Impact of Growth on Tax Revenue in Africa

by

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Abstract

The positive correlation of tax to GDP and GDP per capita at the global level suggests that developing country growth reduces aid dependence by mobilizing domestic revenues (DRM) to finance public expenditure. Income status upgrades by the World Bank represent milestones in this transition and may anticipate a decline in aid precipitating an increase in tax collection to complement the shortfall in government revenue. Applying the synthetic control method (SCM) and synthetic difference-in-differences (SDID) to countries with sufficient data in the UNU-WIDER GRD tax database and the WDI, I investigate whether the income status upgrades raise tax and other government revenue in sub-Saharan Africa (SSA). Results show that upgrades may induce a rise in government/tax revenue in per capita terms, but not relative to GDP. Extensive robustness checks confirm that per capita growth does not raise the tax to GDP ratio.

Key words: synthetic control method (SCM); synthetic difference-in-differences; tax revenue; income status; development aid; sub-Saharan Africa.

JEL codes: H20, H27, H71, O11, O40, O55

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1. Introduction

As less developed countries (LDCs) grow, they are expected to reduce aid dependence by domestic revenue mobilization (DRM) in financing public expenditure. Schumpeter (1918) viewed taxation and state capacity as intertwined, and Besley and Persson (2013) further associated them with governance, institutions and the rule of law. The shift towards increased reliance on taxation is viewed as a strategy to address the accountability issues associated with public funds. Despite the potential of associated benefits ranging from reduced corruption to improved data, especially for low-income African countries, the path to self-sufficiency in public funding has proved a long and winding road.

While the relationship between tax to GDP ratios and GDP are positive at the global level, it is not clear whether growth per capita leads to higher tax to GDP ratios in low and lower middle-income countries, or whether the correlation is due to country fixed effects. While World Bank OurWorldinData[2] figures show a positive relationship between tax per GDP and GDP per capita, the underlying data from the UNU-WIDER GRD database shows that the average SSA tax to GDP ratio rose only about 1.4% from 1985 to 14.6% in 2020, while government revenue per GDP remained unchanged at about 17.6% for available countries. Prior research by Gnangnon & Brun (2018) and McNabb (2018) has found income levels to affect the relationships between growth, aid and tax revenue. While it is obvious that development aid is no longer given to high income countries, Galiani et al (2017) find crossing the IDA threshold to induce a sharp drop in aid. In contrast to ample research on the impact of aid and tax on economic growth, to my knowledge there is no evidence on the impact of economic growth on tax revenue, particularly from Africa.

The purpose of this paper is to fill this gap by exploiting the signal effect of World Bank income status category upgrades before and after crossing the IDA threshold on government and tax revenue in sub-Saharan African (SSA) countries. They are perceived as milestones in economic growth and serve as the primary determinant of access to aid. As income status upgrades raise expectations of a decline in aid, they may prompt replenishments to budget funding from a compensatory structural shift to DRM and other sources.

As the income status upgrades result from per capita income growth, the impact of economic growth on tax revenue can be studied. I adopt a transparent and credible identification strategy that refrains from data manipulation and cherry-picking, while allowing causal inference in small samples. This is ensured by applying the data-driven SCM and SDID methods which construct valid and unique counterfactuals, while averting specification searches and extrapolation (Abadie, 2021). These methods are particularly suitable to analyze resource dependent and volatile SSA economies as they construct a counterfactual based on similar fluctuations, thus controlling for them. The availability of tax data for 1980 – 2022 in the UNU-WIDER GRD tax database allows for sufficient pre- and postintervention periods for many upgrades. At the same time, the lack of economic growth in Africa ensures a large "donor" pool of similar African countries to construct the counterfactual from. Thus, the synthetic counterfactuals control for both time varying and fixed effects. Additional predictors are sought from the WDI database for robustness checks.

Results show an upgrade to rarely affect tax and other government revenue per GDP. This paper contributes to the literature with evidence on the impact of economic growth on tax revenue in sub-Saharan Africa (SSA). Policy-wise it dismantles *ceteris paribus* false expectations of tax ratio increases with economic growth. The following section reviews the related literature. Section three

[2] https://ourworldindata.org/grapher/tax-revenues-vs-gdp-per-capita.

describes the synthetic control and synthetic differences in differences methods, and how the data aligns to their demands, including specifics on countries in the synthetic control donor pool, time periods, variables, and data sources. The fourth section presents the results, and section five concludes.

2. Literature

While the relationship between the tax-to-GDP ratio and GDP is positive at the global level, it remains unclear whether income growth generates higher tax-to-GDP ratios in low and lower middle-income countries. Prior research has found income levels to affect the relationships between growth, aid and tax revenue, but the evidence concerns the impact of taxes on growth rather than *vice versa*. There is ample research on the impact of aid on economic growth and tax revenue, but limited evidence on how per capita growth is translated into tax revenue. Applying simple regression analysis, Glenday et al (2019) find the shift from low income (L) to lower middle income (LM) to be correlated with the largest increase in DRM, of 5.9% of GDP, related to structural transformation from informal and agricultural sectors losing share to imports in GDP and declining aid[3], suggesting upgrade impacts to be significant indeed.

In contrast, there is a large literature on the impact of tax revenue on growth. Prichard (2016) argues the evidence supporting the IMF and World Bank proposition of taxes being detrimental to growth rests mostly on developed countries due to data restrictions. For developing countries, Gaspar et al (2016) find higher tax rates to accelerate growth, with the tipping point found at about 13 percent (excluding social contributions), after which growth acceleration generates 7.5 percent higher per capita GDP after ten years. Arvin et al (2021) find that institutional quality, government expenditure and tax revenue to promote economic growth in low-income and lower middle-income countries. Gnangnon (2022) applies GMM to a sample of 101 developing countries over the period of 1980 to 2019 to find tax transition reform to promote economic growth. Applying the ICTD UNU-WIDER Government Revenue Dataset, McNabb (2018) finds a negative relationship between income taxes and growth, but results to differ by income level. According to him doubts raised for instance by Easterly & Rebelo (1993) of taxation affecting growth have been replaced by which type of taxes, where and how much. Consistent with Acosta-Ormaechea & Yoo (2012), McNabb (2014) finds modest but statistically significant effects for revenue neutral shifts from trade taxes to personal and corporate income taxes to reduce growth.

There is ample evidence on the displacement effect of aid on tax revenue. Aid and tax can be viewed as alternative sources of government revenue according to Morrissey (2015). Gupta et al (2004) find high aid levels to reduce the incentives for politically costly tax collection. Similarly Bräutigam and Knack (2004) and Remmer (2004) find aid to reduce tax collection. Thornton (2014) applies IV to find a significant decline in the tax to GDP ratio following aid inflows, the result being driven by grants. Combes et al (2016) find aid to have significant fiscal, including tax displacement effects, with adverse impacts being more pronounced by low governance scores and absorptive capacity, and IMF-supported programs. For sub-Saharan Africa, Addison & Levin (2012) find the tax to GDP ratio to benefit from more openness and peacefulness, and less agriculture, people and aid. Benedek *et al.*, (2014) find a negative impact from grants on tax collection, and a positive impact of loans. Gnangnon & Brun (2018) find the impact of aid on countries' non-resource tax revenue to depend on their income level, while the correlation between grants and taxes emerges from the low tax bases and high levels of aid prevalent in low-income

[3] Aid per GDP is about is about 2.5% LICs, 0.8% in LMICs and 0.2% in UMICs (Glenday et al 2019).

countries. Crivelli & Gupta (2017) find IMF conditionality to alleviate the potential negative effect of foreign aid on tax revenues in the absence of weak institutions. Bayale (2020) finds the negative effect on tax revenues to depend on the type of aid. Brown & Martinez-Vazquez (2019) find the expectation of debt forgiveness to discourage the tax effort. Yet, results are not uniform. Prichard's (2016) literature review finds conflicting evidence on the impact of aid on tax revenue. Clist & Morrissey (2011) find no consistent effect, and Brun et al., (2008) find the tax impact to depend on institutional quality. Carter (2013) found results weak in terms of robustness to appropriate econometric methods. Clist (2014) was not able to replicate the studies due to apparent data issues.

3. Data and Methodology

3.1 The Synthetic Control Method (SCM)

With a few aggregate entities, such as regions or countries, it may not be possible to find a single unaffected unit that provides a suitable counterfactual for the treated unit. The synthetic control method introduced by Abadie & Gardeazabal (2003) and developed further by Abadie et al. (2010, 2015) is based on the idea that combinations of unaffected units offer a better counterfactual than any single unaffected unit alone. A synthetic control is defined as a weighted combination of the units in the donor pool, i.e., untreated units selected to reflect characteristics of the treated unit prior to the intervention using a data driven procedure. In contrast to conventional panel data methods, such as difference in differences that control only for confounding factors that are time-invariant or share a common trend, the synthetic control method allows the effect of unobservable confounding factors to vary with time. Abadie (2021) lists the advantages of the SCM as no extrapolation, transparency of fit, safeguard against specification searches, transparency of the counterfactual, and sparsity (unlike regression estimator, synthetic controls are typically unique and sparse). Previously it has been applied to economic liberalization (Billmeier & Nannicini, 2013), the economic effects of Hugo Chavez (Grier & Maynard 2016), natural disasters (Cavallo et al 2013), and inflation targeting (Lee 2010), and the impact of oil revenues on domestic taxation (Keller 2022) among others.

The formalization of the generalized SCM is presented in detail, for example, in Wiltshire (2022). Only the simplified case of one treated unit, a uniform time span and one predictor (outcome) variable following his notation is presented below for the classic SCM case by which I refer to the original Abadie & Gardeazabal (2003) method. In addition to the treated unit $j=1$, there are J units in time periods 1, 2, ..., T. There are T_0 pre-treatment periods and $T - T_0 > 0$ treated periods. That is, unit 1 becomes exposed to the intervention from period $T_0 + 1$ onwards until the last period T. The untreated J units are potential controls, the so-called donor pool. Let x_1 be the predictor of Y_{1t} in the treated unit ($j=1$), while x_0 is a vector of respective ($J - 1$) donor pool predictors for Y_{jt}. Let Y_{1t}^N indicate the potential outcomes for the non-treated units. The synthetic counterfactual estimator identifies a weighted average of donor pool units:

$$\hat{Y}_{1t}{}^{N} = \sum_{j=2}^{J+1} \hat{w}_j Y_{jt} \qquad \text{for all t,} \qquad (1)$$

which can be used to estimate the treatment effect $\hat{\tau}_{jt} = Y_{jt} - \hat{Y}_{jt}{}^{N}$. Since in this case the matrix of weights on the predictor variables is a vector of outcomes only, $w = (w_2, ..., w_{J+1})'$ is a collection of weights, with $w_j \geq 0$ for $j = 2, ..., J+1$, which sum to one ($w_2 + \cdots + w_{J+1} = 1$). The SCM seeks to minimize the mean squared prediction error (MSPE) over the entire pre-treatment period. The SCM

selects $\widehat{w}_j$to minimize $\sqrt{(x_1 - w_2x_2 - \ldots - w_{J+1}x_{J+1})^2}$, which can also be expressed more conveniently as

$$\|x_1 - x_0w\| = \sqrt{(x_0 - x_1w)' V (x_0 - x_1w)}, \qquad (2)$$

where V is a diagonal matrix of the weights that define the relative importance of each value in x_1 and the corresponding value in x_0w^*. Abadie & Gardeazabal (2003) and Abadie et al. (2010, 2015) have proposed a data-driven selector of V, but there are others. If $x_1$does not belong to the convex hull of the columns of x_0, w^* is unique and sparse, i.e., it has few nonzero elements. This is likely with only one treated unit (Abadie & Cattaneo 2018).

As listed by Abadie (2021), there are several contextual and data requirements to using the SCM appropriately. To begin with, it is necessary to exclude all those countries from the donor pool that lack sufficient pre- and post-treatment periods. While there is no clear rule, the synthetic control estimator should steadily track the trajectory of the outcome variable for several pre- and post-intervention periods to avoid overfitting. The risk increases with the number of predictors and when there are spurious associations between common and non-common factors. Hence, the number of predictor variables is limited and only those cases treated that offer sufficient pre-treatment periods.

Second, the convex hull condition requires that the treated countries' dependent variables show no such extremes that the donors cannot synthetically replicate them. Third, to avoid interpolation biases and overfitting, treated and donor units should be comparable. The aim of the SCM is to build a donor group which ideally approximates the treated country had it not been treated in all dimensions except for the treatment assignment. When the unit is a country, ideal control units are few due to differing demographic, legislative, historical, cultural and economic characteristics. The number of control units is further reduced by the need to restrict the donor pool "to units with outcomes that are thought to be driven by the same structural process as for the unit representing the case of interest" (Abadie et al., 2015, p.3). To maximize the number of donor countries, all less developed countries with available key variables from the 1980's to 2021 that did not experience a change in their income status are included in the donor pool.

The similarity requirement conflicts with the no-interference-across-units criterion. It requires that there are no spillovers from income status upgrades on the donor countries. While an income status upgrade may divert aid flows from the upgrade country to potential synthetic control donor countries, tax revenue in a donor country is unlikely affected. Neighboring African countries are therefore kept among the donors as they best fulfill the similarity requirement.

Fourth, Abadie et al. (2015) have warned against applying the SCM in the presence of structural breaks. Abadie (2021) specifies the requirement to mean that it is "*important to eliminate from the donor pool any units that may have suffered large idiosyncratic shocks to the outcome of interest during the study period, if it is judged that such shocks would not have affected the outcome of the unit of interest in the absence of the intervention*." That is, it is necessary to eliminate all donor countries that have experienced a structural break on their tax revenue due to the income status upgrade of the treated country. Since an income status upgrade cannot cause structural breaks in tax revenue in potential synthetic control countries, this risk is absent. Nevertheless, as the key aspect of a structural break is that it may change the predictor variables of the outcome, the main analysis is carried out using only lagged outcomes as predictors, as they are guaranteed not to change by structural breaks.

It is also necessary that the approaching income status upgrade had no effect on tax revenue during the pre-treatment period. Otherwise, the SC may be biased by the reactions based on expectations of forward-looking economic agents (Abadie 2021). While anticipatory tax increases could signal declining aid dependence, the incentives for them are weak. Anticipation effects can be observed in the figures and tested by backward-dating. Meanwhile, reverse causality from increased tax collection to government expenditure for instance in infrastructure investment raising economic growth leading to an income status upgrade is a possibility. Sound economic policies accelerate economic growth. Assuming that policy-makers strive to improve their country's GNI per capita, the actual timing of the income status upgrade is more likely a fairly exogenous event, as it depends on external factors such as raw material prices, weather conditions, the global interest rate, aid, etc., that are beyond the control of policy-makers. Hence the pre-treatment donor outcomes (and predictors) can be assumed to consistently predict the pretreatment synthetic control.

Hollingsworth & Wing (2022) list also omitted variable bias and dormant factors as threats to the validity of SCM results. According to Hollingsworth & Wing (2022), omitted variable bias is a concern if there are time-varying factors that affect the treated unit, but not the donors. These could be tax policy and institutional changes to adapt to the income status upgrade. The impact of such policy changes and other omitted variables can, however, be considered integral parts of the adaptation to tax revenue impacts. In addition, there may be dormant factors that are collinear with tax revenue in the pre-period – yet diverge as the upgrade comes into effect. It is, however, difficult to pinpoint any such effects. The methodology allows one to estimate the ability of tax revenue to grow with the relaxation of constraints in the presence of various dormant factors, unobserved fixed or variable effects, or exogenous shocks. Be what they may, the research question is how the SSA economies have been able to harness tax revenue regardless of uncontrolled variables such as exogenous shocks, dormant and/or unobserved variables.

3.2 Synthetic difference-in-differences (SDiD)

The synthetic control method necessitates that a good pre-treatment fit to be reliable, which is not always possible with the available similar donors that fulfill the requirements. The synthetic difference-in-differences (SDiD) relies on less stringent prerequisites combining most of the benefits of the SC and the standard difference-in-differences (DiD) methods. Since the DiD is biased if the parallel trends assumption is not fulfilled, the DiD results are reported in the results tables for information purposes only.

Developed by Arkhangelsky et al., (2021), SDiD seeks to combine the virtues of difference in differences and the SCM by choosing unit weights that approximate parallel trends between control and treated units prior to treatment (Clarke et al 2023, page 5). Relative to the synthetic control, it adds a constant fixed effect, μ, unit fixed effects, α_i, and time weights, δ_t, to the estimation of the treatment effect that minimizes the difference between pre- and post-treatment period for the controls, resulting in a smaller standard error than the SCM. The intercept places the synthetic control at a different level from the treated unit, but with the same pretreatment trend. Meanwhile, the time weights present in SDiD, allow focusing on the more similar periods relative to the post-intervention period. Following Facure (2022), for a synthetic control treatment effect of

$$\hat{\tau}^{sc} = argmin\left\{\sum_{i=1}^{N} \sum_{t=1}^{T} (Y_{it} - \beta_t - \tau D_{it})^2 \widehat{w}_i^{sc}\right\} \quad (3)$$

the respective SDID can be formalized as follows:

$$\hat{\tau}^{sdid} = argmin\left\{\sum_{i=1}^{N}\sum_{t=1}^{T}\left(Y_{it} - (\mu + \alpha_i + \beta_t + \tau D_{it}\right)^2 \widehat{w_i}^{sdid}\widehat{\delta_t}^{sdid}\right\} \quad (4).$$

The only requirement placed by the SDiD method is that units are exposed to treatment forever after by assumption (Clarke et al 2023). However, excluding countries that received a downgrade after the upgrade involves selection. Hence, some reversals, such as Mauritania that experienced a downgrade and re-upgrade in the following two years of the initial upgrade and Senegal that was downgraded in 2015 and upgraded again in 2018, are shown in the results tables.

3.3 The income categorization

Since 1989, the World Bank categorizes countries into low- (L), lower-middle- (LM), upper-middle- (UM) and high-income (H) economies. The categorization is based on GNI per capita in U.S. dollars, converted from local currency using the Atlas method. The limits of these categorizes are checked annually for inflation to keep the real standard of living indicator thresholds constant over time. While having no operational implications for the World Bank, the categories represent globally harmonized thresholds that signal milestones in economic development that influence aid allocations. According to UN-DESA (2022), income per capita is the primary factor determining access to grants and concessional finance, although various vulnerability metrics also play a role. As income per capita grows, the interest rates on concessional loans rise and their maturities shorten. In 2022, most of Africa was categorized low or lower-middle income, most of Latin America upper-middle income, while Asia and Oceania differed by region.[4] Progress in raising tax to GDP ratios has been slow and varying. According to the Gaspar et al. (2023), in 2020 tax to GDP ratios of roughly two-thirds of low-income countries were less than 15 percent.

IDA eligibility requires GNI per capita to be below the IDA operational cut-off, (which was $1,315 in fiscal year 2024), and/or lack creditworthiness for International Bank for Reconstruction and Development (IBRD) borrowing. In the early 1990's, many SSA countries fell back to low-income status and reversed their IDA graduation. They include the Republic of Congo (in 1994), Cameroon (in 1994), Ghana, Kenya, Mauritania, Nigeria (1989), Senegal, Sudan and Zambia. These reversals added macroeconomic, debt, vulnerability, institutional, poverty and social indicators to the calculation. Dobronogov *et al.*'s (2020) statistical model of IDA graduation for 1987-2016, found graduation to be associated with creditworthiness and country size in terms of population, in addition to income per capita. After 1998, also life expectancy, reduced poverty, urbanization, and institutional development have been significant predictors of graduation. Few SSA countries, such as Seychelles, Mauritius (in 1975) and Namibia, South Africa and Botswana have graduated from IDA eligibility or have not been eligible to begin with.[5] In 2023, Africa received 75 percent of the total IDA commitments, Kenya, Nigeria and Senegal of sample countries featuring among the top 10 borrowers. [6]

Countries that prioritize access to aid and debt relief may not wish to graduate from IDA eligibility, as this may cost 20 % in bilateral aid flows according to Knack et al. (2013). Kerner et al. (2017) find that "less revised GNI per capita data display patterns that are consistent with aid-seeking data

[4] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.
[5] https://ida.worldbank.org/en/about/borrowing-countries
[6] Resource rich SSA countries, namely Chad, Equatorial Guinea, Gabon, Mauritania, Nigeria and the Republic of the Congo received rents and royalties over 5% of GDP in recent years and 32 % declines in them. In addition, oil generated over 25% of export revenue in Cameroon, Ghana and Togo. According to the OECD (2023, page 107), African rents and royalties follow the price of crude oil. Although ore, raw metal, diamond and other mineral exports have outgrown the value of fossil fuels, this is not true for government revenue. (OECD 2023, page 107ss).

management among aid-dependent countries". Anecdotal evidence from Omanufeme (2014) reports that the rebasing[7] of Nigerian GDP in 2000 was pushed off until 2014 for fear of acceding to medium income status and losing access to multilateral aid and grants, as well as debt relief or forgiveness being considered by the G8 at the time. In consequence, Nigeria's GDP almost doubled to $510 billion in 2013 making it the largest African economy accounting for almost one third of sub-Saharan African GDP. Kenya's 2013 revision raised it to lower-middle-income status.[8] As political leaders may push for an income status upgrade or manipulate data (Christensen & Breed 2022)[9] to appear successful, relevant data is checked at the World Bank and shifts decided only based on revised data.

3.4 Treated units and data transformations

To allow for sufficient pre- and post-treatment observations considering that many observations are missing in the first and last years of the UNU-WIDER GRD database, treated units were those that received an income status upgrade in 1990-2017. Developing countries that did not receive an upgrade are potential donor countries to the synthetic control (Table 3). IDA graduation is not included in the basic treatment as SSA cases are few. Results are analyzed for differences before and after IDA graduation.

The sample consists of all such countries for which data is available, whose treatment is not confused by downgrades, allowing sufficient pre- and post-treatment data (Table 2). Missing income status values were replaced if the last and subsequent available status were the same. If status data was unavailable for the early years, the first available status was applied. If status was unavailable for the last years, the last available status categorization was applied. As the SCM requires strongly balanced data, the pre- and post-year average was imputed for those countries and key variables for which the number of missing observations was small. Otherwise, the country was removed from the analysis. All observations for 2022 were removed due to the lack of key tax data. In practice, the availability of government revenue per GDP excluding grants, obtained from the GRD database, defined the sample. At the baseline, the impact was studied separately for each country in order to maximize the number of treated units, donors, and pre- and post-treatment periods. Summary statistics for treated and donor countries are reported by initial income status in Table 1.

SSA countries that were upgraded from lower income to lower middle-income status include Ghana in 2010, Zambia in 2010, the Republic of Congo in 2005, Kenya in 2014, Nigeria in 2005, Sudan in 2007, Mauritania in 2010, Cameroon in 2005 and Senegal in 2009. The last two were downgraded in 1994, so that the pretreatment periods start only in 1994 for both. Mauritania was downgraded in 2011 and upgraded again in 2012, but since there is only one year between the upgrades and downgrades, Mauritania is kept in the sample. There are two upgrades from lower middle-income status to upper-middle-income status: Mauritius in 1992 and Namibia in 2008. Only one country, Seychelles received an upgrade to high income status in 2014. Some were excluded due to the late

[7] Rebasing gross domestic product (GDP) means that the methods and base data used to calculate GDP are revised, providing governments with a clearer picture of their fiscal positions and potential revenue bases. In 2014 alone, Kenya, Nigeria, Tanzania, Uganda, and Zambia all completed rebasing exercises, which led to significant revaluations of their GDPs: Nigeria's latest (2013) GDP nearly doubled, Tanzania's grew by a third, Kenya's and Zambia's increased by a quarter, and Uganda's rose by 13 percent (Brookings 2015).
[8] Nigeria: Why Nigeria Delayed GDP Rebasing for Twenty-Four Years - allAfrica.com, https://allafrica.com/stories/201404060011.html
[9] https://devinit.org/blog/data-behind-debate-over-ugandas-income-status/.

occasion of the upgrade that does not allow for a sufficient post-intervention period[10]. Others experienced shifts back and forth, such as Equatorial Guinea[11], South Africa[12], Angola[13], Botswana[14], and Lesotho[15]. To maximize the number of treated countries, those time spans that allowed for sufficient pre- and post-treatment periods were included and shifts back and forth within two years were ignored. Moreover, as I am interested in observing changes in tax revenue due to manifestations of per capita growth, anticipation or lagged effects are interesting. Countries that hover back and forth around the upgrade, are therefore included despite the obvious anticipation risks involved. These impacts are discussed, and the synthetic control effects estimated for available upgrade years.

Final estimations including tax data were run on a balanced sample from 1995 to 2020 as this provides the same large donor pool for all treated countries. Not surprisingly, pretreatment fits are better for this sample, but it excludes Mauritius which was upgraded in 1992. Data either on taxes or government revenue was missing for China, Nigeria, Cameroon, and Ivory Coast.

As for WDI sourced predictors, NODA was missing for many, while IDA eligibility was constant for many. Additional covariates for tax and government revenue to GDP were identified with by machined learning, namely LASSO. As a balanced panel was necessary, only rural population, women in business and law, and the adjusted savings predictors made it to the final covariates along with GDP per capita.

3.5 IDA graduation

IDA graduation is rarely associated with an income status upgrade, but it influences the aid and debt reduction outlook. The expectation is that at least tax per capita should be positively impacted by the income status upgrade after IDA graduation. Botswana IDA graduated already in 1974, Eswatini in 1975 and Mauritius in 1975. South Africa, Seychelles and Namibia have never been eligible to IDA funding. IDA graduates with available data in the SSA are limited to resource rich Equatorial Guinea (1999[16]) and Angola (2014)[17], which were both downgraded subsequently (Equatorial Guinea in 2015 and Angola in 2016). Results for them are shown for limited time periods before the downgrades. Their economic growth is highly volatile and related to oil and gas exports.[18]

Further robustness is sought beyond the SSA, from countries such as North Macedonia (IDA 2002, upgrade 2008), Albania (IDA 2008, upgrade 2012), Armenia (201 IDA 2014, upgrade 20174), Azerbaijan (2011), Bosnia and Herzegovina (2014), Montenegro (2008), Serbia (2007/2008), Georgia (2014 status downgrade in 2016), St Kitts and Nevis (IDA 1994, upgrade 2011), India (2014), Vietnam (2017), as well as two relapsed graduates after their graduation from re-eligibility,

[10] Namely, Benin (LM in 2019), Comoros (LM in 2018), Guinea, Tanzania (LM in 2019), and Zimbabwe (L in 1991 and LM in 2018).
[11] LM in 1997, L in 2001, UM in 2004, H in 2007, and UM in 2015.
[12] UM88_LM98_UM99_LM01_UM04.
[13] LM87_L95_LM04_UM11_LM16.
[14] UM91_LM93_UM97.
[15] LM in 1995, L in 1996, LM in 2005.
[16] Although Equatorial Guinea graduated in 1993, it maintained IDA eligibility until 1999.
[17] Angola's tax to GDP declined significantly in 2014, following a rapid increase in resource revenue and GDP. World oil prices collapsed in 2015 leading to the subsequent downgrade in 2016.
[18] Results for Equatorial Guinea and Angola are shown because they are the only non-reversed IDA graduations in the time frame for which data is available.

namely Egypt (1991 relapse-1999 graduation) and Indonesia (1999 relapse – 2008 graduate). They are complemented by China (IDA 1999[19], upgrade 2010).[20]

3.6 The outcome variables

In addition to the choice of units in the donor pool, the other significant way the design of a study may influence results is the choice of predictors of the outcome variable. Even Abadie et al. (2015) have been criticized by Klößner et al. (2018) for applying a cross-validation technique depending on non-uniquely defined predictor weights resulting in different results when using a different ordering of variables. Following Ferman et al (2020), to remove suspicions of cherry-picking predictors for suitable outcomes, only pre-treatment outcomes are used as predictors. There are, in fact, several other good reasons to this restriction. Not only is restricting predictors to pre-intervention outcomes common practice in the literature, of which Botosaru and Ferman (2019) provide a non-exhaustive list, this approach maximizes the number of donors and preintervention periods, as an initial training period to select the predictors that would shorten the validation period, raising the risk of a spurious fit, is unnecessary. While this risk can be reduced by using powerful predictors (Abadie 2021), data on them may not be available for all. Furthermore, Kaul et al. (2022) show that pre-intervention outcomes render all other predictors irrelevant when all pre-intervention outcomes are used to estimate the weights of the synthetic control. Most importantly, warnings (e.g., Abadie 2021) of applying the SCM over periods witnessing large idiosyncratic shocks on the outcome variable, are related to their impact on predictor variables, as they may no longer be appropriate as a result. Past tax revenue can be expected to remain appropriate to predict future tax revenue[21]. Moreover, all attempts with various predictors resulted in worse pre-treatment fits even for bias-corrected synthetic controls.

The three outcome variables are tax and government revenue per GDP, as well as government revenue per capita. Per capita revenue is measured in constant 2015 US dollars. The data source for tax data is the UNU-WIDER GRD (2023) database and the World Development Indicators (WDI) database for GDP per capita in constant 2015 US dollars. If the revenue per GDP excluding grants and social contributions[22] was missing, it was substituted by revenue per GDP excluding grants and social contributions[23] provided that the magnitude of the two series is approximately the same[24]. The (total government) revenue per GDP excluding grants in the GRD database differs from tax revenue by including also non-tax revenue[25] unless otherwise mentioned. Taxes include resource-based taxes. Total government revenue excluding grants is hereafter used synonymously with its principal component, tax revenue, unless separately mentioned.

[19] Government revenue data excluding grants is available for China only from 2005 onwards.
[20] Source: https://ida.worldbank.org/en/about/borrowing-countries/ida-graduates.
[21] While structural change may favor some aspect more than another, the basic mechanisms affecting productivity growth do not change.
[22] Variable ”rev_ex_gr_ex_sc” in UNU-WIDER GRD(2023) database, with “tax_ex_sc” for taxes respectively.
[23] Variable “rev_ex_gr_inc_sc” UNU-WIDER GRD(2023) database, with “tax_inc_sc” for taxes respectively.
[24] For detailed variable descriptions, see https://www.wider.unu.edu/sites/default/files/Publications/Technical-note/PDF/tn2021-11-GRD-variable-description.pdf
[25] Non-tax revenue refers to revenue collected by the government that does not fall into tax, grant or social contributions categories, including property income, sales of goods and services, fines, penalties, and forfeits, transfers not classified elsewhere, and premiums, fees, and claims related to nonlife insurance and standardized guarantee schemes.

4. Results

4.1 Panel regression estimation results

OLS and fixed effects per capita regressions show negative correlation between aid and tax revenue for African as well as upper-middle-income countries (Table 5). Government and tax revenues correlated negatively with net official development aid (NODA). The correlation supports the point of departure of income status upgrades predict future declines in aid that need to be compensated by tax revenue. While the substitution effect may dominate in Africa, the impact may truly kick in only at the upper-middle income country level. This confirms findings that NODA substitutes for other forms of revenue. It is in line with the assumption that African governments complement falls in NODA by increasing tax and other government revenues. Hence, it may be that aid reduces pressure on tax collection, and *vice versa*. Meanwhile, the positive correlation of tax and government revenue per GDP with NODA per capita may follow from decreased NODA per capita as GDP grows, as increased GDP reduces the tax to GDP ratio.

As aid is more available to IDA eligible countries, passing its threshold may mark an increased dependence on DRM. Consistently with the literature review in section 2a, IDA eligibility is reversely associated with tax revenue per GDP at the global level and upper-middle-income countries when controlling for country fixed effects (Table 6). In per capita terms, IDA eligibility is negatively correlated with both government and tax revenue when introduced separately, though the correlation is significant only for the global, low and lower-middle-income panels. (High income is excluded as none of them are IDA eligible). IDA eligible countries enjoy more aid and concessional finance per capita and may therefore compensate tax and other revenue with it. Hence, there may be threshold effects associated with aid. Lack of significance in aid dependent SSA is surprising, however, and needs further inspection.

For tax and government revenue per capita, the correlation with GDP per capita is highly significant for all income categories (Table 4). Considering the negative correlation with aid per capita, income status upgrades may indeed prompt an increase in tax and government revenue in per capita terms. The global correlation between GDP per capita and tax/ government revenue per GDP is only partially significant when country fixed effects are controlled for. For high-income countries, the relationship is actually negative though insignificant. The premise that income status upgrades precipitate tax or government revenue increases (by means of more vigorous tax collection, additional or higher taxes), is sound particularly for the upper-middle-income category. These are countries for which NODA per capita is negatively correlated with tax and government revenue per capita suggesting a shift from ODA to tax or government revenue. Their number is low in Africa. In sum, the regressions support the point of departure that tax revenue can be expected to grow with income status upgrades and eventual loss of IDA eligibility. I now examine causality.

4.2 Synthetic Control Estimates

The income status upgrade impacts were estimated with the synthetic control method, the synthetic difference in differences as well as difference in differences for comparison. For brevity, results are reported without covariates in the Tables and Figures section, as covariates rarely improved significance or fit. Due to high variation in the tax data, 3-year averages were taken. Synthetic control results are relied on when the pre-treatment fit is reasonably good, but in the case of poor pre-treatment fits or pre-trends, the SDID results are considered more reliable than the SC and DID results due to the method's less stringent requirements. Figures 1a – 4b present the synthetic control results. They (Figures 1a – 4b) do not reveal any systematic lags or leads in the income status impact. Hence no backdating tests on anticipation effects are carried out.

Results varied somewhat depending on the donor pool. Various donor pools were tested ranging from Africa, low-income, low & lower-middle-income to the global level. If the donor group includes all those countries that did not experience changes in the income status during the treatment period (Tables 11a to 13b), the income status upgrades rarely have an impact on tax or government revenue in African countries. Figures reveal that apparent significances are in many cases not supported by good pre-treatment fits (e.g. Angola and Seychelles) Figures 3b and 3c suggest an increase in revenue per GDP and tax per GDP for Lesotho and Mauritania (2012), but revenue per capita developments (Figure 1b) show that this may be due to a decline in GDP rather than an increase in tax revenue. In other parts of the world, Georgia is an exception to the rule.

Donor Pool According to Income Group

In contrast, if African economies are compared only to other African countries, the more advanced and richer African economies show significant increases in their tax per capita levels, but rarely in terms of tax revenue per GDP. Rather than the IDA threshold, this result is driven by higher per capita incomes in the treated economies. That is, the positive impacts for revenue per capita in IDA ineligible SSA countries is driven by their higher GDP per capita and hence higher revenue per capita level relative to poorer SSA countries. Methodologically, this finding points towards the need to use only similar countries as donors for constructing the synthetic counterfactual. Their number was, however, often too low to generate good pre-treatment fits. This was true particularly for the middle-income groups, leading to poor pretreatment fits and thus unreliable results in many cases. Results from regressions on the respective income level are shown in Tables 7a to 10c. As Tables 7a to 8c show, per capita impacts were often significant, while per GDP effects (Tables 9a to 10c) remained often insignificant or negative significant. Government revenue per capita (in constant 2015 US dollars) was more likely to increase with the income status upgrades when the donor pool was formed same initial income level countries (Tables 7a-8b). This was particularly true for IDA graduated or ineligible countries (Tables 8a-8b). While the income status upgrade generally raised tax per capita, results on tax per GDP were modest. Any significant impacts appear exceptions, and often they were negative.

Low and Lower-Middle-Income Country Donor Pool

To obtain better pre-treatment fits while maintaining comparability of the donors, low and lower-middle-income countries were pooled together (Tables 14a to 16b). This includes almost all African upgrades, as only Seychelles experienced an upgrade from upper-middle-income to high-income status. Results remained mostly insignificant for African countries with few exceptions. The lack of significance could be due to suboptimal predictors limited by the number of donors. Various initially LASSO selected predictors were tested for significance impacts. While some predictors were left out from the results tables. Moreover, as the predictors failed to improve pre-treatment fits, insignificance cannot be due to a lack of appropriate predictors. Overall, tax to GDP results were in line with government revenue per GDP results, and there is nothing to suggest that the tax to GDP ratio will increase as African economies grow.

4.3 Potential reasons for the results

Potential reasons for the lack of impact on tax to GDP ratio are numerous. Countries that lack data may use tax revenue data as an input in the estimation of economic growth. In these countries, there should exist a mechanical link between output and tax revenue that may remove the impact of growth on tax to GDP ratios. Yet, high volatility in government and tax revenue per GDP deteriorated pretreatment fits in the sample countries to the point that they had to be smoothed by using 3-year outcome averages. Hence, a mechanical link cannot explain the result.

Tax collectors may not have updated their presumptive taxation estimates with rapid GDP growth, and there may be a general lack of political will to raise taxes, resulting in economic growth outpacing tax revenue collection or tax reductions. Indeed, some countries appear to respond negatively, generating less taxes after economic growth. Blend countries are close to the IDA threshold. They include Cabo Verde, Cameroon, Congo, Kenya, and Nigeria. Cabo Verde is the only donor in this group. Among the treated blend countries, revenue per GDP increased only in the Congo when compared to the same income group. Figure 3b, however suggests that revenue per GDP declined after the upgrade. Resource rich countries, such as Nigeria, tend to rely on other than tax revenue for government expenditure.

The lack of significant impact on government revenue per GDP in SSA countries may be related to IDA eligibility, which gives access to aid and concessional loans as alternative sources of budget funding. Declining aid inflows may not be compensated by politically risky tax increases if there are alternative sources of public finance, emerging for instance from renewed access to international capital markets, as happened after the debt relief round of the early and mid-2000's. The financial and euro crises kept interest rates low after 2009[26] leading investors to seek higher returns from risky assets. In addition, China channeled its massive current account surpluses to overseas investment, including Africa, through for instance its Belt and Road initiative from 2012 onwards. Commodity price hikes may also open access to private financing in resource rich countries.

Income status upgrades may seem politically desirable demonstrations of good economic management, in contrast to IDA graduation which may reduce aid, debt relief and increase the price of loans. Hence, income status upgrades may be due to falsification of growth data[27].

Rapid population growth reduces tax growth relative to GDP, but as it also postpones an upgrade based on GNI per capita, it cannot explain tax results, only low per capita growth in the SSA on average. In Kenya the upgrade resulted from the rebasing of GDP rather than real economic growth. Many countries, such as Sudan, suffer from internal conflicts.

4.3 Spillovers

The no interference requirement across units means that a country's upgrade should not affect tax outcomes in the donor countries. This is plausible for tax revenue. For instance, Seychelles' upgrade to high-income status in 2014 was accompanied by income status upgrades e.g., in Kenya, Bangladesh, Myanmar and Paraguay and IDA graduations in Angola, Armenia, Bosnia and Herzegovina, India, Georgia and Tajikistan. The upgrades may have raised tax expectations increasing capital flight to tax havens, but results for Seychelles were insignificant, and the treated tax havens, Mauritius, Seychelles[28] and St. Kitts and Nevis differed in their impacts. Beyond potential regional spillovers in aid impacts, the links between status upgrades and growth in donor countries are limited to regional growth spillovers.

[26] https://www.macrotrends.net/2015/fed-funds-rate-historical-chart

[27] Despite the statistical checks made by the World Bank prior to income status upgrades, for instance Tanzania's upgrade to lower-middle-income status in 2019 has been suggested to have resulted from the falsification of growth statistics. Source: The Economist, July 23rd 2020, "Why Tanzania's statistics look fishy".

[28] Income from foreign sources is tax exempt in the Seychelles. Mauritius has offered competitive taxes and tax incentives to foreign investors, combined with negligible transparency requirements for corporate reporting.

Aid flows, in contrast, may be diverted from a status upgrade country to SC or SDID donor pool countries that have not been upgraded[29]. NODA is surprisingly volatile, which may be due to various issues, such as crisis support, disbursement time schedules, etc. Yet the volatility may mask long term trends, while it is evident that the public finance ship needs to be turned slowly starting early on. Overall, the share of aid in SSA government revenue is only half of what it was in the 1990's, peaking in per capita terms in 2011[30].

5. Conclusions

With a transparent and credible identification strategy that refrains from data manipulation and cherry-picking when applying the synthetic control and synthetic difference in differences methods, this paper explores the revenue impact of income status upgrades of the World Bank. The absence of predictor variables beyond the pre-intervention values of the outcome insulates the analysis from potentially confounding structural breaks and cherry-picking. The method is appropriate to study the issue in cyclical raw material price dependent Africa as it automatically forms the synthetic control from donor countries that follow the same economic cycles.

The income status upgrade representing GNI growth per capita, may translate into tax and other government revenue growth per capita, but not in relation to GDP. When the synthetic control is constructed from countries at a similar initial level of development, there is little evidence to suggest that tax to GDP increases with per capita growth in the SSA. The positive effect on tax per capita, but not on tax per GDP implies that in SSA tax revenue grows with output, not tax rates or tax collection effort. IDA eligibility has little impact on tax to GDP ratios, although IDA ineligible countries cannot rely on aid inflows for budget financing or seek debt reduction at advantageous IDA terms.

The policy implication of this result is that *ceteris paribus* assumptions of increasing tax to GDP ratios are likely to backfire. This concerns both government expenditure as well as long term solvency estimates that provide the basis for borrowing or lending decisions. A specific aid focus on DRM appears necessary to remove obstacles to tax revenue generation. Whether this is sufficient is another matter. Possible causes such as a substitution of tax by aid in Africa, is left for further research.

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[29] In practice, Seychelles, Mauritius, Namibia, Botswana, Equatorial Guinea, Angola, and South Africa continue to receive grants, despite being ineligible to IDA terms in funding and debt relief.

[30] The Economist, Jan 11th 2020, "African governments are trying to collect more tax".

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Tables

Table 1. Descriptive statistics for all and by initial income status for 3-year dependent variable averages, i.e., government revenue per capita (in constant 2015 USD), government revenue per GDP (in percent) and tax revenue per GDP (, in percent)

	N	Mean	SD	Median	1st Perc.	99th Perc.
Revenue/ capita	3276	463040.95	760780.223	111043.29	2981.682	4119043
Revenue/ GDP	3276	24.97	11.993	22.688	6.711	56.312
Tax/ GDP	3276	17.898	8.005	17.482	1.31	44.923

Initial Income Status

Low income

	N	Mean	SD	Median	1st Perc.	99th Perc.
Revenue/ capita	1196	37373.001	53087.317	18758.069	2359.61	272391.88
Revenue/ GDP	1196	17.102	9.083	14.928	5.765	48.02
Tax/ GDP	1196	13.057	6.968	11.37	4.479	40.953

Lower-Middle-Income

	N	Mean	SD	Median	1st Perc.	99th Perc.
Revenue/ capita	1040	153233.44	113764.620	118733.53	27493.762	563039.94
Revenue/ GDP	1040	23.899	7.465	22.359	10.831	42.707
Tax/ GDP	1040	18.455	5.110	18.084	8.086	31.421

Upper-Middle-Income

	N	Mean	SD	Median	1st Perc.	99th Perc.
Revenue/ capita	624	1752170	897419.046	1604471.2	343553.03	4504086.5
Revenue/ GDP	624	38.623	11.713	38.077	11.345	66.349
Tax/ GDP	624	24.973	8.733	26.535	.892	47.034

Table 2. List of treated countries

Sub-Saharan Africa				
		Before IDA graduation	**IDA graduation**	**After IDA graduation**
Angola	L-UM	(1995), 2004, 2011	2014	(2016)
Botswana	LM-UM		1974	1991, (1993), 1997
Cameroon	L-LM	2005	1981 (1994)	
Congo, Rep. of the	L-LM	2005	1982 (1994)	
Cote d'Ivoire	L-LM	(1993), 2008		
Equatorial Guinea	L-H	1997	1993/1999	(2001), 2004, 2007, (2015)
Ghana	L-LM	2010		
Kenya	L-LM	2014		
Lesotho	L-LM	1995, (1996), 2005		
Mauritania	L-LM	2010, (2011), 2012		
Mauritius	LM-H		1975	1992, 2019, (2020)
Namibia	LM-UM		Ineligible	2008
Nigeria	L-LM	2008	1965 (1989)	
Senegal	L-LM	(1994), 2009, (2015), 2018		
Seychelles	UM-H			2014
South Africa	LM-UM		Ineligible	1988, (1998), 1999, (2001), 2004
Sudan	L-LM	2007, (2019)		
Zambia	L-LM	2010, (2021), 2022		

Other countries				
		Before IDA graduation	**IDA graduation**	**After IDA graduation**
Albania	L-UM	(1993), 1996, (1997), 1998	2008	2009, (2011), 2012
Armenia	L-UM	(1993), 2002	2014	2017
Azerbaijan	L-UM	(1994), 2003, 2009	2011	
Bolivia	LM		2017	
Bosnia and Herzegovina	L-UM	(1993), 1998, 2008	2014	
China	L-UM	1997, (1998), 1999	1999	2010
Egypt	L-LM	1995	1981, (1991), 1999	(1990)
Georgia	L-UM	(1993), 1996, (1999), 2003	2014	2015, (2016), 2018
India	L-LM	2007	2014	
Indonesia	L-UM	2003	1980, (1999), 2008	1993, (1998), 2019, (2020), 2022
Montenegro	UM		2008	
North Macedonia	LM-UM		2002	2008
Saint Kitts and Nevis	UM-H		1994	2011
Serbia	UM		2008	
Vietnam	L-LM	2009	2017	

Note: Parentheses signify a reversal, i.e. income status downgrade or reversal back to IDA eligibility.

Table 3. List of donor countries

SSA	
Donors	**IDA Donors**
Burkina Faso, Burundi, Cabo Verde, Central African Republic, Chad, Congo, Democratic Republic of the, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, The, Guinea-Bissau, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Rwanda, Sierra Leone, Somalia, Togo, Uganda	Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Congo, Democratic Republic of the, Eritrea, Ethiopia, Gabon, Gambia, The, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda

Other	
Donors	**IDA Donors**
Afghanistan, Andorra, Australia, Austria, Bahamas, The, Belgium, Bermuda, Bolivia, British Virgin Islands, Brunei Darussalam, Canada, Cayman Islands, Curacao, Denmark, Djibouti, Faroe Islands, Finland, France, French Polynesia, Germany, Greenland, Hong Kong SAR, China, Iceland, Ireland, Israel, Italy, Japan, Kiribati, Kuwait, Libya, Liechtenstein, Luxembourg, Micronesia, Federated States of, Monaco, Montenegro, Morocco, Netherlands, New Zealand, Norway, Philippines, Qatar, San Marino, Serbia, Singapore, Spain, St. Martin (French part), Sweden, Switzerland, Turks and Caicos Islands, United Arab Emirates, United Kingdom, United States, Vanuatu, Virgin Islands (U.S.)	Afghanistan, Algeria, American Samoa, Andorra, Antigua and Barbuda, Argentina, Aruba, Australia, Austria, Bahamas, The, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Bermuda, Brazil, British Virgin Islands, Brunei Darussalam, Bulgaria, Cambodia, Canada, Cayman Islands, Croatia, Cuba, Curacao, Cyprus, Czechia, Denmark, Djibouti, Estonia, Faroe Islands, Finland, France, French Polynesia, Germany, Gibraltar, Greece, Greenland, Guam, Guatemala, Haiti, Hong Kong SAR, China, Hungary, Iceland, Iran, Iraq, Ireland, Isle of Man, Israel, Italy, Jamaica, Japan, Kazakhstan, Kiribati, Korea, Dem. People's Rep., Kosovo, Kuwait, Kyrgyzstan, Lao PDR, Latvia, Libya, Liechtenstein, Lithuania, Luxembourg, Macao, China, Malaysia, Maldives, Malta, Marshall Islands, Mexico, Micronesia, Federated States of, Monaco, Myanmar, Nauru, Nepal, Netherlands, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Pakistan, Palau, Panama, Peru, Poland, Portugal, Puerto Rico, Qatar, Romania, Russian Federation, Samoa, San Marino, Saudi Arabia, Singapore, Slovakia, Slovenia, Solomon Islands, Spain, St. Martin (French part), Suriname, Sweden, Switzerland, Tajikistan, Timor-Leste, Tonga, Trinidad and Tobago, Turkmenistan, Turks and Caicos Islands, Tuvalu, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, Virgin Islands (U.S.), Yemen

OLS and Panel Regression Results

Table 4. Fixed effects regressions with GPD per capita in constant 2015 USD as an explanatory variable

IDA_eligible	OLS global with all xvars	Panel global with all xvars	Panel global	Africa	Low income	Lower-middle-income	Upper-middle income	High income
Tax per GDP	-0.00	0.00***	0.00	0.00	0.00	0.00**	0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Revenue per GDP	0.00*	0.00***	0.00	0.00	0.00***	0.00	0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tax per capita	27.90***	29.89***	33.25***	28.26***	28.63***	26.60***	39.17***	30.99***
	(2.34)	(2.57)	(3.30)	(2.05)	(1.85)	(1.91)	(3.54)	(4.21)
Revenue per capita	27.72***	29.53***	33.14***	28.27***	28.64***	26.61***	38.81***	30.99***
	(2.34)	(2.52)	(3.30)	(2.04)	(1.85)	(1.91)	(3.76)	(4.21)
Observations	4,477	4,477	5,672	1,572	2,122	1,666	609	877
R-squared	0.82	0.44	0.00	0.03	0.12	0.00	0.01	
Number of cno		166	190	48	67	55	20	29

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

Table 5. Fixed effects regressions with net official development aid per capita as an explanatory variable

IDA_eligible	OLS global with all xvars	Panel global with all xvars	Panel global	Africa	Low income	Lower-middle-income	Upper-middle income	High income
Tax per GDP	0.00***	0.00	0.00	0.00	0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Revenue per GDP	0.01***	0.00*	0.00*	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tax per capita	44.36	28.59**	10.23	-106.92**	-65.05	4.15	-78.19**	83.42
	(30.00)	(12.71)	(13.76)	(43.58)	(65.93)	(8.92)	(31.75)	(261.85)
Revenue per capita	44.58	28.58**	10.43	-106.74**	-64.95	4.16	-76.18**	83.47
	(29.95)	(12.68)	(13.74)	(43.59)	(65.94)	(8.92)	(31.12)	(261.87)
Observations	4,477	4,477	4,477	1,561	2,122	1,523	382	103
R-squared	0.82	0.44	0.00	0.04	0.01	0.00	0.01	0.00
Number of cno		166	166	48	67	55	18	7

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

Table 6. Fixed effects regressions with IDA eligibility as an explanatory variable

IDA_eligible	OLS global with all xvars	Panel global with all xvars	Panel global	Africa	Low income	Lower-middle-income	Upper-middle income	High income
Tax per GDP	-4.33***	0.16	-0.95	2.68	-0.63	0.30	-2.66***	
	(1.16)	(1.17)	(1.13)	(4.68)	(1.84)	(1.06)	(0.00)	
Revenue per GDP	-6.14***	-0.36	-1.61	3.21	-1.10	-0.38	-6.10	
	(1.57)	(1.22)	(1.30)	(2.65)	(1.86)	(0.57)	(.)	
Tax per capita	-34.34	3,023.13	-61,854.63***	-45,667.39	-52,344.48***	-21,240.48***	-241,295.74	
	(11,732.81)	(6,670.67)	(18,093.93)	(44,114.58)	(18,916.63)	(4,505.35)	(.)	
	274.79	2,293.58	-61,845.95***	-45,667.39	-52,344.48***	-21,182.87***	-241,295.74	
Revenue per capita	274.79	2,293.58	-61,845.95***	-45,667.39	-52,344.48***	-21,182.87***	-241,295.74	
	(11,693.09)	(6,616.92)	(18,094.57)	(44,114.58)	(18,916.63)	(4,475.84)	(.)	
Observations	4,477	4,477	5,672	1,572	2,122	1,666	609	877
R-squared	0.82	0.44	0.00	0.03	0.12	0.00	0.01	
Number of cno		166	190	48	67	55	20	29

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

Respective Income Level Donor Pool Results

Table 7a. Government Revenue per Capita before IDA graduation, 3-year average in constant 2015 US dollars

Method	Ghana 2010	Lesotho 2005	Zambia 2010	Equatorial Guinea 1997	Cameroon 2005	Kenya 2014
SC	13,170***	36,476***	11,171***	56,189***	9,982***	12,805***
	(2,941)	(2,493)	(2,941)	(597.9)	(2,394)	(2,868)
SDID	9,849***	5,519**	6,133**	38,188***	2,075	2,336
	(3,027)	(2,325)	(3,027)	(309.8)	(2,483)	(2,610)
DID	12,096***	10,379***	3,108	49,646***	1,815	3,961
	(3,082)	(2,273)	(3,082)	(862.8)	(2,304)	(3,334)
Observations	432	325	432	160	351	432

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

Table 7b. Government Revenue per Capita before IDA graduation, 3-year average in constant 2015 US dollars

Method	Mauritania 2010	Mauritania 2012	Senegal 2009	Cote d'Ivoire 2008	Angola 2011	Nigeria 2008	Sudan 2007
SC	17,683***	18,346***	8,286***	1,861	17,346	14,844***	22,177***
	(2,941)	(3,155)	(1,773)	(1,853)	(14,583)	(2,142)	(1,874)
SDID	2,216	1,651	-819.5	1,346	-16,288	-16,017***	-14,609***
	(3,027)	(3,722)	(1,148)	(3,034)	(15,173)	(2,742)	(1,590)
DID	4,290	4,945	886.6	670.7	-16,407	-10,693***	7,504***
	(3,082)	(3,246)	(2,384)	(2,767)	(13,287)	(2,489)	(2,658)
Obs.	432	432	336	336	108	377	462

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

Table 7c. Government Revenue per Capita before IDA graduation, 3-year average in constant 2015 US dollars

Method	Vietnam 2009	India 2007	Egypt 1995	Indonesia 2003	Georgia 2003	Azerbaijan 2009	Bosnia & Herzegovina 2008
SC	37,163***	18,196***	49,142***	30,519***	62,242***	106,375***	35,938**
	(2,417)	(2,716)	(1,793)	(2,467)	(2,826)	(12,934)	(15,025)
SDID	13,506***	6,710***	7,382***	8,497***	43,631***	103,598***	10,500
	(2,932)	(2,247)	(1,653)	(1,503)	(2,051)	(13,088)	(14,436)
DID	23,755***	12,688***	9,395***	10,422***	45,687***	80,220***	18,198*
	(2,844)	(2,860)	(1,675)	(1,643)	(2,055)	(9,422)	(10,981)
Obs.	372	432	420	315	256	144	154

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

Table 8a. Government Revenue per Capita after IDA graduation, 3-year average in constant 2015 US dollars

Method	Congo, Rep. 2005	Botswana 1997	Mauritius 1992	Namibia 2008	South Africa 2004
SC	61,991***	160,079***	76,720***	87,489***	105,509***
	(2,394)	(17,836)	(15,884)	(22,028)	(17,055)
SDID	10,018***	94,880***	54,187**	21,311***	24,072*
	(2,483)	(26,049)	(21,648)	(1,962)	(12,412)
DID	19,552***	32,281	42,477*	22,607	30,671**
	(2,304)	(25,138)	(22,095)	(21,134)	(13,426)
Observations	351	156	156	148	161

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

Table 8b. Government Revenue per Capita after IDA graduation, 3-year average in constant 2015 US dollars

Method	North Macedonia 2008	Georgia 2008	China 2010	Armenia 2017	Albania 2012	Georgia 2018
SC	1,861	79,549***	91,471***	26,948	4,743	30,056
	(1,853)	(1,576)	(13,035)	(18,473)	(17,273)	(18,993)
SDID	1,346	19,790***	72,391***	21,104	3,022	23,579
	(3,034)	(1,279)	(14,924)	(17,495)	(17,523)	(14,500)
DID	670.7	49,619***	53,820***	16,257	1,367	26,751*
	(2,767)	(2,187)	(20,430)	(16,254)	(13,094)	(15,835)
Observations	336	256	144	152	161	144

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

Table 8c. Impact of income status upgrade on upper-middle-income countries' government revenue per capita (after IDA graduation, 3-year average in constant 2015 US dollars)

Method	Seychelles 2014	St.Kitts & Nevis 2011
SC	7,312	193,965
	(223,872)	(188,293)
SDID	-646.7	115,042
	(73,741)	(150,170)
DID	-50,382	159,032
	(303,312)	(236,997)
Observations	585	480

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Note: Donors include lower-middle-income and high-income countries for these two countries.

Table 9a. Government Revenue per GDP before IDA graduation, 3-year average

Method	Ghana 2010	Lesotho 2005	Zambia 2010	Equatorial Guinea 1997	Cameroon 2005	Kenya 2014
SC	2.148	31.98***	1.730	5.692***	0.119	-0.548
	(3.977)	(3.296)	(3.978)	(1.647)	(3.711)	(4.093)
SDID	2.293	-4.460	-1.687	4.011***	-1.762	-0.788
	(3.734)	(3.017)	(3.734)	(0.671)	(3.289)	(3.465)
DID	1.288	-2.144	-4.230	1.827	-2.322	-2.028
	(3.252)	(2.845)	(3.252)	(1.501)	(2.761)	(3.307)
Observations	432	325	432	160	351	432

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

Table 9b. Government Revenue per GDP before IDA graduation, 3-year average

Me-tho	Mauritania 2010	Mauritania 2012	Senegal 2009	Cote d'Ivoire 2008	Angola 2011	Nigeria 2008	Sudan 2007
SC	2.966	3.035	0.319	1.319	-21.03*	-5.098	-1.931
	(3.978)	(3.907)	(1.798)	(3.219)	(12.28)	(3.316)	(3.079)
SDID	-0.157	-1.014	-1.635	0.908	-5.222	-14.88***	-5.004*
	(3.734)	(4.616)	(1.676)	(3.514)	(10.26)	(2.810)	(2.776)
DID	-0.792	-0.495	-0.937	-0.372	-9.425	-13.75***	-1.587
	(3.252)	(3.380)	(2.996)	(3.216)	(10.55)	(2.954)	(3.062)
Obs.	432	432	336	336	108	377	462

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

Table 9c. Government Revenue per GDP before IDA graduation, 3-year average

Method	Vietnam 2009	India 2007	Egypt 1995	Indonesia 2003	Georgia 2003	Azerbaijan 2009	Bosnia & Herzegovina 2008
SC	2.959	4.152	5.445***	1.087	9.846***	5.802	-6.058
	(3.480)	(3.935)	(1.956)	(2.795)	(3.024)	(6.493)	(5.720)
SDID	-1.219	-4.451	-5.467***	-3.418	6.430**	7.604	-3.752
	(3.611)	(3.359)	(1.628)	(2.449)	(2.693)	(5.115)	(5.728)
DID	-2.755	-3.593	-5.647***	-3.090	6.451**	5.937	-4.715
	(3.207)	(2.974)	(1.484)	(2.412)	(2.579)	(4.239)	(4.292)
Obs.	372	432	420	315	256	144	154

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

Table 10a. Government Revenue per GDP after IDA graduation, 3-year average

Method	Congo[31], Rep. 2005	Botswana 1997	Mauritius 1992	Namibia 2008	South Africa 2004
SC	17.57***	16.47***	-4.290**	7.237***	-0.662
	(3.711)	(2.679)	(2.158)	(2.388)	(3.252)
SDID	5.150	-1.080	-5.780*	-0.155***	-0.778
	(3.289)	(1.962)	(3.448)	(2.36e-06)	(3.327)
DID	4.862*	-8.033***	-4.713*	-0.500	-1.260
	(2.761)	(2.687)	(2.816)	(1.053)	(3.886)
Observations	351	156	156	148	161

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

Table 10b. Government Revenue per GDP after IDA graduation, 3-year average

Method	North Macedonia 2008	Georgia 2008	China 2010	Armenia 2017	Albania 2012	Georgia 2018
SDID	0.908	0.693	-4.418	0.0444	-4.999	0.810
	(3.514)	(1.632)	(13.87)	(4.418)	(6.394)	(2.751)
SC	1.319	12.04***	-1.174	0.652	-4.962	0.930
	(3.219)	(1.596)	(20.33)	(7.345)	(6.770)	(7.352)
DID	-0.372	6.366**	-9.215	-1.866	-5.437	-0.334
	(3.216)	(2.965)	(16.78)	(7.616)	(5.756)	(7.381)
Observations	336	256	144	152	161	144

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

Table 10c. Impact of income status upgrade on upper-middle-income countries' government revenue per GDP (after IDA graduation, 3-year average)

Method	Seychelles 2014	St. Kitts & Nevis 2011
SDID	-1.264	5.301***
	(4.773)	(1.817)
SC	-2.388	5.951**
	(4.575)	(2.951)
DID	-5.178	7.885***
	(4.770)	(2.861)
Observations	585	480

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Note: Donors include lower-middle-income and high-income countries for these two countries.

[31] Note: The Republic of Congo retreated to IDA eligibility in 1994.

Global Donor Pool Results for Revenue per Capita

Table 11a. Government Revenue per Capita before IDA graduation, 3-year average in constant 2015 US dollars (3-year average)

	Congo 2005	Ghana 2010	Kenya 2014	Lesotho 2005	Sudan 2007	Senegal 2009
SC	-13,151	5,094	-2,229	-10,006	-24,578	-791.2
	(99,281)	(127,837)	(123,796)	(104,390)	(111,242)	(118,493)
SDID	-73,426	-15,195	-13,485	-41,957	-50,512	-20,788
	(78,330)	(115,274)	(104,443)	(87,422)	(96,532)	(123,042)
DID	184,993	-118,231	-131,609	-153,778	-149,741	-128,083
	(188,909)	(146,013)	(153,875)	(168,899)	(155,133)	(145,489)
	Mauritania 2010	**Mauritania 2012**	**Zambia 2010**	**Angola 2004**	**Angola 2011**	
SC	1,124	120.1	2,300	19,962	-65,355	
	(127,710)	(110,376)	(127,725)	(102,843)	(125,210)	
SDID	-19,112	-15,644	-18,596	-33,929	-87,534	
	(115,275)	(66,093)	(115,274)	(94,394)	(100,062)	
DID	-124,418	-127,862	-124,710	-137,188	-135,207	
	(146,013)	(147,743)	(146,013)	(173,386)	(147,591)	
	Vietnam 2009	**Georgia 2003**	**Albania 2003**	**Armenia 2002**	**Azerbaijan 2009**	**India 2007**
SC	6,240	46,138	6,184	27,639	85,688	-65.54
	(118,423)	(109,008)	(109,070)	(106,019)	(118,462)	(111,013)
SDID	-11,272	-2,083	-40,380	-10,113	32,241	-20,042
	(123,054)	(104,025)	(104,131)	(101,968)	(122,944)	(96,541)
DID	-109,616	-100,266	-128,354	-119,579	7,217	-137,062
	(145,489)	(177,169)	(177,169)	(181,830)	(145,489)	(155,133)
Obs.	1,118	1,118	1,118	1,118	1,118	1,118

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

Table 11b. Government Revenue per Capita after IDA graduation, 3-year average in constant 2015 US dollars

	Equatorial Guinea 2004	Equatorial Guinea 2007	Botswana 1997	Namibia 2008	South Africa 2004	Seychelles 2014
SC	-14,419	-22,578	202,796**	13,726	-14,419	-25,894
	(97,630)	(107,191)	(93,143)	(113,055)	(97,630)	(123,854)
SDID	-64,666	-30,117	268,784	-1,731	-64,666	-30,915
	(88,415)	(87,794)	(189,286)	(106,015)	(88,415)	(104,478)
DID	206,602	152,266	366,585	-87,097	206,602	-25,875
	(194,276)	(169,998)	(247,662)	(148,435)	(194,276)	(153,875)
Obs.	1,092	1,092	1,092	1,118	1,092	1,118
	North Macedonia 2008	**Georgia 2018**	**Albania 2012**	**Armenia 2017**		
SC	26,053	22,939	7,065	13,692		
	(108,666)	(119,894)	(110,441)	(140,988)		
SDID	6,174	-2,434	-22,864	3,917		
	(99,273)	(31,530)	(66,098)	(63,932)		
DID	150,058	-71,956	-101,559	-87,206		
	(159,780)	(168,001)	(147,743)	(174,613)		
Obs.	1,092	1,118	1,118	1,118		

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

Global Donor Pool Results for Revenue per GDP

Table 12a. Government Revenue per GDP before IDA graduation, 3-year average in constant 2015 US dollars (3-year average)

	Congo 2005	Ghana 2010	Kenya 2014	Lesotho 2005	Sudan 2007	Senegal 2009
SC	-3.573	0.973	-1.589	1.137	-4.569	-0.469
	(2.777)	(2.478)	(1.934)	(2.761)	(2.787)	(2.736)
SDID	-4.621	1.025	-0.563	-1.491	-6.187**	-0.154
	(3.645)	(1.579)	(1.960)	(3.492)	(2.787)	(1.704)
DID	-2.422	3.221	-0.122	0.00423	-1.114	1.285
	(3.398)	(2.756)	(2.492)	(3.177)	(3.070)	(2.854)
Obs.	1,092	1,118	1,118	1,118	1,118	1,118
	Mauritania 2010	**Mauritania 2012**	**Zambia 2010**	**Angola 2004**	**Angola 2011**	
SC	1.026	1.027	-0.177	-0.633	-13.55***	
	(2.486)	(2.479)	(2.475)	(2.657)	(2.414)	
SDID	1.140	0.155	1.721	0.653	-14.81***	
	(1.577)	(2.075)	(1.578)	(3.052)	(1.971)	
DID	1.955	1.951	-0.448	-2.125	-10.02***	
	(2.756)	(2.626)	(2.756)	(3.159)	(2.676)	
	Vietnam 2009	**Georgia 2003**	**Albania 2003**	**Armenia 2002**	**Azerbaijan 2009**	**India 2007**
SC	-2.639	7.152**	0.401	2.006	7.712***	-3.550
	(2.720)	(3.061)	(3.014)	(3.034)	(2.724)	(2.770)
SDID	-3.406**	8.798***	-0.104	3.010	1.249	-2.618
	(1.703)	(2.916)	(2.916)	(2.994)	(1.703)	(2.786)
DID	-0.695	10.31***	1.426	3.086	13.58***	-0.375
	(2.854)	(3.151)	(3.151)	(3.140)	(2.854)	(3.070)
Obs.	1,118	1,118	1,118	1,118	1,118	1,118

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

Table 12b. Government Revenue per GDP after IDA graduation, 3-year average in constant 2015 US dollars

	Equatorial Guinea 2004	Equatorial Guinea 2007	Botswana 1997	Namibia 2008	South Africa 2004	Seychelles 2014
SC	-3.342	-3.605	0.756	0.333	-3.342	-6.665***
	(2.964)	(2.942)	(2.939)	(2.825)	(2.964)	(1.974)
SDID	-4.350	-4.187	1.516	0.366	-4.350	-3.762*
	(3.345)	(3.033)	(2.926)	(2.417)	(3.345)	(1.960)
DID	-1.957	-3.082	1.943	2.122	-1.957	-3.118
	(3.323)	(3.397)	(3.158)	(2.965)	(3.323)	(2.492)
Obs.	1,092	1,092	1,092	1,118	1,092	1,118
	North Macedonia 2008	**Georgia 2018**	**Albania 2012**	**Armenia 2017**		
SC	-2.875	2.427	-2.124	1.028		
	(3.017)	(1.785)	(2.477)	(1.609)		
SDID	-2.843	-0.0136	-1.556	0.714		
	(2.957)	(2.331)	(2.076)	(1.493)		
DID	-3.134	4.737*	-1.197	1.238		
	(3.344)	(2.666)	(2.626)	(2.692)		
Obs.	1,092	1,118	1,118	1,118		

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

Global Donor Pool Results for Tax per GDP

Table 13a. Tax Revenue per GDP before IDA graduation, 3-year average in constant 2015 US dollars (3-year average)

	Congo 2005	Ghana 2010	Kenya 2014	Lesotho 2005	Sudan 2007	Senegal 2009
SC	-1.660	0.292	0.00830	6.172*	-0.378	-0.272
	(3.592)	(3.309)	(3.169)	(3.195)	(3.200)	(3.283)
SDID	-4.149*	0.679	-0.119	1.030	-0.0118	-0.229
	(2.471)	(1.224)	(1.720)	(1.943)	(1.817)	(1.468)
DID	-3.373	2.025	0.570	3.649	-0.902	1.212
	(2.989)	(2.143)	(1.909)	(2.474)	(2.350)	(2.205)
Obs.	1,092	1,118	1,118	1,118	1,118	1,118
	Mauritania 2010	**Mauritania 2012**	**Zambia 2010**	**Angola 2004**	**Angola 2011**	
SC	1.039	1.354	-0.353	-1.066	-11.45***	
	(3.307)	(3.352)	(3.307)	(3.220)	(3.355)	
SDID	0.587	1.028	0.872	-0.447	-14.68***	
	(1.224)	(2.005)	(1.224)	(2.193)	(1.867)	
DID	0.961	1.064	-2.010	-2.998	-10.20***	
	(2.143)	(2.046)	(2.143)	(2.469)	(2.089)	
	Vietnam 2009	**Georgia 2003**	**Albania 2003**	**Armenia 2002**	**Azerbaijan 2009**	**India 2007**
SC	-1.154	7.323**	2.605	1.038	-2.250	-0.827
	(3.284)	(3.631)	(3.653)	(3.585)	(3.281)	(3.206)
SDID	-2.887**	7.117***	1.091	2.430	-3.002**	-0.871
	(1.468)	(2.546)	(2.547)	(2.598)	(1.469)	(1.818)
DID	0.0275	10.37***	3.701	3.162	-1.093	1.322
	(2.205)	(2.441)	(2.441)	(2.398)	(2.205)	(2.350)
Obs.	1,118	1,118	1,118	1,118	1,118	1,118

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

Table 13b. Tax Revenue per GDP after IDA graduation, 3-year average in constant 2015 US dollars

	Equatorial Guinea 2004	Equatorial Guinea 2007	Botswana 1997	Namibia 2008	South Africa 2004	Seychelles 2014
SC	-1.633	-1.526	-0.969	3.007	-1.633	0.0299
	(3.633)	(3.651)	(3.349)	(3.241)	(3.633)	(3.171)
SDID	-4.172	-3.712	-1.663	1.721	-4.172	-0.143
	(2.680)	(2.421)	(2.362)	(1.914)	(2.680)	(1.720)
DID	-3.077	-3.750	-1.396	3.390	-3.077	1.333
	(2.936)	(2.965)	(2.333)	(2.269)	(2.936)	(1.909)
Obs.	1,092	1,092	1,092	1,118	1,092	1,118
	North Macedonia 2008	**Georgia 2018**	**Albania 2012**	**Armenia 2017**		
SC	-1.661	2.817	-0.0773	0.651		
	(3.765)	(3.054)	(3.357)	(2.961)		
SDID	-2.475	0.696	-0.235	0.702		
	(2.603)	(0.996)	(2.004)	(1.165)		
DID	-3.756	4.314**	0.879	1.795		
	(2.933)	(1.909)	(2.046)	(1.883)		
Obs.	1,092	1,118	1,118	1,118		

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

Low and Lower-Middle-Income Donor Pool Results for Revenue per Capita

Table 14a. Government Revenue per Capita before IDA graduation, 3-year average in constant 2015 US dollars (3-year average)

	Congo 2005	Ghana 2010	Kenya 2014	Lesotho 2005	Sudan 2007	Senegal 2009
SC	-185.2	5,013	-3,454	-6,842	-24,580***	-1,547
	(7,564)	(8,883)	(9,941)	(6,187)	(6,161)	(8,344)
SDID	-5,000	5,789	-2,090	-6,410	-30,065***	-596.0
	(6,298)	(9,068)	(9,790)	(8,267)	(7,693)	(8,923)
DID	-8,215	2,704	-5,819	2,411	-9,852	-5,665
	(12,395)	(14,101)	(14,780)	(15,936)	(15,430)	(14,210)
	Mauritania 2010	**Mauritania 2012**	**Zambia 2010**	**Angola 2004**	**Angola 2011**	
SC	-2,406	-3,103	2,378	9,123	-9,369	
	(8,883)	(9,415)	(8,884)	(7,018)	(9,160)	
SDID	770.8	28.18	1,733	8,474	-52,676***	
	(9,068)	(11,112)	(9,067)	(13,110)	(10,775)	
DID	-3,482	-3,833	-3,775	21,349	-12,703	
	(14,101)	(14,925)	(14,101)	(15,550)	(14,486)	
	Vietnam 2009	**Georgia 2003**	**Albania 2003**	**Armenia 2002**	**Azerbaijan 2009**	**India 2007**
SC	8,085	46,082***	6,947	27,517***	110,774***	1,663
	(8,351)	(7,886)	(7,886)	(8,152)	(8,350)	(6,155)
SDID	8,056	39,236***	3,958	25,438**	38,455***	1,853
	(8,923)	(12,444)	(12,449)	(11,160)	(8,925)	(7,693)
DID	12,801	58,966***	30,878**	42,311***	129,634***	2,827
	(14,210)	(14,975)	(14,975)	(14,292)	(14,210)	(15,430)
Obs.	468	468	468	468	468	468

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

Table 14b. Government Revenue per Capita after IDA graduation, 3-year average in constant 2015 US dollars

	Equatorial Guinea 2004	Equatorial Guinea 2007	Botswana 1997	Namibia 2008	South Africa 2004	Seychelles 2014
SC	60.29	630.3	-2,892	56,338***	60.29	1.920
	(8,181)	(6,357)	(9,886)	(7,345)	(8,181)	(10,460)
SDID	-7,296	-1,133	-5,455	14,745*	-7,296	-2,371
	(10,559)	(6,252)	(9,093)	(8,707)	(10,559)	(9,209)
DID	-7,873	-8,185	-4,804	42,019***	-7,873	-8,902
	(12,096)	(12,133)	(10,389)	(14,722)	(12,096)	(13,736)
Obs.	442	442	442	468	442	442
	North Macedonia 2008	**Georgia 2018**	**Albania 2012**	**Armenia 2017**		
SC	616.4	49,652***	8,441	32,668***		
	(7,308)	(7,341)	(9,425)	(7,623)		
SDID	-574.3	21,473***	7,413	25,125***		
	(7,471)	(5,771)	(11,111)	(6,204)		
DID	-7,889	55,151***	22,469	39,589***		
	(11,724)	(13,093)	(14,925)	(13,967)		
Obs.	442	468	468	468		

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

Low and Lower-Middle-Income Donor Pool Results for Revenue per GDP

Table 15a. Government Revenue per GDP before IDA graduation, 3-year average in constant 2015 US dollars (3-year average)

	Congo 2005	Ghana 2010	Kenya 2014	Lesotho 2005	Sudan 2007	Senegal 2009
SC	-0.430	0.747	-2.747	17.13***	-4.190	-0.444
	(2.836)	(3.554)	(3.405)	(2.926)	(3.231)	(3.650)
SDID	-0.545	0.137	-2.847	-4.659	-5.818	-0.936
	(2.743)	(3.409)	(3.456)	(2.968)	(3.540)	(3.749)
DID	-0.632	0.732	-2.794	-2.498	-3.596	-1.203
	(2.638)	(3.299)	(3.810)	(2.952)	(3.032)	(3.187)
Obs.	442	468	468	468	468	468
	Mauritania 2010	**Mauritania 2012**	**Zambia 2010**	**Angola 2004**	**Angola 2011**	
SC	1.195	1.272	-1.103	2.480	-5.501	
	(3.555)	(3.585)	(3.552)	(2.845)	(3.500)	
SDID	0.489	-0.0222	-2.461	-4.901	-15.22***	
	(3.409)	(3.861)	(3.409)	(3.106)	(3.676)	
DID	-0.534	-0.627	-2.938	-4.661	-12.55***	
	(3.299)	(3.545)	(3.299)	(2.839)	(3.406)	
	Vietnam 2009	**Georgia 2003**	**Albania 2003**	**Armenia 2002**	**Azerbaijan 2009**	**India 2007**
SC	-1.623	8.067***	-3.886	-2.177	7.712**	-3.057
	(3.649)	(2.840)	(2.858)	(2.825)	(3.651)	(3.223)
SDID	-4.531	7.532***	-2.455	-0.507	6.433*	-3.949
	(3.749)	(2.908)	(2.907)	(2.682)	(3.749)	(3.540)
DID	-3.183	7.754***	-1.128	0.611	11.09***	-2.858
	(3.187)	(2.688)	(2.688)	(2.559)	(3.187)	(3.032)
Obs.	468	468	468	468	468	468

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

Table 15b. Government Revenue per GDP after IDA graduation, 3-year average in constant 2015 US dollars

	Equatorial Guinea 2004	Equatorial Guinea 2007	Botswana 1997	Namibia 2008	South Africa 2004	Seychelles 2014
SC	-0.810	1.285	-1.801	-0.288	-0.810	-1.277
	(2.601)	(2.955)	(2.127)	(3.485)	(2.601)	(4.506)
SDID	-0.620	0.422	-0.985	0.953	-0.620	-1.760
	(2.882)	(3.217)	(2.559)	(3.827)	(2.882)	(3.335)
DID	-0.624	-0.375	-0.521	-0.360	-0.624	-0.497
	(2.551)	(2.797)	(2.599)	(3.088)	(2.551)	(3.864)
Obs.	442	442	442	468	442	442
	North Macedonia 2008	**Georgia 2018**	**Albania 2012**	**Armenia 2017**		
SC	1.526	2.679	-1.862	0.321		
	(3.345)	(3.239)	(3.586)	(3.179)		
SDID	0.482	0.126	-1.657	0.729		
	(3.519)	(2.902)	(3.861)	(2.397)		
DID	-0.155	2.174	-3.776	-1.448		
	(2.919)	(4.273)	(3.545)	(4.294)		
Obs.	442	468	468	468		

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

Low and Lower-Middle-Income Donor Pool Results for Tax per GDP

Table 16a. Tax Revenue per GDP before IDA graduation, 3-year average in constant 2015 US dollars (3-year average)

	Congo 2005	Ghana 2010	Kenya 2014	Lesotho 2005	Sudan 2007	Senegal 2009
SC	-0.504	0.0952	-0.00407	16.87***	-3.189	0.146
	(2.599)	(2.493)	(2.250)	(2.628)	(2.617)	(2.776)
SDID	-0.336	0.355	-0.378	-2.006	-1.924	-0.996
	(2.069)	(2.224)	(2.855)	(2.325)	(2.557)	(2.781)
DID	-0.623	-0.138	-1.359	1.338	-3.207	-1.008
	(2.357)	(2.830)	(2.682)	(2.685)	(2.671)	(2.774)
Obs.	442	468	468	468	468	468
	Mauritania 2010	**Mauritania 2012**	**Zambia 2010**	**Angola 2004**	**Angola 2011**	
SC	0.104	0.295	-0.729	5.598**	-1.208	
	(2.492)	(2.385)	(2.492)	(2.525)	(2.388)	
SDID	0.114	0.569	-0.465	-4.639*	-14.78***	
	(2.224)	(3.373)	(2.224)	(2.656)	(3.080)	
DID	-1.201	-1.021	-4.172	-5.293**	-12.32***	
	(2.830)	(2.829)	(2.830)	(2.620)	(2.840)	
	Vietnam 2009	**Georgia 2003**	**Albania 2003**	**Armenia 2002**	**Azerbaijan 2009**	**India 2007**
SC	-2.681	8.643***	1.915	-2.044	-2.588	-0.480
	(2.777)	(2.385)	(2.384)	(2.310)	(2.776)	(2.615)
SDID	-2.795	7.192***	-0.0893	0.0432	-3.397	-1.897
	(2.780)	(2.691)	(2.691)	(2.533)	(2.780)	(2.557)
DID	-2.193	8.095***	1.424	0.928	-3.314	-0.983
	(2.774)	(2.507)	(2.507)	(2.392)	(2.774)	(2.671)
Obs.	468	468	468	468	468	468

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

Table 16b. Tax Revenue per GDP after IDA graduation, 3-year average in constant 2015 US dollars

	Equatorial Guinea 2004	Equatorial Guinea 2007	Botswana 1997	Namibia 2008	South Africa 2004	Seychelles 2014
SC	-0.881	1.697	-1.841	5.864**	-0.881	-0.810
	(2.333)	(2.554)	(3.055)	(2.728)	(2.333)	(2.289)
SDID	-0.582	0.600	-1.251	2.428	-0.582	-0.322
	(2.323)	(2.215)	(2.318)	(2.768)	(2.323)	(2.031)
DID	-0.657	-0.330	-1.055	1.119	-0.657	-0.00204
	(2.318)	(2.403)	(2.239)	(2.703)	(2.318)	(2.517)
Obs.	442	442	442	468	442	442
	North Macedonia 2008	**Georgia 2018**	**Albania 2012**	**Armenia 2017**		
SC	1.928	2.819	-0.0457	3.284		
	(2.686)	(2.901)	(2.384)	(2.825)		
SDID	0.684	0.587	-0.183	0.156		
	(2.398)	(1.720)	(3.373)	(3.222)		
DID	-0.106	2.634	-1.206	0.0671		
	(2.474)	(3.235)	(2.829)	(3.094)		
Obs.	442	468	468	468		

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

Synthetic Control Figures

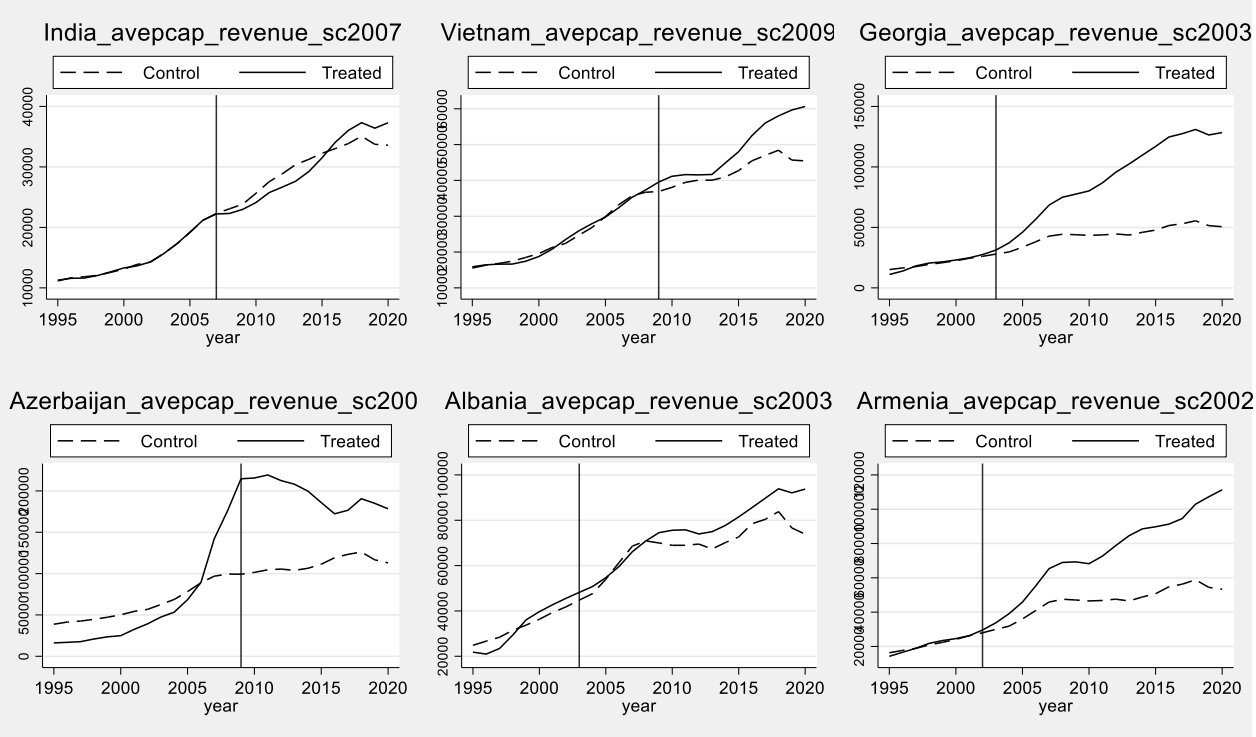

Figure 1a. Upgrade for IDA Eligible Countries from Low to Lower-Middle-Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government Revenue per Capita.

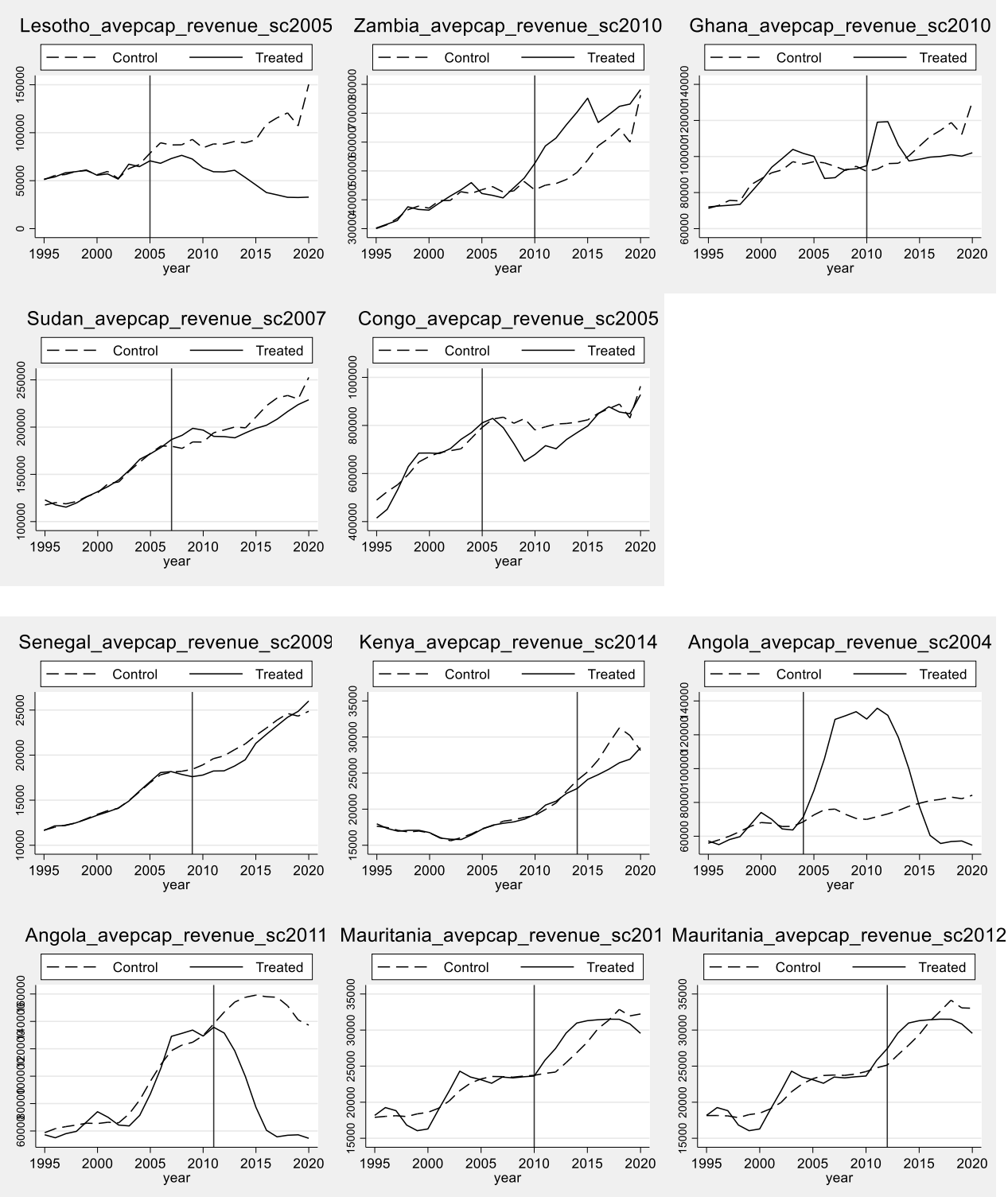

Figure 1b. Upgrade for IDA Eligible Countries from Low to Lower-Middle-Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government Revenue per Capita.

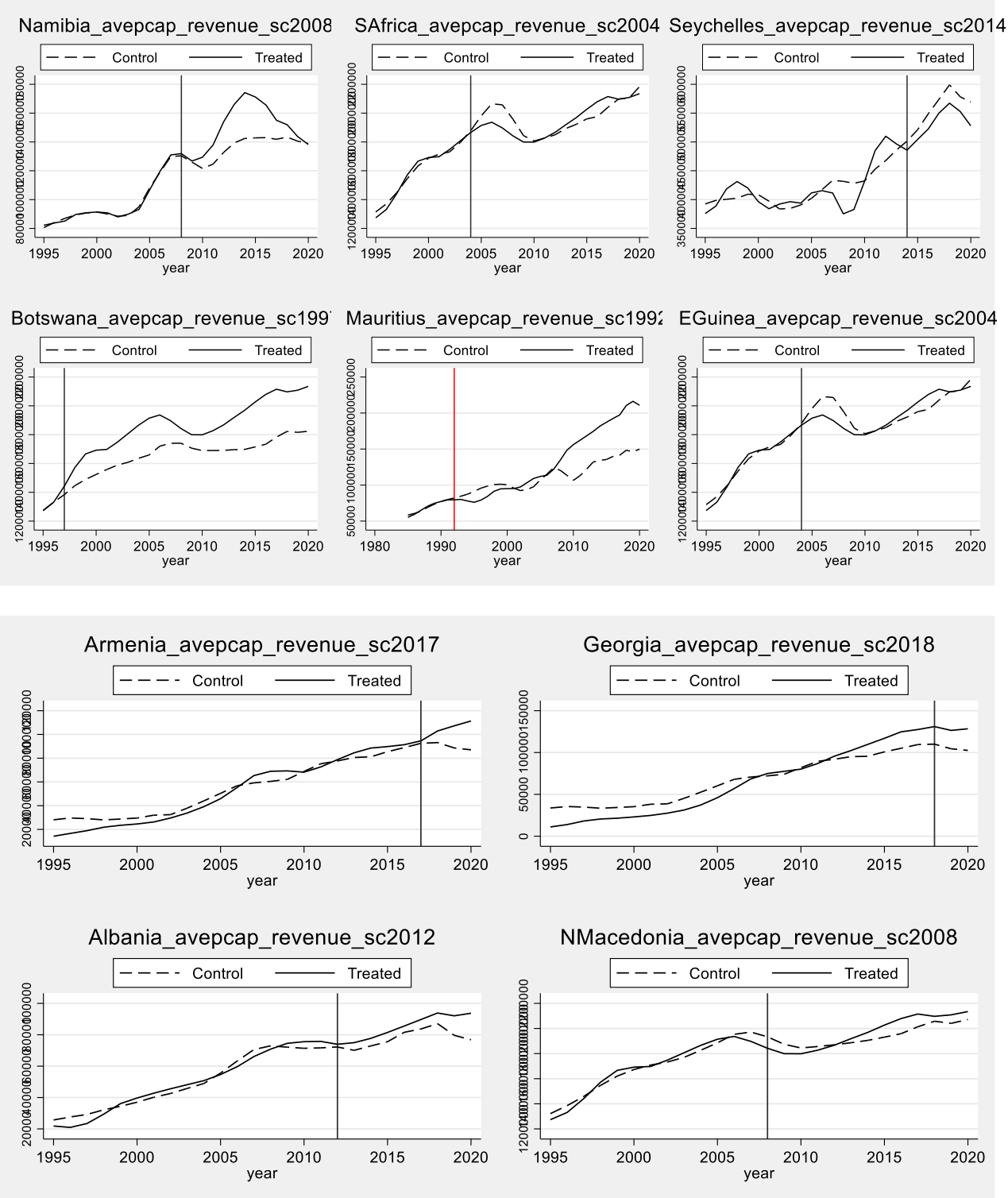

Figure 2. Upgrade for IDA ineligibles, Synthetic Control from Global Donor Pool 1995-2020 for 3-year average of Government Revenue per Capita.

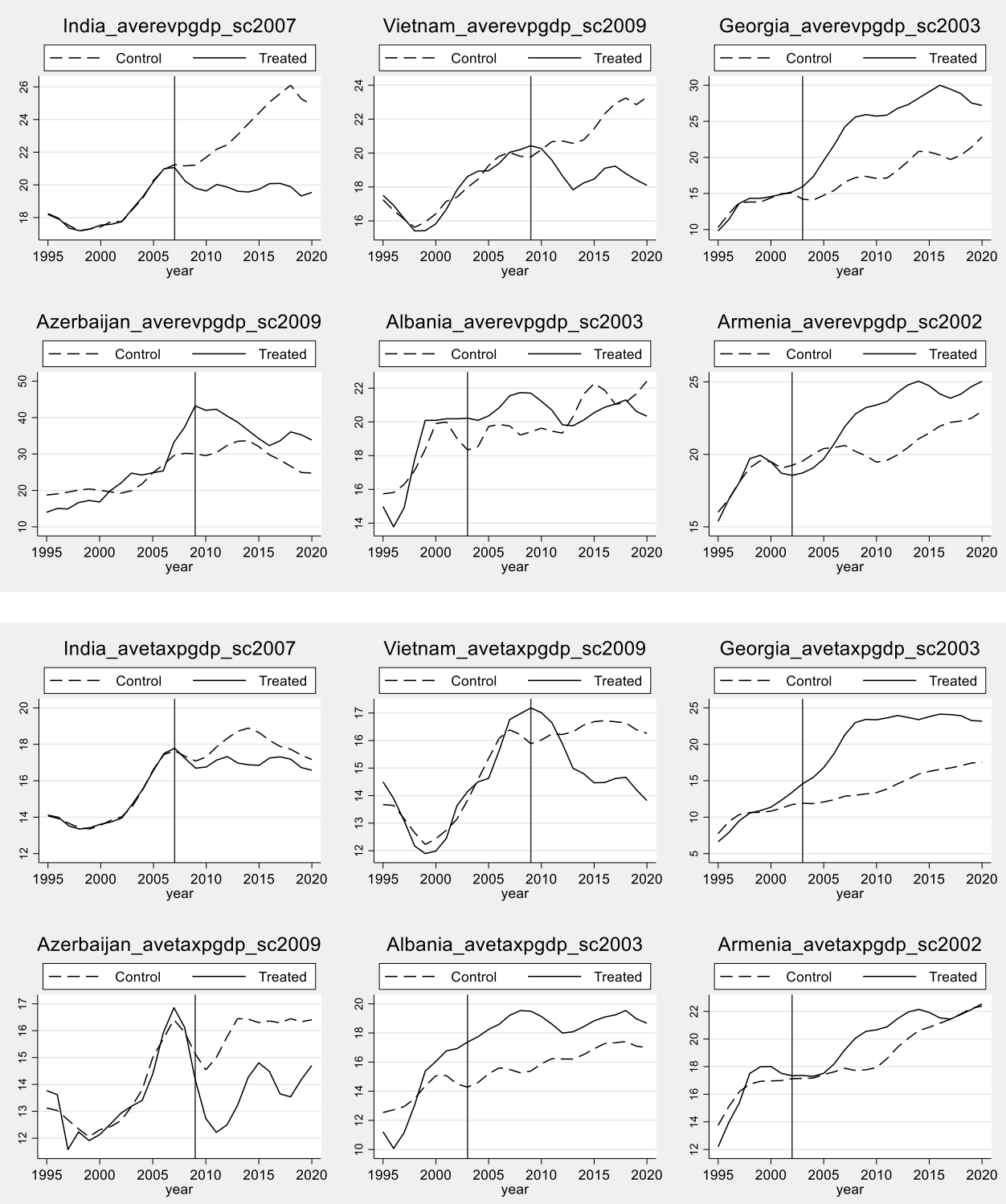

Figure 3a. Upgrade for IDA Eligible Countries from Low to Lower-Middle-Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government and Tax Revenue per GDP.

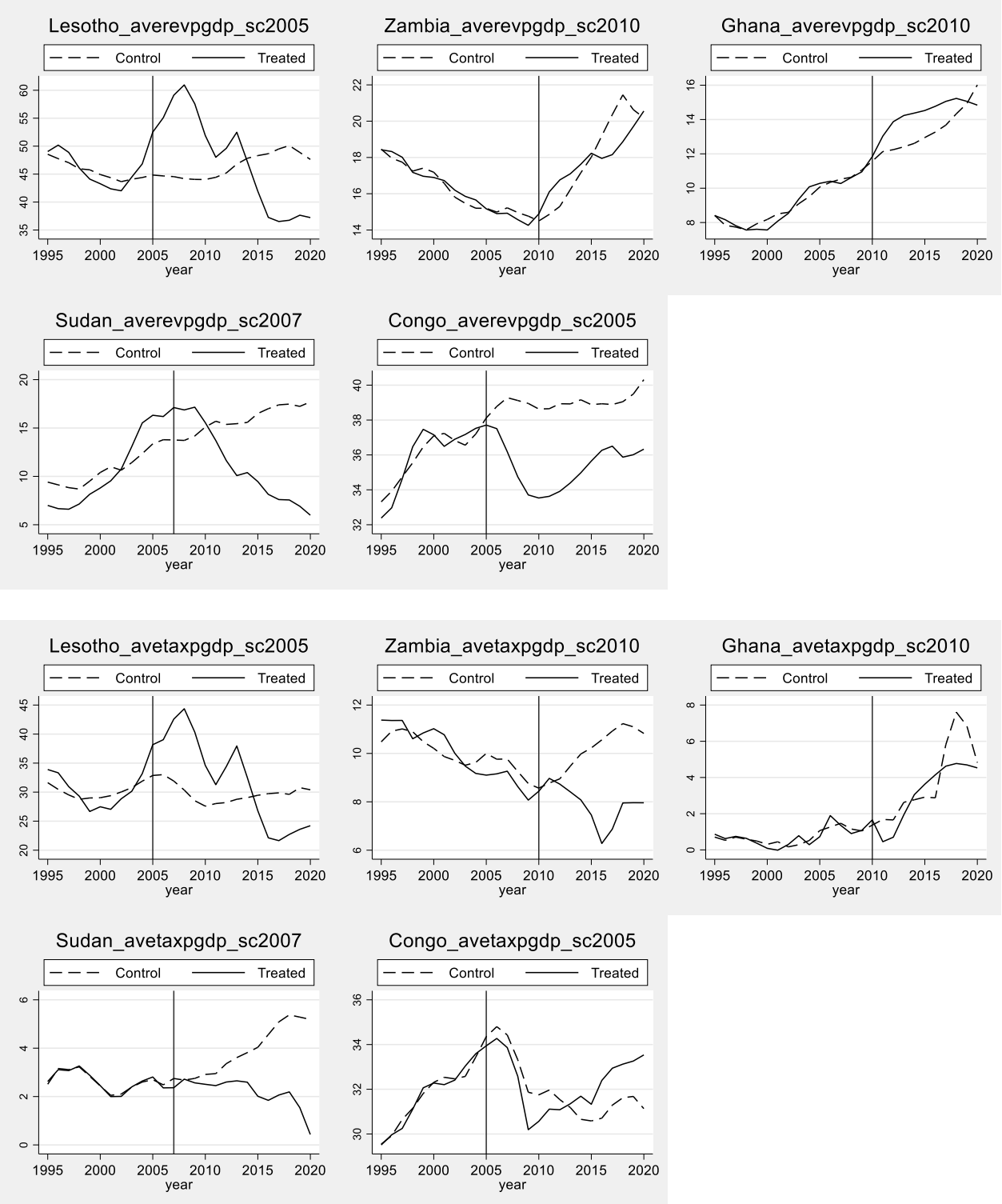

Figure 3b. Upgrade for IDA Eligible Countries from Low to Lower-Middle-Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government and Tax Revenue per GDP.

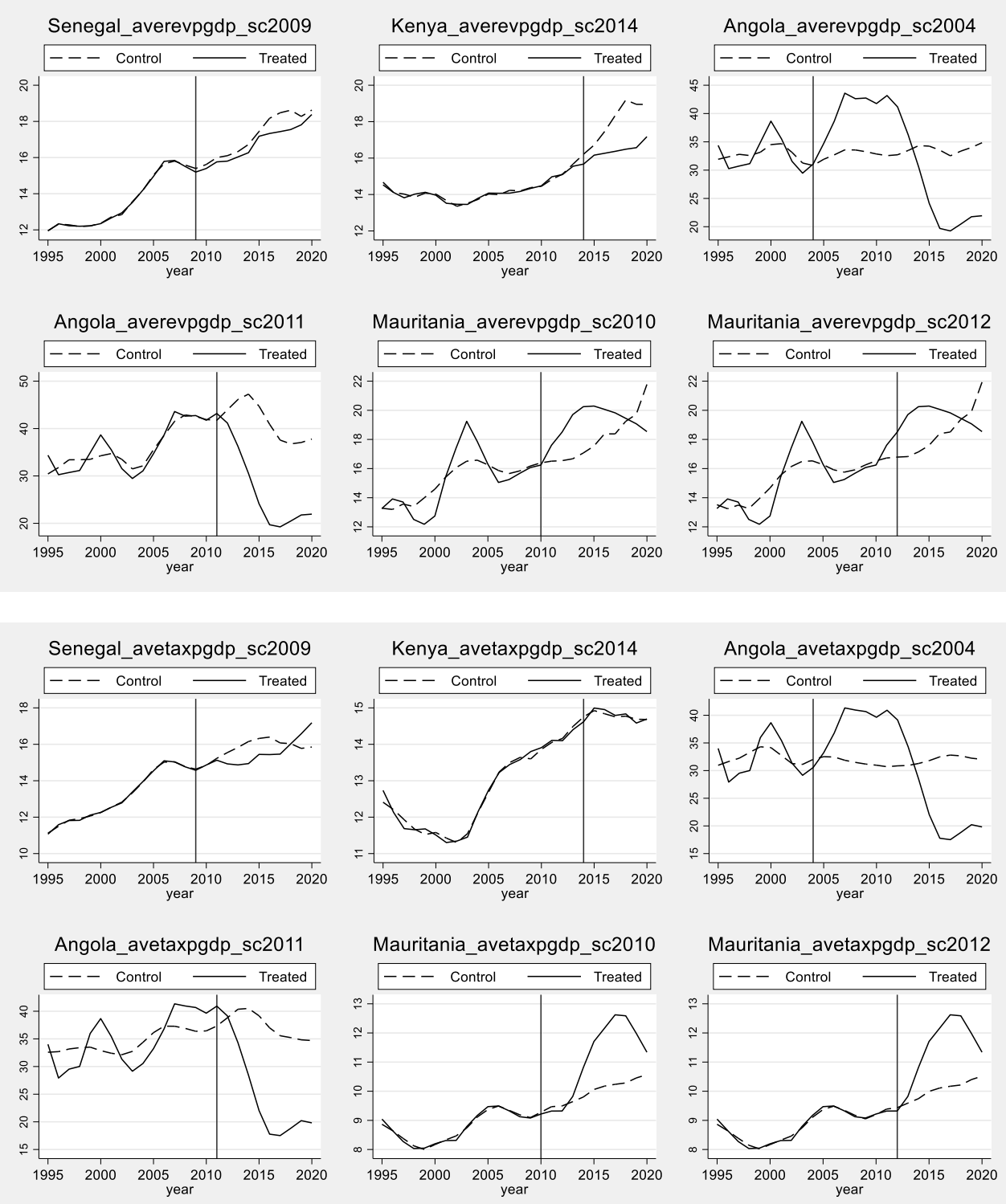

Figure 3c. Upgrade for IDA Eligible Countries from Low to Lower-Middle-Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government and Tax Revenue per GDP.

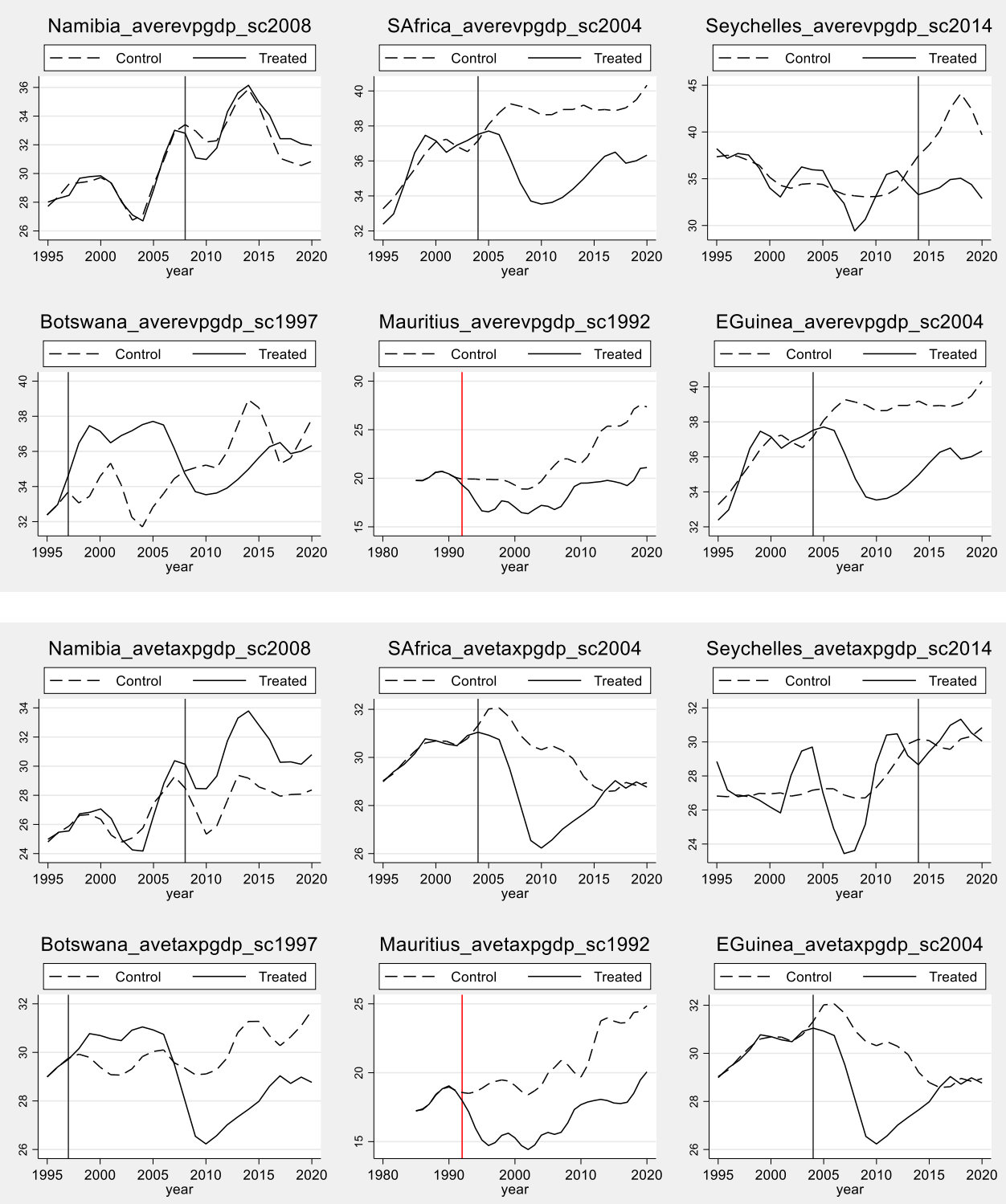

Figure 4a. Upgrade for IDA Ineligible Countries from Lower to Upper-Middle-or High Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government and Tax Revenue per GDP.

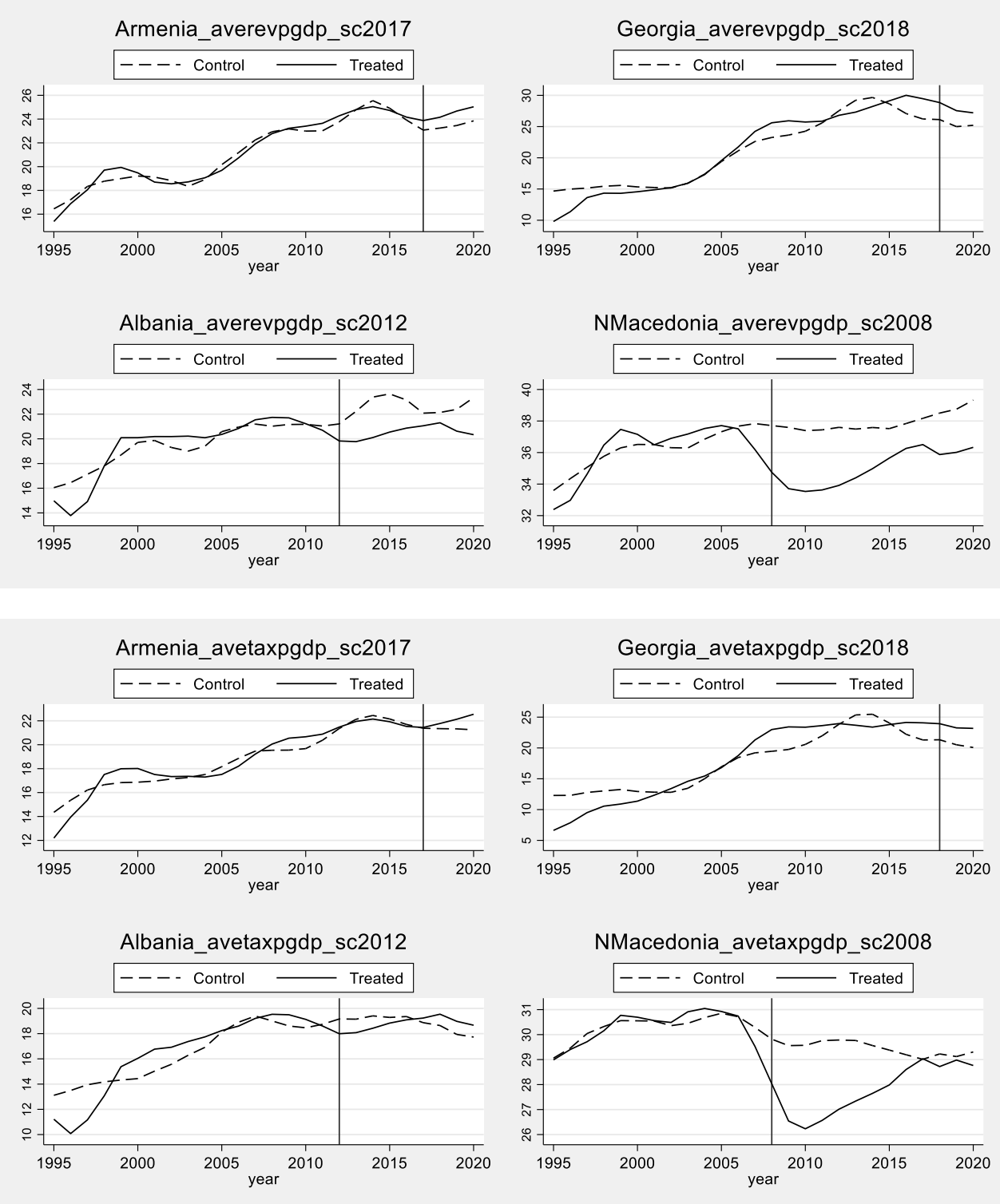

Figure 4b. Upgrade for IDA Ineligible Countries from Lower to Upper-Middle-or High Income Status, Synthetic Control from Global 1995-2020 Donor Pool for 3-year average of Government and Tax Revenue per GDP.