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# Semi-Autonomous Revenue Authorities in Sub-Saharan Africa

## Silver Bullet or White Elephant*

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**Abstract**

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, which in turn should have made more resources available to fund improved public services. Yet 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. 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. This finding points to the need to revisit "business as usual" approaches to strengthening tax and public service delivery systems.

**JEL Classification:** H20, O23, O55

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

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# 1 Introduction

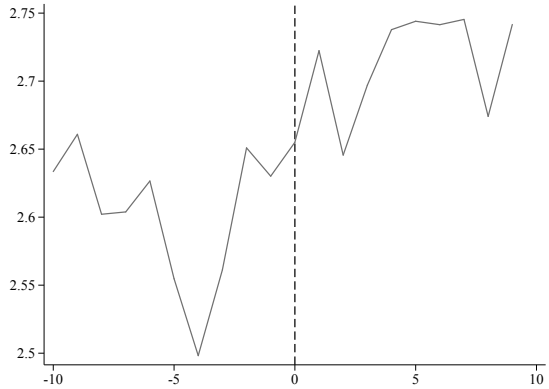
Increasing domestic resource mobilisation has been a key objective of international efforts to boost economic development since the 1950s. However, taxation and particularly its administration remain severely constrained in much of the developing world, especially in Sub-Saharan Africa where political corruption and patronage are said to be particularly problematic. Since the 1990s, reforms have increasingly focussed on ring-fencing tax administrations from political interference by setting up semi-autonomous revenue authorities (SARAs), which operate at arm's length from the ministry of finance. This political autonomy should improve tax compliance and collection because it signals a credible commitment to less discretionary tax collection, and because it creates managerial space to introduce business-like principles such as merit-based recruitment (Chand and Moene, 1999; Toma and Toma, 1992; Taliercio, 2004; Devas et al., 2001; Fjeldstad and Moore, 2009). However, due to its one-size-fits-all nature, the SARA reform possibly remains blind to local political and societal sensitivities, which risks to result in "square pegs for round holes" or isomorphic mimicry (Andrews, 2013; Pritchett et al., 2013). Moreover, by removing power from the executive the SARA reform could threaten the political bargain underlying the fiscal equilibrium and thereby undermine its own sustainability (Bird et al., 2008; Di John and Putzel, 2009; Therkildsen, 2004; Von Soest, 2006; Von Schiller, 2016).

Empirically, the revenue impact of SARAs is still unclear. At best, there is evidence for an initial, but unsustained revenue increase. Jenkins et al. (2000) conclude that experiences worldwide have been "impressive". However, initial increases were often not sustained nor caused by SARAs (Devas et al., 2001; Fjeldstad and Moore, 2009). Comparative case studies stress the importance of the political context for the effectiveness of SARAs (Di John, 2010; Mann, 2004; Von Soest, 2008). Econometric models, not accounting for revenue dynamics, find a positive effect. Von Haldenwang et al. (2014) show that Peruvian municipalities with a SARA collect more tax than municipalities without one. Ahlerup et al. (2015) conclude that in Sub-Saharan Africa (SSA) the introduction of a SARA resulted in an initial but unsustained revenue increase. Employing synthetic control methods, Ebeke et al. (2016) find a positive revenue effect, while Sarr (2016)'s results suggest considerable cross-country heterogeneity.

This paper re-evaluates the revenue gains from unified semi-autonomous revenue authorities in SSA. Relying on a panel of 46 countries between 1980 and 2012, we estimate this effect using, for the first time, dynamic panel methods to account for revenue dynamics. 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. We also

go beyond the total revenue effect and look at direct, goods & services, and trade taxation. We find suggestive evidence that the SARA reform has contributed to the shift away from trade taxes and towards increased taxation of goods and services. This suggests that SARAs are not only part of the global tax reform agenda, but have also contributed to its rise (Bird, 2013; Fjeldstad and Moore, 2008; Stewart, 2003).

**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 centred so that the introduction of a SARA in all countries takes place in year 0.

The paper contributes to the literature by addressing four challenges faced by existing empirical studies. First, by taking into account revenue dynamics, this paper provides more reliable estimates of the revenue effect of SARAs. As shown in Figure 1, the introduction of a SARA appears to be preceded by a temporary drop in the tax-to-GDP-ratio. This negative pre-treatment shock either indicates that individuals are pre-empting the introduction of a revenue authority by decreasing their compliance or that governments introduce a SARA in response to a revenue shock. The former seems unlikely given the temporary nature of the dip and the uncertainty that is usually associated with the timing of these reforms. The latter is more plausible and is supported by the literature (Fjeldstad and Moore, 2009; Mascagni, 2016). Either way, if not accounted for, as is the case in the existing literature, a pre-reform dip in revenue leads to an overestimation of the revenue effect of SARAs (Ashenfelter, 1978; Heckman and Smith, 1999).

Second, existing measures of SARAs are often imprecise, resulting in situations where countries are coded as having a SARA whereas in reality there is no such institution present[1].

[1]Certain studies assume that Ghana has continuously had a SARA since the late 1980s. In the 1980s Ghana had three separate semi-autonomous revenue administrations. However, 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).

Except for Sarr (2016), the sources underlying existing studies are often unclear. This leads to serious discrepancies in reported establishment years, as documented in Table A.1 in the Appendix. We overcome this by being precise and transparent about our SARA definition and by relying on primary data sources for our coding. Following Kidd and Crandall (2006), 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, but we extend it by imposing that it integrates customs and tax operations. This is motivated by the fact that all African SARAs now integrate these functions.

Third, 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 our SARA measure captures operational establishment.

Fourth, even when accounting for the dynamics of tax revenue, we cannot be completely certain that the presence of a SARA is not correlated with unobserved economic factors. Therefore, we instrument the presence of a SARA. The identification strategy builds on the observation that SARAs are often more likely to be established when the UK is an influential donor compared to situations where France is an important donor. Hence, we exploit the variation in the relative contributions to total aid by the UK and France to proxy for their agenda setting power. The underlying assumption is that these aid shares affect the presence of a SARA, but do not directly affect tax revenue, conditional on a number of controls. This strategy leads to results similar to our baseline findings.

The paper continues as follows: the next section describes the construction of our SARA variable and gives a description of the revenue data. Section 3 introduces the dynamic and instrumental frameworks used in the subsequent empirical analyses. Our baseline results are presented in Section 4. Before we conclude, section 5 examines the robustness of our results by widening our analysis to alternative measures of tax capacity. In addition, we examine one of the channels through which SARAs are said to affect revenue performance. These additional tests all confirm our initial conclusion; SARAs, at least on average, appear to have done little to increase tax capacity across Africa.

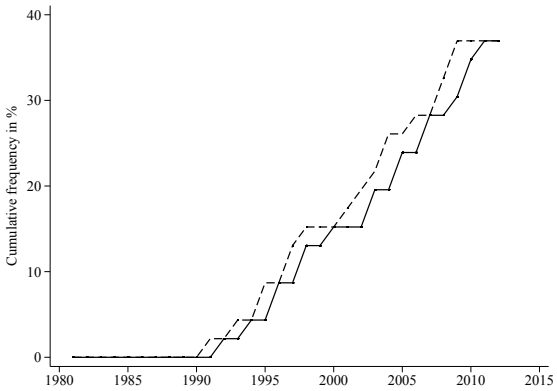
# 2 Data

For our analysis of the revenue effect of SARAs we use an unbalanced panel dataset covering 46 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. This should stack the deck against us. Including Zimbabwe into the sample unfairly biases our estimation towards a null-result. Almost immediately after establishing its SARA economic crisis struck Zimbabwe, leading to a collapse in the tax ratio. Out of the remaining 46 countries 17 established a SARA during the period under consideration.

Following the definition introduced above, we only consider unified semi-autonomous revenue authorities. This means, for instance, that we do not code Ghana as having had a SARA before 2009 for the reasons discussed in footnote 1. Neither do we consider Ethiopia to have had a SARA before 2009, because of similar reasons (Mascagni, 2016). In line with Mann (2004), we recognise that significant gaps might exist between legal creation and operational establishment. The latter is the main variable of interest, as we are arguably interested in the effect of the actual institutional change. The rise of the SARA from the early 1990s onwards is shown in Figure 2. The figure illustrates 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.

**Figure 2:** Spread of SARA reform



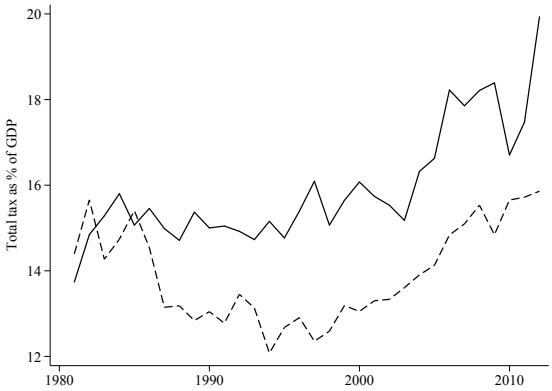

*Notes*: Figure 2 illustrates the spread of the SARA reform, measured as the percentage of countries in the sample which have a SARA in a given year. The dotted line represents legal creation, while the full line captures operational establishment.

To deal with this we code two separate dichotomous variables. 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. These dummies tell us whether a SARA was (legally or operationally) present in any given country at any given point in time. The former is instrumental for the coding of the latter. The official establishment acts of the SARAs were used to code the legal dummy. When these were unavailable secondary literature was consulted. Operational establishment was inferred from case studies and media reports. If no information was avail-

able, then the coding of operational establishment depended on legal creation. If the SARA was established before the 30th of June, then the operational dummy takes value one in the same year. If the SARA was created after June 30th, the operational dummy takes the value one starting from the next year. Table A.2 in the Appendix provides an overview of the dates and their sources, while Table A.1 compares dates across existing studies.

Our 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 the relation between taxation and development (Prichard, 2016). We 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.

**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.

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, 2010a,b). 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.

For parts of our analysis we rely on additional variables, including data on macroeconomic and political indicators. The precise definitions and sources of all variables are listed 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.

# 3 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. 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 erroneous omission of lagged revenue in econometric estimations will bias upwards the revenue effect of SARAs (Cameron and Trivedi, 2005, p.56). In this case, accounting for past revenue should bring down the SARA coefficient and provide a more reliable estimate of the revenue effect.

## 3.1 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. Since each model has its own assumptions, we include all three to address concerns that our results depend on specific assumptions.

Our first dynamic model is the standard within estimator:

$$y_{i,t} = \beta d_{i,t} + \gamma y_{i,t-1} + \alpha_i + \delta_t + t \times \alpha_i + \epsilon_{i,t} \tag{1}$$

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 $t$. 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 Ahlerup et al. (2015). This addresses the concern that strict exogeneity of the treatment fails due to persistence in the reform (Wooldridge, 2010). The vector $\alpha_i$ denotes a full set of country fixed effects, while $\delta_t$ is a full set of year effects. Country-specific linear time trends are included as well, $t \times \alpha_i$. Although the within estimate for $\gamma$ is not asymptotically consistent when $T$ is not large (Nickell, 1981), it will be our baseline model since the bias in $\beta$ should be negligible (Judson and Owen, 1999).

Secondly, we estimate equation 1 using the system GMM estimator which produces consistent estimates for dynamic panel models for finite $T$. Moreover, it deals with simultaneity and omitted variable bias as regressors are "internally" instrumented by their lags. The system GMM is chosen over the difference GMM since the SARA dummy is a persistent process and because past changes in the SARA dummy convey reasonable information about its present level (Blundell and Bond, 1998). With a relatively large $T$ there is a danger of instrument proliferation, which could weaken key test statistics (Roodman, 2009). It is therefore sensible to restrict the number of instruments. Hence, 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 $h = \{2, 3\}$, which corresponds to the single moment condition:

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

where $w_{i,t-h}$ are the instruments. 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)'s finite sample correction, else we would risk downward biased standard errors. 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. We 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 is also tested. While $\Delta\epsilon_{i,t}$ is likely to be first-order correlated (AR1), it should not be second-order correlated (AR2).

Thirdly, we employ a Common Correlated Effects Mean Group estimator (CCEMG). When dealing with macro-panels, which often involve a large $T$, 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). Allowing for heterogeneous parameters is a particularly important advantage over GMM which will be biased if the true effect of SARAs is heterogeneous across countries (Soderbom et al., 2015). 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. Failing to control for the latter would lead to cross-section bias. CCEMG estimators introduce cross-section means of the dependent and independent variables into the estimation to account for this (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, formally:

$$y_{i,t} = \beta_i d_{i,t} + \gamma_i y_{i,t-1} + \sum_{l=0}^{p} \delta_{i,l} \bar{z}_{t-l} + \alpha_i + t_i + \epsilon_{i,t} \tag{3}$$

where $\bar{z}_t = (\bar{y}_{t-1}, \bar{x}_t)$, $p$ is the number of lags (which in our case will be 3, given that $T = 31.5$) and $t_i$ is a country-specific (linear) trend. We test for cross-section dependence (CD) using Pesaran (2004)'s test.

## 3.2 Instrumental Variable Approach

To deal with time-varying omitted variables, we resort to an instrumental variable (IV) estimator. The motivation for our IV strategy builds on the observation that SARAs are often established under severe donor pressure. Case study evidence suggests that the United Kingdom, in particular, has championed the SARA reform in the developing world (Fjeldstad and Moore, 2008, 2009; Von Soest, 2006; Devas et al., 2001). This is in contrast to France which, traditionally, favours more centralist policies (Schedler and Proeller, 2002). Comparing French and UK aid programmes, Caulfield (2006) finds the latter focus more heavily on the establishment of executive agencies, such as SARAs, in SSA. The observation that there are hardly any SARAs in francophone Africa further supports this argument. Hence, the assumption underlying the IV strategy is that SARAs are more likely if the UK has more agenda setting power in country $i$. In contrast, SARAs should be less likely when France is a more important donor. We operationalise agenda setting power by the UK's and France's relative contributions to total aid revenue received by country $i$.

As applied in Adams et al. (2009), we follow a three-step procedure described by Wooldridge (2010). First, we estimate a probit model of $d_{i,t}$ on $z_{i,t}$ and a set of controls $x_{i,t}$:

$$Pr(d_{i,t} = 1 | z_{i,t}, x_{i,t}, \bar{z}_i, \bar{x}_i) = \Phi(\theta_0 + \theta_1 UKAidShare_{i,t} + \theta_2 FrAidShare_{i,t} + \phi x_{i,t} + \pi \bar{z}_i + \sigma \bar{x}_i) \tag{4}$$

where $\Phi(-)$ is the cumulative distribution function, $x_{i,t}$ is a vector of control variables which includes: total net aid received by country $i$, the identity of the former coloniser, the presence of a short- and mid-term IMF programme and a linear time trend. To take into account the nature of our data, we include the Chamberlain-Mundlak device or the means of the explanatory variables, $\bar{z}_i$ and $\bar{x}_i$, to account for country-fixed effects (Chamberlain, 1982; Mundlak, 1978). Next, we compute the fitted probabilities $\hat{p}$. Finally, we estimate $\beta$ using a

two-stage least squares model with $\hat{p}$ as the instrument:

$$\begin{aligned} y_{i,t} = &\quad \beta d_{i,t} + \gamma_1 y_{i,t-1} + \mu_1 x_{i,t} + \alpha_i + \delta_t + t \times \alpha_i + \epsilon_{i,t} \\ d_{i,t} = &\quad \pi \hat{p}_{i,t} + \gamma_2 y_{i,t-1} + \mu_2 x_{i,t} + \alpha_i + \delta_t + t \times \alpha_i + u_{i,t} \end{aligned} \tag{5}$$

The identification strategy relies on the exclusion restriction that, conditional on the included controls, the agenda setting power of the UK and France, proxied by their aid shares, only affects taxation through the SARA reform. While there is an extensive literature on the relationship between total foreign aid and taxation (e.g. Clist, 2016; Morrissey et al., 2014; Morrissey, 2015), it is unlikely that individual donors affect tax revenues other than through the reforms they support. Conversely, while the donor community as a whole might be moved by tax issues, which we account for by controlling for total aid, we are not aware of reasons why the UK and France would have a particular (and opposing) interest in taxation. 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.

# 4 Results

## 4.1 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. If this is the case, then the inclusion of the lagged tax revenue should bring down the SARA coefficient.

In Table 1 we present the results of our dynamic models specified in subsection 3.1. Each panel represents a different type of tax with the relevant summary statistics and test statics included at the bottom. In uneven columns 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.

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. 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, we do not report the fixed effects or the country-specific time trends. The reported standard errors are clustered at the country level.

Examining the first panel of Table 1, 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 suggests 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 highly significant. 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 impacted 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 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.

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, the GMM estimation does not include country-specific time trends. 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 1:** 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. 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. We do 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.5 in the Appendix contains the results. 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 can 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. Static models were most likely picking up a recovery effect which would have occurred regardless of the SARA reform. However, there does appear to be some 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 have been instrumental in advancing this agenda.

## 4.2 IV Estimation

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 in sub-section 3.2, 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 results from the first stage probit model are given in Table 2. The reported coefficients are the average partial effects. Column I only includes the aid shares, while in column II we add in the controls. The Chamberlain-Mundlak device is included in column III. The predicted values from the third specification will be used in the two-stage least squares estimation. The results shown here are merely illustrative. We will formally test the validity of the predicted probabilities as instruments when we discuss Table 3.

**Table 2:** Determinants 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 is the presence of a SARA. 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. SARAs are also more likely if countries are experiencing a reduction in contemporary aid, possibly because they are forced to invest more in domestic resource mobilisation to make up for the shortfall in aid. As opposed to short-term programmes, medium-term IMF programmes increase the likelihood of a SARA reform. This is to be expected given their more conditional nature and the IMF's reputation

**Table 3:** Second stage results of a 2SLS estimation of the effect of SARAs 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 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 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 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 3.2) 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.

as a supporter of the SARA reform. Finally, the linear time trend is highly significant, which corresponds to our discussion of Figure 2.

Table 3 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 5, 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 3. 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 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. These findings further strengthen our scepticism about a positive revenue impact of SARAs in Sub-Saharan Africa.

# 5 Alternative Outcomes

In this section we broaden the scope of our analysis with a number of alternative outcome measures. The analysis 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).

First, we examine the impact of semi-autonomous revenue authorities on the government's tax effort. The government's tax effort is 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. Appendix A.1 provides more detail on the precise estimation of the tax effort.

Next, we turn to tax 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 tax revenue volatility as the absolute percentage deviation, but from a three-year moving average instead of a quadratic trend. See appendix A.2 for details.

Finally, we look at an intermediate variable linking the SARA reform to increased rev-

enue, control of corruption. Addressing corruption was one of the key reasons for establishing SARAs. Reducing the political dependence of tax administrations and reforming their HR management would lower corruption, increase professionalism and ultimately result in higher revenue (Chand and Moene, 1999; Jenkins, 1994). Fjeldstad (2003) indeed finds that corruption initially decreased after the Tanzania Revenue Authority was created, but later increased again. To examine the corruption effect of SARAs we use three corruption measures: political corruption, public sector and executive corruption. We examine all three indicators, but are particularly interested in the public sector corruption index since it explicitly attempts to get at the "use of public office for personal gain" in the bureaucracy.

To test these hypotheses, we rerun our baseline dynamic model presented in equation 1, but replace the dependent variable with our alternative outcome variables. We only present the baseline model and not the system GMM or CCEMG estimators. However, the results are robust to the various estimation strategies (Dom, 2017).

The results in table 4 provide no support for a significant effect of SARAs on any of the alternative outcomes. For tax effort we note that the total number of countries has dropped to 44 since we are unable to estimate the tax effort for Lesotho and Sao Tome and Principe due to missing trade data. The coefficients on the SARA dummies are generally close to zero, suggesting that SARAs have not had an impact on tax efforts across Sub-Saharan Africa. While in the tax volatility model the SARA coefficient appears sizeable, it is not statistically significant. Finally, in the corruption models we lose one country as we do not have corruption data for Equatorial Guinea. Across the different specifications there is little evidence for any effect from SARAs on corruption.

This section broadened the scope of our assessment of SARAs by looking at their impact on a number of alternative indicators. The inclusion of tax effort and tax 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 SARAs on either tax effort, volatility or corruption. We take this as confirmation of our baseline results and conclude that overall SARAs have done little to improve the tax capacity of African states.

**Table 4:** Alternative outcome measures

| | Tax Effort<br>I | Tax Volatility<br>II | Political Corruption<br>III | Public Sector Corruption<br>IV | Executive Corruption<br>V |
|---|---|---|---|---|---|
| | *Panel A: SARA before-after* | | | | |
| SARA | -0.010 | -0.209 | -0.006 | -0.007 | -0.002 |
| | (0.032) | (0.309) | (0.006) | (0.009) | (0.007) |
| L.Tax effort | 0.696*** | | | | |
| | (0.086) | | | | |
| L.Volatility, total tax revenue | | 0.087*** | | | |
| | | (0.032) | | | |
| L.Political corruption | | | 0.823*** | | |
| | | | (0.029) | | |
| L.Public sector corruption | | | | 0.812*** | |
| | | | | (0.028) | |
| L.Executive corruption | | | | | 0.815*** |
| | | | | | (0.020) |
| N | 1132 | 1110 | 1379 | 1379 | 1379 |
| Groups | 44 | 46 | 45 | 45 | 45 |
| adj. R-sq | 0.638 | 0.066 | 0.840 | 0.824 | 0.824 |
| | *Panel B: SARA over time* | | | | |
| SARA, years 1-2 | -0.008 | -0.222 | -0.003 | -0.002 | -0.000 |
| | (0.024) | (0.355) | (0.005) | (0.009) | (0.005) |
| SARA, years 3-5 | -0.032 | -0.172 | -0.009 | -0.008 | 0.001 |
| | (0.048) | (0.372) | (0.007) | (0.011) | (0.007) |
| SARA, years 6-10 | -0.058 | -0.307 | -0.019 | -0.010 | -0.014 |
| | (0.054) | (0.507) | (0.015) | (0.018) | (0.020) |
| SARA, years >10 | -0.108 | -0.257 | -0.019 | -0.002 | -0.006 |
| | (0.080) | (0.680) | (0.017) | (0.021) | (0.018) |
| L.Tax effort | 0.693*** | | | | |
| | (0.085) | | | | |
| L.Volatility, total tax revenue | | 0.087*** | | | |
| | | (0.032) | | | |
| L.Political corruption | | | 0.821*** | | |
| | | | (0.028) | | |
| L.Public sector corruption | | | | 0.812*** | |
| | | | | (0.028) | |
| L.Executive corruption | | | | | 0.815*** |
| | | | | | (0.020) |
| N | 1132 | 1110 | 1379 | 1379 | 1379 |
| Groups | 44 | 46 | 45 | 45 | 45 |
| adj. R-sq | 0.637 | 0.064 | 0.840 | 0.824 | 0.824 |

*Notes*: The table reports the estimated effects of SARAs on several alternative outcome measures. (I) Tax effort is measured as the ratio of actual tax collection over what should be collected given the economic structure of the country. (II) Tax volatility is measured as the absolute percentage deviation of total tax revenue from a three-year moving average. (III) Aggregate measure of political corruption. (IV) Combined measure of public sector bribery and embezzlement. (V) Combined measure of executive bribery and embezzlement. Panel A includes a single before and after dummy, taking the value 1 if a SARA is present. Panel B includes a series of SARA dummies capturing post-treatment effects. All models account for country and year fixed effects as well as 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.

# 6 Conclusion

Over the past 30 years semi-autonomous revenue authorities (SARAs) have been introduced across Sub-Saharan Africa. By ring-fencing tax administrations from politics and by introducing new public management practices, this reform would boost tax collection. However, the empirical evidence on the revenue effect of the SARA reform is limited and inconclusive. At best, it points to an initial but unsustained revenue gain. Moreover, this existing literature fails to account for the dynamics in tax revenue, which leads to an overestimation of the revenue effect of SARAs since the SARA reform often followed a negative revenue shock.

This paper re-examines the revenue effect of semi-autonomous revenue authorities in Sub-Saharan Africa, taking into account revenue dynamics. We show that once revenue dynamics are controlled for, the positive revenue effect of SARAs disappears. This results is consistent across different dynamic panel estimators. Moreover, it holds true when we instrument for the presence of a SARA using donor influence. Overall, there is little statistical evidence for a systematic relationship between SARAs and total tax revenues in SSA. This is confirmed when we extend the analysis to alternative measures of tax capacity, specifically tax effort and revenue volatility. Moreover, corruption, one of the channels through which SARAs are argued to raise revenue, is unaffected by their presence. Earlier estimations which omit past revenue are, therefore, most likely picking up a recovery effect, which would have occurred anyway, as opposed to a causal revenue effect.

Nevertheless, we do find suggestive evidence that SARAs have contributed to a compositional shift in revenue patterns. Across our estimations, the effect of SARAs on direct tax revenue is consistently positive, though economically negligible. Interestingly, following the introduction of a SARA revenues from taxes on goods and services seem to have increased at the expense of trade taxation. This suggests that SARAs are not only part of the so-called global tax reform agenda, but they have also been instrumental in its advancement.

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, since our scope was limited to the average revenue effect of SARAs across Africa, this paper does not claim that SARAs never work. The lack of an average effect might be masking context-specific effects, as stressed by the case study literature. 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.

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# A Appendix

**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 | http://www.ura.go.ug | Mann (2004) |
| Zambia | 1993 | 1994 | http://www.zambia.gov.zm | http://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:** 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.

## A.1 Tax Effort

The tax effort variable is calculated as follows:

$$TaxEffort_{i,t} = \frac{Tax_{i,t}}{\widehat{Tax_{i,t}}} \quad (6)$$

$$Tax_{i,t} = \beta X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t} \quad (7)$$

where $\widehat{Tax_{i,t}}$ is the country's taxable capacity, or its predicted total tax revenue given equation 7. This predicted revenue is the result of an estimation which takes into account country, $\alpha_i$, and year, $\delta_t$, 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-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. As before, we log-transform the tax effort variable.

## A.2 Tax Revenue Volatility

For every country $i$ in each year $t$ we measure tax revenue volatility as follows:

$$Vol_{i,t} = \frac{abs(Tax_{i,t} - \overline{Tax}_{i,t})}{\overline{Tax}_{i,t}} \tag{8}$$

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:

$$\overline{Tax}_{i,t} = \frac{1}{n}\sum_{s=1}^{n} Tax_{i,t-s} \tag{9}$$

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.