(0.027)	(0.053)
L5.Goods & Services					0.028
					(0.043)
N	984	925	867	810	757
Groups	46	46	46	46	45
adj. R-sq	0.777	0.783	0.783	0.769	0.774
AIC	-85.29	-187.48	-254.55	-254.09	-365.90
BIC	66.35	-32.93	-106.84	-108.49	-222.39
	Panel D: Trade tax revenue				
SARA	-0.069	-0.064	-0.083	-0.100	-0.090
	(0.053)	(0.056)	(0.057)	(0.061)	(0.064)
L.Trade	0.616***	0.593***	0.581***	0.559***	0.535***
	(0.045)	(0.053)	(0.056)	(0.055)	(0.059)
L2.Trade		0.002	-0.032	-0.038	-0.034
		(0.035)	(0.039)	(0.035)	(0.044)
L3.Trade			0.029	0.087	0.084
			(0.043)	(0.055)	(0.059)
L4.Trade				-0.090**	-0.106**
				(0.041)	(0.050)
L5.Trade					0.010
					(0.036)
N	1037	980	924	870	820
Groups	46	46	46	45	45
adj. R-sq	0.748	0.752	0.753	0.754	0.749
AIC	-84.14	-115.33	-114.39	-125.54	-119.89
BIC	69.12	36.18	35.30	27.05	30.81

Notes: The table reports estimates of the effect of the SARA reform (0/1 dummy) on the log of tax revenue. Panel A presents the estimates for total tax revenue; Panel B for direct tax revenue; Panel C for revenue from goods and services and Panel D for trade tax revenue. All models account for country and year fixed effects and include country-specific time trends. Robust standard errors in parentheses, clustered at the country level. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Table A.6: Panel unit root tests

	No trend		*With trend*	
	0 lags	1 lag	0 lags	1 lag
	Panel A: Total tax revenue			
Maddala and Wu (1999)	0.000	0.495	0.000	0.000
Pesaran (2007)	0.000	0.067	0.000	0.000
	Panel B: Direct tax revenue			
Maddala and Wu (1999)	0.001	0.616	0.000	0.092
Pesaran (2007)	0.001	0.003	0.001	0.169
	Panel C: Goods & services revenue			
Maddala and Wu (1999)	0.000	0.000	0.002	0.004
Pesaran (2007)	0.002	0.047	0.265	0.930
	Panel D: Trade tax revenue			
Maddala and Wu (1999)	0.000	0.000	0.000	0.000
Pesaran (2007)	0.001	0.022	0.349	0.730

Notes: Null-hypothesis for panel unit root test: series has a unit root. P-values reported. Maddala and Wu (1999) assume cross-sectional independence. Pesaran (2007) allows for cross-sectional dependence.

Table A.7: Dynamic models, alternative SARA dummy

	Within Estimates		Sys-GMM		CCEMG	
	I	II	III	IV	V	VI
	Panel A: Total tax revenue					
SARA	0.010		0.171**		0.010	
	(0.031)		(0.076)		(0.021)	
SARA, years 1-2		0.016		0.196**		0.020
		(0.032)		(0.085)		(0.028)
SARA, years 3-5		0.008		0.214***		0.025
		(0.040)		(0.076)		(0.040)
SARA, years 6-10		-0.025		0.181**		0.017
		(0.053)		(0.077)		(0.056)
SARA, years >10		-0.031		0.203**		-0.022
		(0.079)		(0.092)		(0.063)
L.Total	0.680***	0.679***	0.744***	0.820***	0.222***	0.192***
	(0.099)	(0.099)	(0.168)	(0.172)	(0.049)	(0.052)
N	1273	1273	1273	1273	1110	1110
Groups	46	46	46	46	46	46
adj. R-sq	0.692	0.691			0.340	0.371
# instr.			37	45		
M1			0.002	0.001		
M2			0.143	0.152		
Hans. p-val.			0.284	0.604		
Diff. Hans. J			0.529	0.828		
CD p-val.					0.188	0.460
	Panel B: Direct tax revenue					
SARA	0.010		0.090		0.025	
	(0.042)		(0.122)		(0.063)	
SARA, years 1-2		0.035		0.182		0.046
		(0.042)		(0.133)		(0.048)
SARA, years 3-5		0.022		0.200		0.032
		(0.048)		(0.128)		(0.061)
SARA, years 6-10		-0.028		0.189		0.031
		(0.058)		(0.135)		(0.066)
SARA, years >10		0.045		0.216		0.014
		(0.070)		(0.140)		(0.071)
L.Direct	0.614***	0.611***	0.918***	0.907***	0.119*	0.085
	(0.030)	(0.030)	(0.080)	(0.066)	(0.067)	(0.065)
N	990	990	990	990	833	833
Groups	44	44	44	44	44	44
adj. R-sq	0.743	0.744			0.913	0.920
# instr.			37	46		
M1			0.001	0.001		
M2			0.574	0.559		
Hans. p-val.			0.248	0.494		
Diff. Hans. J			0.485	0.456		
CD p-val.					0.095	0.033

Continued on next page

	Panel C: Goods & services revenue					
SARA	0.047		0.057		-0.033	
	(0.054)		(0.246)		(0.040)	
SARA, years 1-2		0.042		-0.109		-0.041
		(0.055)		(0.194)		(0.033)
SARA, years 3-5		0.074		-0.099		-0.036
		(0.064)		(0.196)		(0.050)
SARA, years 6-10		0.121*		-0.100		-0.054
		(0.067)		(0.197)		(0.051)
SARA, years >10		0.178*		-0.235		-0.066
		(0.095)		(0.236)		(0.065)
L.Goods & Services	0.629***	0.624***	0.926***	0.855***	0.078	0.056
	(0.066)	(0.065)	(0.102)	(0.128)	(0.069)	(0.065)
N	984	984	984	984	810	810
Groups	46	46	46	46	46	46
adj. R-sq	0.777	0.777			0.499	0.548
# instr.			37	46		
M1			0.000	0.001		
M2			0.582	0.581		
Hans. p-val.			0.035	0.281		
Diff. Hans. J			0.073	0.221		
CD p-val.					0.000	0.000
	Panel D: Trade tax revenue					
SARA	-0.070		0.115		-0.077*	
	(0.060)		(0.245)		(0.044)	
SARA, years 1-2		-0.026		0.010		-0.004
		(0.068)		(0.265)		(0.034)
SARA, years 3-5		-0.093		-0.043		-0.130*
		(0.090)		(0.257)		(0.077)
SARA, years 6-10		-0.224**		-0.137		-0.152
		(0.101)		(0.279)		(0.095)
SARA, years >10		-0.216		-0.046		-0.127
		(0.134)		(0.313)		(0.125)
L.Trade	0.618***	0.605***	0.744***	0.884***	0.248***	0.131**
	(0.045)	(0.045)	(0.114)	(0.091)	(0.085)	(0.061)
N	1037	1037	1037	1037	870	870
Groups	46	46	46	46	46	46
adj. R-sq	0.748	0.750			0.531	0.593
# instr.			37	46		
M1			0.000	0.000		
M2			0.311	0.330		
Hans. p-val.			0.012	0.057		
Diff. Hans. J			0.039	0.020		
CD p-val.					0.000	0.000

Notes: The table reports estimates of the effect of SARAs on the log of tax revenue. The SARA dummies were constructed using SARA introduction years from Ahlerup et al. (2015). Panel A presents the estimates for total tax revenue; Panel B for direct tax revenue; Panel C for revenue from goods and services and Panel D for trade tax revenue. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I through IV acount for country and year fixed effects. Models I, II, V and VI include country-specific time trends. Standard errors in parentheses. Models I and II include robust standard errors clustered at the country level. In models III and IV Windmeijer (2005)'s finite sample correction was applied. Whereas models V and VI were corrected for small time series bias using Jackknife corrected standard errors. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Table A.8: Within estimates with controls

	Total		Direct		Goods & Services		Trade	
	I	II	III	IV	V	VI	VII	VIII
SARA	0.030		0.041		0.097		-0.059	
	(0.039)		(0.051)		(0.059)		(0.058)	
SARA, years 1-2		0.018		0.055		0.093		-0.044
		(0.031)		(0.044)		(0.068)		(0.062)
SARA, years 3-5		0.024		0.010		0.119**		-0.115
		(0.055)		(0.072)		(0.058)		(0.083)
SARA, years 6-10		-0.013		-0.018		0.172**		-0.286**
		(0.074)		(0.087)		(0.073)		(0.121)
SARA, years $>$10		-0.064		-0.039		0.191*		-0.338**
		(0.110)		(0.134)		(0.097)		(0.165)
L.Total	0.564***	0.561***						
	(0.086)	(0.086)						
L.Direct			0.477***	0.476***				
			(0.054)	(0.054)				
L.Goods & Services					0.522***	0.519***		
					(0.043)	(0.043)		
L.Trade							0.600***	0.579***
							(0.048)	(0.049)
Total aid	-0.018	-0.018	-0.015	-0.014	-0.051**	-0.051**	-0.038	-0.037
	(0.021)	(0.021)	(0.039)	(0.040)	(0.022)	(0.022)	(0.031)	(0.029)
Dep. share, old	-0.238	-0.240	-0.159	-0.132	-0.178	-0.213	-0.032	0.038
	(0.226)	(0.208)	(0.477)	(0.472)	(0.306)	(0.332)	(0.424)	(0.389)
Dep. share, young	0.558**	0.601**	0.559	0.575	0.230	0.218	0.491	0.591*
	(0.264)	(0.252)	(0.451)	(0.461)	(0.486)	(0.508)	(0.335)	(0.345)
Urban population	0.021	0.005	-0.010	-0.051	-0.194	-0.148	0.103	-0.028
	(0.155)	(0.154)	(0.334)	(0.338)	(0.166)	(0.143)	(0.277)	(0.322)
Exports	0.058	0.060	0.041	0.046	0.026	0.020	0.013	0.027
	(0.046)	(0.046)	(0.076)	(0.076)	(0.078)	(0.079)	(0.074)	(0.075)
Imports	0.109***	0.107***	0.118	0.114	0.130	0.134	0.181**	0.176**
	(0.038)	(0.040)	(0.079)	(0.079)	(0.082)	(0.082)	(0.075)	(0.080)
Agriculture	-0.300***	-0.297***	-0.223***	-0.219***	-0.039	-0.044	-0.015	0.001
	(0.100)	(0.101)	(0.073)	(0.074)	(0.106)	(0.106)	(0.110)	(0.113)
GDP per cap.	0.292***	0.298***	0.420***	0.423***	0.107	0.103	0.115	0.131
	(0.094)	(0.094)	(0.131)	(0.132)	(0.193)	(0.194)	(0.165)	(0.174)
IMF mid-term	0.006	0.006	-0.058**	-0.056**	0.005	0.004	0.009	0.014
	(0.016)	(0.016)	(0.023)	(0.023)	(0.019)	(0.019)	(0.028)	(0.027)
IMF short-term	0.053	0.053	-0.038	-0.040	0.006	0.007	-0.030	-0.035
	(0.039)	(0.039)	(0.053)	(0.052)	(0.045)	(0.045)	(0.044)	(0.044)
Democracy index	0.063	0.069	0.017	0.023	-0.168	-0.171	0.082	0.110
	(0.136)	(0.134)	(0.193)	(0.194)	(0.194)	(0.196)	(0.166)	(0.166)
N	1098	1098	859	859	874	874	908	908
Groups	43	43	41	41	43	43	41	41
Adj. R-sq	0.733	0.733	0.735	0.735	0.758	0.757	0.701	0.704

Notes: The tabel reports the estimates of the effect of SARAs on the log of tax revenue. The dependent variables are listed at the top. Robust standard errors in parentheses, clustered at the country level. All models include time and year fixed effects, as well as country-specific time trends. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Table A.9: System GMM, alternative lag lengths

	2 lags		3 lags		4 lags		10 lags	
	I	II	III	IV	V	VI	VII	VIII
	Panel A: Total tax revenue							
SARA	0.083*		0.083*		0.083*		0.072*	
	(0.047)		(0.046)		(0.046)		(0.040)	
SARA, years 1-2		0.048		0.200*		0.055		-0.054
		(0.040)		(0.117)		(0.054)		(0.232)
SARA, years 3-5		0.034		0.192		0.045		-0.092
		(0.049)		(0.121)		(0.047)		(0.228)
SARA, years 6-10		0.041		0.189		0.039		0.211
		(0.048)		(0.117)		(0.047)		(0.482)
SARA, years >10		0.025		0.256		0.023		0.283
		(0.038)		(0.170)		(0.032)		(0.606)
L.Total	0.744***	0.849***	0.750***	0.779***	0.747***	0.778***	0.725***	0.728***
	(0.166)	(0.158)	(0.149)	(0.121)	(0.130)	(0.119)	(0.096)	(0.108)
N	1273	1273	1273	1273	1273	1273	1273	1273
Groups	46	46	46	46	46	46	46	46
# instr.	37	46	39	50	41	53	53	65
M1	0.002	0.001	0.002	0.000	0.001	0.000	0.000	0.000
M2	0.136	0.137	0.134	0.142	0.133	0.131	0.143	0.121
Hans. p-val.	0.395	0.687	0.736	0.990	0.920	0.990	0.990	1.000
Diff. Hans. J	0.876	0.605	0.909	1.000	0.911	1.000	1.000	1.000
	Panel B: Direct tax revenue							
SARA	0.011		0.040		0.040		-0.149	
	(0.042)		(0.041)		(0.039)		(0.134)	
SARA, years 1-2		0.048		0.018		-0.019		-0.611
		(0.046)		(0.175)		(0.178)		(0.555)
SARA, years 3-5		0.009		-0.025		-0.064		-0.695
		(0.041)		(0.179)		(0.189)		(0.572)
SARA, years 6-10		0.053		0.032		-0.009		-0.764
		(0.044)		(0.208)		(0.210)		(0.606)
SARA, years >10		0.043		0.019		-0.038		-0.403
		(0.031)		(0.253)		(0.261)		(1.027)
L.Direct	0.930***	0.911***	0.903***	0.873***	0.903***	0.884***	0.902***	0.935***
	(0.075)	(0.074)	(0.083)	(0.108)	(0.081)	(0.094)	(0.080)	(0.122)
N	990	990	990	990	990	990	990	990
Groups	44	44	44	44	44	44	44	44
# instr.	37	46	39	50	41	53	53	65
M1	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.001
M2	0.556	0.540	0.553	0.597	0.554	0.604	0.477	0.334
Hans. p-val.	0.039	0.215	0.066	0.522	0.190	0.783	0.794	0.994
Diff. Hans. J	0.181	0.783	0.111	0.901	0.117	0.919	0.157	0.513
	Panel C: Goods & services revenue							
SARA	0.082**		0.085**		0.086***		0.117***	
	(0.039)		(0.035)		(0.032)		(0.040)	
SARA, years 1-2		0.076		0.029		0.029		0.354*
		(0.052)		(0.072)		(0.077)		(0.183)
SARA, years 3-5		0.084		0.024		0.036		0.386*
		(0.057)		(0.076)		(0.077)		(0.201)
SARA, years 6-10		0.093*		-0.034		-0.011		0.402
		(0.056)		(0.106)		(0.100)		(0.256)
SARA, years >10		0.081		-0.048		-0.013		0.498
		(0.054)		(0.127)		(0.127)		(0.303)
L.indirect	0.908***	0.856***	0.920***	0.891***	0.913***	0.908***	0.835***	0.804***

Continued on next page

	(0.066)	(0.079)	(0.055)	(0.062)	(0.062)	(0.087)	(0.071)	(0.082)
N	984	984	984	984	984	984	984	984
Groups	46	46	46	46	46	46	46	46
# instr.	37	46	39	50	41	53	53	65
M1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
M2	0.577	0.619	0.560	0.536	0.575	0.570	0.655	0.769
Hans. p-val.	0.186	0.131	0.440	0.803	0.594	0.950	0.875	1.000
Diff. Hans. J	0.389	0.174	0.550	0.993	0.425	1.000	0.559	1.000
	Panel D: Trade tax revenue							
SARA	-0.038		-0.020		-0.053		-0.066	
	(0.114)		(0.108)		(0.103)		(0.119)	
SARA, years 1-2		-0.054		0.092		-0.256		-0.141
		(0.066)		(0.345)		(0.338)		(0.314)
SARA, years 3-5		-0.092		0.081		-0.277		-0.230
		(0.060)		(0.383)		(0.363)		(0.370)
SARA, years 6-10		-0.147**		0.017		-0.384		-0.332
		(0.068)		(0.389)		(0.387)		(0.371)
SARA, years >10		-0.326***		0.021		-0.541		-0.383
		(0.109)		(0.537)		(0.492)		(0.458)
L.Trade	0.773***	0.710***	0.797***	0.756***	0.804***	0.733***	0.769***	0.754***
	(0.103)	(0.094)	(0.090)	(0.099)	(0.076)	(0.097)	(0.083)	(0.101)
N	1037	1037	1037	1037	1037	1037	1037	1037
Groups	46	46	46	46	46	46	46	46
# instr.	37	46	39	50	41	53	53	65
M1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
M2	0.273	0.269	0.273	0.245	0.264	0.254	0.253	0.245
Hans. p-val.	0.016	0.451	0.067	0.449	0.172	0.908	0.431	0.999
Diff. Hans. J	0.017	0.305	0.023	0.566	0.035	0.741	0.471	1.000

Notes: The table reports the results of a system GMM estimation of the effect of SARAs on the log of tax revenue. Alternative lag lengths were used as shown at the top. Panel A presents the estimates for total tax revenue; Panel B for direct tax revenue; Panel C for revenue from goods and services and Panel D for trade tax revenue. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Robust standard errors in parentheses, the Windmeijer (2005) correction was applied. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Table A.10: Dynamic models, trimmed

	Within Estimates		Sys-GMM		CCEMG	
	I	II	III	IV	V	VI
	Panel A: Total tax revenue					
SARA	0.003		0.044		0.054	
	(0.019)		(0.055)		(0.037)	
SARA, years 1-2		0.004		0.044		0.015**
		(0.018)		(0.041)		(0.007)
SARA, years 3-5		-0.004		0.037		0.016
		(0.031)		(0.037)		(0.023)
SARA, years 6-10		-0.003		0.063		0.041
		(0.038)		(0.041)		(0.027)
SARA, years >10		-0.017		0.055		0.016
		(0.068)		(0.055)		(0.022)
L.Total	0.588***	0.588***	0.475***	0.492***	0.203***	0.194***
	(0.042)	(0.042)	(0.100)	(0.098)	(0.067)	(0.067)
N	1112	1112	1112	1112	909	909
Groups	46	46	46	46	46	46
adj. R-sq	0.683	0.683			0.377	0.416
# instr.			37	46		
M1			0.000	0.000		
M2			0.308	0.308		
Hans. p-val.			0.261	0.699		
Diff. Hans. J			0.781	0.993		
CD p-val.					0.919	0.747
	Panel B: Direct tax revenue					
SARA	0.020		0.023		0.055**	
	(0.042)		(0.062)		(0.026)	
SARA, years 1-2		0.056		0.040		-0.015
		(0.037)		(0.059)		(0.051)
SARA, years 3-5		0.007		0.016		-0.061
		(0.062)		(0.057)		(0.060)
SARA, years 6-10		0.022		0.042		-0.028
		(0.069)		(0.061)		(0.052)
SARA, years >10		0.105		0.046		0.009
		(0.104)		(0.069)		(0.013)
L.Direct	0.564***	0.561***	0.799***	0.782***	0.150	0.166
	(0.054)	(0.056)	(0.117)	(0.099)	(0.139)	(0.142)
N	879	879	879	879	722	722
Groups	44	44	44	44	44	44
adj. R-sq	0.693	0.694			0.961	0.967
# instr.			37	46		
M1			0.000	0.000		
M2			0.958	0.905		
Hans. p-val.			0.012	0.172		
Diff. Hans. J			0.052	0.629		
CD p-val.					0.006	0.003

Continued on next page

	Panel C: Goods & services revenue					
SARA	0.086**		0.145**		0.066**	
	(0.041)		(0.063)		(0.029)	
SARA, years 1-2		0.105**		0.143**		0.092*
		(0.051)		(0.070)		(0.048)
SARA, years 3-5		0.103**		0.149**		0.161
		(0.039)		(0.061)		(0.106)
SARA, years 6-10		0.198**		0.171**		0.258
		(0.079)		(0.076)		(0.165)
SARA, years >10		0.274**		0.146**		-0.001
		(0.117)		(0.070)		(0.031)
L.Goods & Services	0.524***	0.514***	0.753***	0.701***	0.367	0.403
	(0.060)	(0.059)	(0.129)	(0.094)	(0.246)	(0.248)
N	868	868	868	868	694	694
Groups	45	45	45	45	45	45
adj. R-sq	0.705	0.706			0.887	0.899
# instr.			37	46		
M1			0.000	0.000		
M2			0.844	0.983		
Hans. p-val.			0.234	0.507		
Diff. Hans. J			0.344	0.666		
CD p-val.					0.000	0.000
	Panel D: Trade tax revenue					
SARA	-0.062		-0.149		0.039	
	(0.055)		(0.096)		(0.057)	
SARA, years 1-2		-0.048		-0.120*		0.006
		(0.060)		(0.069)		(0.033)
SARA, years 3-5		-0.086		-0.130*		-0.014
		(0.078)		(0.078)		(0.072)
SARA, years 6-10		-0.224		-0.198**		-0.013
		(0.134)		(0.083)		(0.057)
SARA, years >10		-0.239		-0.258***		-0.024*
		(0.162)		(0.092)		(0.014)
L.Trade	0.569***	0.559***	0.709***	0.684***	0.176	0.149
	(0.060)	(0.062)	(0.094)	(0.084)	(0.110)	(0.109)
N	915	915	915	915	734	734
Groups	45	45	45	45	45	45
adj. R-sq	0.637	0.639			0.707	0.738
# instr.			37	46		
M1			0.000	0.000		
M2			0.704	0.715		
Hans. p-val.			0.098	0.660		
Diff. Hans. J			0.110	0.908		
CD p-val.					0.000	0.000

Notes: The table reports estimates of the effect of SARAs on the log of tax revenue. The original sample was trimmed at the top and bottom 5% percentile. Panel A presents the estimates for total tax revenue; Panel B for direct tax revenue; Panel C for revenue from goods and services and Panel D for trade tax revenue. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I through IV account for country and year fixed effects. Models I, II, V and VI include country-specific time trends. Standard errors in parentheses. Models I and II include robust standard errors clustered at the country level. In models III and IV Windmeijer (2005)'s finite sample correction was applied. Whereas models V and VI were corrected for small time series bias using Jackknife corrected standard errors. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Table A.11: 2SLS Results, trimmed

Panel A: Total tax revenue

	I	II
SARA	-0.038	-0.008
	(0.029)	(0.079)
L.Total	0.773***	0.599***
	(0.029)	(0.039)
Total aid	0.020*	0.024*
	(0.011)	(0.012)
IMF mid-term	0.014	0.013
	(0.010)	(0.011)
IMF short-term	0.014	0.015
	(0.020)	(0.025)
N	963	963
Groups	45	45
Country/Year	No	Yes
LM stat., p-val.	0.00	0.01
Kleibergen-Paap F-stat	46.26	10.86

Panel C: Goods & services revenue

	I	II
SARA	-0.095	0.123
	(0.104)	(0.140)
L.Goods & Services	0.717***	0.517***
	(0.053)	(0.055)
Total aid	-0.041*	-0.037*
	(0.022)	(0.022)
IMF mid-term	0.048**	0.024
	(0.021)	(0.021)
IMF short-term	0.019	0.008
	(0.048)	(0.055)
N	737	737
Groups	45	45
Country/Year	No	Yes
LM stat., p-val.	0.00	0.07
Kleibergen-Paap F-stat	19.90	4.25

Panel B: Direct tax revenue

	I	II
SARA	0.059	0.192
	(0.058)	(0.191)
L.Direct	0.771***	0.561***
	(0.030)	(0.048)
Total aid	0.006	0.018
	(0.016)	(0.027)
IMF mid-term	-0.021	-0.034
	(0.018)	(0.022)
IMF short-term	-0.030	-0.038
	(0.035)	(0.040)
N	761	761
Groups	41	41
Country/Year	No	Yes
LM stat., p-val.	0.00	0.05
Kleibergen-Paap F-stat	25.44	5.53

Panel D: Trade tax revenue

	I	II
SARA	-0.237**	-0.588***
	(0.093)	(0.216)
L.Trade	0.692***	0.548***
	(0.045)	(0.067)
Total aid	0.015	0.026
	(0.021)	(0.027)
IMF mid-term	0.015	0.033
	(0.024)	(0.031)
IMF short-term	-0.004	-0.022
	(0.041)	(0.049)
N	791	791
Groups	45	45
Country/Year	No	Yes
LM stat., p-val.	0.00	0.03
Kleibergen-Paap F-stat	25.60	5.25

Notes: The table reports the estimates of the second stage of a two-stage least squares estimation of the effect of a SARA on tax revenue. The original sample was trimmed at the top and bottom 5% percentile. The instrument was constructed following the three-step procedure described in the text (section 4.2) and exploits French and UK aid shares. Panel A reports the results on total tax revenue, Panel B on direct tax revenue, Panel C on revenue from goods and services taxation and Panel D on trade tax revenue. All models include country and year fixed effects. Column I excludes country-specific linear time trends, while they are included in column II. Robust standard errors in parentheses, clustered at the country level. ***$p \leq 0.01$, **$p \leq 0.05$, *$p \leq 0.1$.

Table A.12: Tax effort

	1980s	2010s
Angola	1.283	2.366
Benin	0.691	1.123
Botswana	1.797	1.532
Burkina Faso	0.559	0.803
Burundi	0.908	0.920
Cameroon	0.674	0.782
Cape Verde	0.788	1.272
Central African Republic	0.973	0.656
Chad	0.318	0.625
Comoros	0.852	0.946
Congo, Dem. Rep.	0.597	0.399
Congo, Rep.	2.173	0.465
Côte d'Ivoire	1.502	1.065
Djibouti	1.405	1.206
Equatorial Guinea	3.242	.
Eritrea	.	0.844
Ethiopia	.	0.768
Gabon	2.610	.
Gambia	0.823	0.796
Ghana	0.606	0.910
Guinea	0.979	0.902
Guinea-Bissau	0.409	0.519
Kenya	0.759	0.929
Liberia	1.703	2.050
Madagascar	0.675	0.651
Malawi	1.164	0.972
Mali	0.821	1.000
Mauritania	1.557	0.840
Mauritius	1.222	1.131
Mozambique	0.612	0.783
Namibia	.	1.596
Niger	0.617	0.850
Nigeria	.	0.647
Rwanda	0.729	0.796
Senegal	0.858	1.091
Seychelles	2.302	1.918
Sierra Leone	0.415	0.882
South Africa	1.262	1.516
Sudan	0.570	0.454
Swaziland	1.038	1.676
Tanzania	0.524	0.618
Togo	1.573	1.117
Uganda	0.454	0.634
Zambia	.	0.892
Total	*1.078*	*0.999*

Notes: Tax effort is measured as the ratio of actual collection over what should be collected given the economic structure of the country. The table presents decade averages of the estimated tax effort, given the available data.

Table A.13: Revenue volatility, alternative moving averages

	Static models				*Dynamic models*	
	Within estimates		CCEMG		Within estimates	
	I	II	III	IV	V	VI
	Panel A: 4 year moving average					
SARA	0.038		-0.138		0.006	
	(0.292)		(0.142)		(0.252)	
SARA, years 1-2		0.245		-0.030		0.112
		(0.257)		(0.128)		(0.249)
SARA, years 3-5		-0.143		-0.263		-0.177
		(0.436)		(0.205)		(0.379)
SARA, years 6-10		0.078		-0.310		-0.099
		(0.568)		(0.218)		(0.517)
SARA, years >10		0.163		-0.343		-0.235
		(0.888)		(0.216)		(0.830)
L.Total tax revenue					0.160***	0.159***
					(0.034)	(0.036)
N	1110	1110	1110	1110	1056	1056
Groups	46	46	46	46	46	46
adj. R-sq	0.061	0.060	0.135	0.177	0.096	0.094
CD p-val.			0.024	0.030		
	Panel B: 5 year moving average					
SARA	0.129		-0.039		0.044	
	(0.232)		(0.098)		(0.218)	
SARA, years 1-2		0.294*		0.049		0.159
		(0.171)		(0.087)		(0.185)
SARA, years 3-5		-0.156		-0.228		-0.230
		(0.366)		(0.190)		(0.331)
SARA, years 6-10		-0.254		-0.308		-0.373
		(0.515)		(0.239)		(0.490)
SARA, years >10		-0.447		-0.350*		-0.661
		(0.979)		(0.195)		(0.891)
L.Total tax revenue					0.198***	0.197***
					(0.036)	(0.035)
N	1056	1056	1056	1056	1004	1004
Groups	46	46	46	46	46	46
adj. R-sq	0.081	0.081	0.112	0.171	0.112	0.112
CD p-val.			0.037	0.048		

Notes: The table reports the estimates of the effect of SARAs on revenue volatility. Revenue volatility is measured as the absolute percentage deviation of total tax revenue from a four-year moving average in Panel A, and from a five-year moving average in Panel B. Uneven columns include a single before and after dummy, taking the value 1 if a SARA is present. Even columns include a series of SARA dummies capturing post-treatment effects. Models I, II, V and VI account for country and year fixed effects. All models include country-specific time trends. Standard errors in parentheses. Models I, II, V and VI include robust standard errors clustered at the country level. ***p $\leq$ 0.01, **p $\leq$ 0.05, *p $\leq$ 0.1.