Appendix to

'The Fiscal State in Africa: Evidence from a Century of Growth'

Contents

1 Existing work on African tax data

In this appendix, we briefly survey existing data work on taxation in African polities.

Precolonial taxation: The conventional periodization usually divides African history into the precolonial, colonial and postcolonial period.[1] Each period has its own distinct data problems, but only for the precolonial period do these preclude integration into our dataset.

There is an abundance of states to study in the long precolonial period. However, written (and kept) state records are extremely scarce for this period and thus the creation of annual comparable time series for a range of states is likely to be impossible. Certainly the precolonial period deserves more attention in future research (Reid, 2011). A number of centralized kingdoms collected taxes in a mix of in-kind, tribute, and cash (see Goody, 1969, for a review). For some precolonial centralized states, information exists about types and rates of taxation that may well be used for comparative studies. These include work on the Mahdist State (present-day Sudan) by Abu Shouk and Bjørkelo (1996) and the Merino Kingdom in present-day Madagascar (Sanchez, 2013). Clearly, this list is not exhaustive. Even so, the rise of early colonial taxation—and the extent to which it replaced or supplemented taxation of the preceding precolonial period—-most likely will remain a subject that requires detailed historical case studies rather than efforts to build a comprehensive panel dataset.

The issue for the colonial and postcolonial periods is quite different. One cannot blame a dearth of data in archives. Here the records do indeed exist, but they are not easily standardized. They have therefore not been compiled for the entire continent in a systematic and comparable fashion.

Colonial taxation: Our understanding of colonial taxation is improving as the literature on the impact of colonial institutions grows. Relatively little comparative work across the colonial empires exists. Most research focuses on the British and (to a slightly lesser extent) French colonies. There are also studies that focus on single countries, or parts thereof. Unfortunately, the data are not always published in a fashion that makes them comparable to other polities. Moreover, the fact that the source material is recorded in different languages and is located in scattered archives mean that creating a harmonized database is resource-intensive. This may explain the lack of a continent-wide dataset. Table 1.1 reports a selection of papers that have been published in the past decade that focus on colonial taxation in Africa.

This progress notwithstanding, large gaps in coverage and concerns about data comparability remain. Revenue collection and reporting differed substantially between colonial empires. These differences are often, though not always, reflected in country- or group-specific studies (for example in the classification of revenue items). Finally, for a sensible comparison across countries, it is important to develop a metric that converts the nominal data into real data. Unlike the postcolonial period, when GDP deflators become available, GDP estimates for colonial times are extremely scarce.

Taxation in sovereign polities: As a general rule, most countries published official statistics in a regular fashion in the postcolonial period. Moreover, efforts to accumulate data in larger databases through the UN and related agencies have increased (Ward, 2004). While these databases have decent coverage for the last decade, this does not apply to earlier years. The impact of the difficulties most African economies found themselves in between the late 1970s and early 1990s on statistical reporting has been well noted. The 1980s and the 1990s have been referred to as "lost decades" not only in terms of economic growth, but also in terms of statistical record-keeping (Jerven, 2013). The emergence of international datasets has improved data access, but problems of data coverage in the official databases remain.

Figure 1.1 underscores the validity of this point by comparing the coverage of two prominent databases. The International Monetary Fund's Government Finance Statistics (IMF GFS) is a dataset of revenue and expenditure

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[1]These are of course overlapping and vary from polity to polity.

Table 1.1: Comparison of coverage in existing data sets on African colonial taxation

Countries/Area:	Time period:	Authors:
Francophone West Africa: Benin, Côte d'Ivoire, Niger and Senegal	1850-2010	Andersson (2018)
The French Empire: covers almost the entire second French colonial empire. Except for the Indochinese Union, most colonies are in Africa: Algeria, Tunisia Mauritania, and Morocco, the federations of French West Africa (Afrique Occidentale Francaise, AOF) and French Equatorial Africa (Afrique Equatoriale Francaise, AEF), Togo, Cameroon, and Madagascar. The total coverage is 21 countries.	1830-1962	Cogneau et al. (2021)
Portuguese Africa: Mozambique and Angola	1850s-1970s	Alexopoulou (2018)
Portuguese Africa: Mozambique, Angola, and Guinea	Late 1800s-1950s	Havik (2013)
British Africa: Gambia, Sierra Leone, Gold Coast, Nigeria, Nyasaland, Kenya, Uganda, and Mauritius	1880-1940	Frankema (2011)
British Africa/Empire: Mainly focusing on: East & Southern Africa: Bechuanaland, Northern Rhodesia, Nyasaland Protectorate, Kenya and Tanganyika Territory. West Africa: Gambia, Sierra Leone, Gold Coast, Nigeria, Mauritius (and India). Also includes some data on United Kingdom and the Dominions: Australia, New Zealand, Canada and Union of South Africa	1870-1940	Frankema (2010)
French and British Africa: French West Africa (AOF): Côte d'Ivoire, Dahomey/Benin, Guinée, Haute Volta/Burkina Faso, Mauritanie, Niger, Sénégal and Soudan. French Equatorial Africa (AEF): Congo, Gabon, Oubangui-Chari and Tchad. French Africa Other: Cameroun, Madagascar, Somaliland, Togo and Réunion. British West Africa (BWA): Gambia, Gold Coast, Nigeria and Sierra Leone. British East Africa (BEA): Bechuanaland, Kenya, Northern Rhodesia, Nyasaland, Uganda and Tanganyika. British Africa other: Mauritius	c. 1880-1940: The majority of data is from early 20th century with: 1911, 1920, 1925, 1929, 1934, and 1937 as key years.	Frankema and van Waijenburg (2014)

statistics from countries around the world. The GFS dataset provides four main tax measures: total taxes, trade taxes, direct taxes, and indirect taxes in nominal terms. Yet for the African continent, the coverage is extremely sparse. Data are missing for 80 to 90 percent of African polities in the 1970s and 1980s. For the 1990s, data are missing for more than half of the continent's polities. Coverage did not improve to around 70 percent until recently. It is important to note that a "missing" observation does not imply that the revenue data itself has never been compiled or recorded. In fact, the potential catalogue of data available to the IMF is more comprehensive, but IMF regulations on data dissemination have prevented these data from being standardized and added to the official databases (Jerven, 2016).

Many scholars have attempted to fill these gaps, often by taking the GFS dataset as a starting point and supplementing it with data collected through other sources. Baskaran and Bigsten (2013) construct a dataset for 31 countries for 1990–2005 by combining data from the OECD's African Economic Outlook dataset with the World Bank's African Development Indicators. Noting the high correlation (0.9) between these two datasets, the authors use the OECD statistics to fill in the gaps in the World Bank dataset. Prichard and Leonard (2010) similarly merge existing datasets into a new dataset on taxation in Africa. Their dataset covers 45 countries from 1972 to 2005, although roughly 7–20 percent of observations remain missing, depending on the criteria employed. Mansour (2014) augments the GFS dataset with
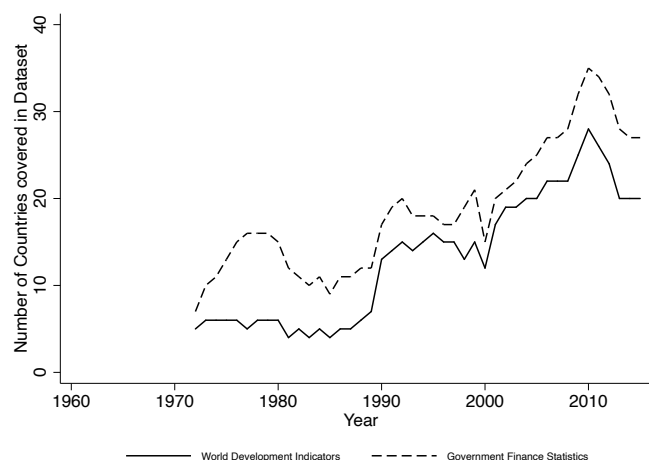
Figure 1.1: Coverage in existing data sets on African taxation from official bodies

data from IMF staff reports and statistical appendices. By doing so, he increases coverage for 1980–2010 for a sample of 41 sub-Saharan countries. Moreover, the dataset provides a disaggregation that builds on the GFS's main categories (total taxes, trade taxes, direct taxes, and indirect taxes) with seven different constituent series (the original four plus corporate taxes, individual taxes, and resource taxes). The coverage across these series is commendable, as relatively few gaps exist in the actual data.

The postcolonial dataset with the best coverage is the Government Revenue Dataset, which is housed at the International Centre for Tax and Development (Prichard, 2016). Nonetheless, the dataset is still plagued by methodological concerns, and in particular, the contributors worry about the lack of a suitable deflator (Prichard et al., 2014, 17-29). The dataset is comprehensive, albeit for a brief time, and covers 40 countries from 1980 to 2015.

Long run datasets: Lee and Paine (2022)'s paper on "The Great Revenue Divergence" paints a broad panorama of government revenue collection over the past two centuries in a broad sample of countries. The authors make use of data from Mitchell (1998)'s statistical compendium for revenue data, which they complement with historical population and exchange rate data from the same source. This is used to calculate revenue per capita in grams of gold at nominal exchange rates. This procedure provides revenue data for at least one year for 18 Western countries (including 15 with at least one data point in the nineteenth century) and 76 non-Western countries (42 of which have a data point in the nineteenth century). The dataset's coverage of the African continent is noteworthy for the colonial period. Of the 49 non-Western countries in the dataset in 1913, almost half are in Africa. Yet the dataset's coverage is not exhaustive: coverage of African polities decreases in the late colonial period around 1950, and there is no data after 1970. This is due to the dataset's purpose, which is not to to track individual African polities over time, but rather to compare revenue collection in broad groups of countries (mainly Western and non-Western).

Summary assessment: Figure 1.2 summarizes the patchy picture for the twentieth century. For the period 1940–1980, the available material is so scant that it forbids generalizations. Even for the other periods, the figure overstates the usefulness of the available material because it only refers to nominal tax data. Beyond the patchiness of the data and the problems with harmonizing the existing datasets, the lack of a suitable deflator often precludes comparative research. The challenges to overcome for a new dataset are thus (i) the lack of exhaustive coverage over time and across space; (ii) making the data comparable across countries and historical periods; and (iii) finding a suitable deflator to convert nominal into real data.
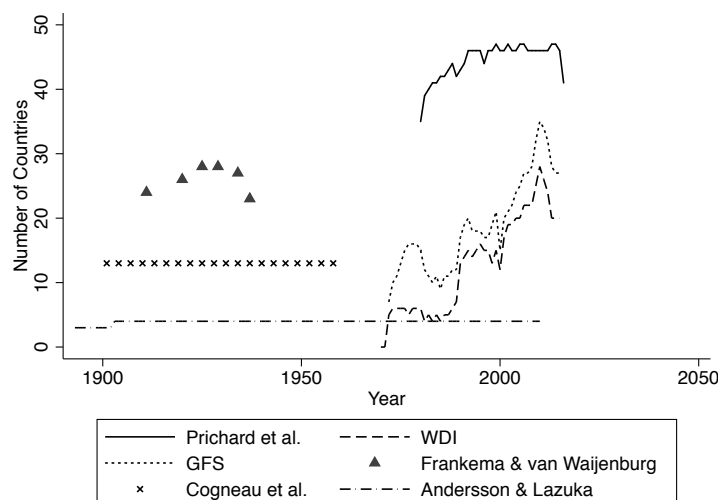
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Figure 1.2: Comparison of coverage in existing datasets on African taxation in the twentieth century

2 The new dataset

2.1 Fiscal data

Given the insufficiency of the available material and concerns about the comparability across time and space, we started our data collection from primary sources.[2] For each year and each polity, we aimed to gather data on revenues actually received. Where these data did not exist, we relied on estimates of the revenue or (in rare cases) on budgeted revenue. The challenge in the data collection was not that data did not exist, but to locate the main data repositories. For the postcolonial period, this was relatively straightforward. With few exceptions, we drew on reports by the IMF that had recently been declassified. Typically, these reports also make it possible to estimate the part of the revenues that can be attributed to the oil or mining sectors.[3] For the colonial period, we visited seven archives[4] and drew on recently digitized sources where possible.[5] We end up with a total of more than 4,700 annual revenue statements (or country-year combinations).

The level of detail of these budgets differs greatly; they contain as few as 10 items per year up to more than 100 items per year. In order to condense these data to our variables of interest, we converted these budgets to spreadsheet data at the highest resolution possible. We transcribed more than 130,000 disaggregated items, of which over 25,000 are unique items. The unique items were manually coded according to the IMF government finance statistics manual in the same way revenues are classified today.[6] We used this classification dictionary to differentiate ordinary revenues according to the type of taxation: direct taxation, indirect taxation proper, trade taxation, other ordinary revenue, and resource revenue. We also introduced the category of "extraordinary revenue", which includes revenues the polity of the time classified as ordinary, but current IMF definitions classify as extraordinary (such as certain colonial transfers from the metropolis). Where revenues from trade taxation are pooled across federations, we took great care to separate them using auxiliary primary data. For example, the French federation (AOF and AEF) budgets contain information about the distribution of such revenues in certain years.

A natural advantage of this strategy is that by definition we made the data comparable across space and time, given that our coding is the same regardless of the country that recorded the tax. Our database thus produces comparable

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[2]The only exception is the data on Portuguese colonies before 1945, for which we mostly relied on Philip Havik's data (Havik, 2013).

[3]For some countries, we consult country-specific sources. From the 2000s onwards, the OECD also provides harmonized data for a selection of countries.

[4]Namely, collections in Paris, Aix-en-Provence, Rome, Porto, Berlin, and London (LSE and British Library).

[5]In particular, British (Blue Books) and French (Gallica colection) colonial records are comparatively well digitized, although large gaps remain.

[6]In addition, we introduced a category that covers resource revenues.

disaggregated revenue data for 41 African polities in the balanced sample (46 in the full sample). Once a polity enters our balanced sample (the average entry date being 1903), the average country-year coverage is over 97 % and thus almost complete (see table 2.1).[7] We document all the sources for each year and country with accompanying graphs in a separate appendix that will be available on our websites.

2.2   Deflator: Wage data

The wages we use reflect the daily remuneration of unskilled non-agricultural laborers in nominal local currency. Data before 1960 are from the unaltered series on urban laborer compensation by Frankema and van Waijenburg (2012) for the British colonies, except for Egypt, Sudan, and South Africa, for which we used various sources. For the other colonies, we used a wide variety of primary and secondary sources. We interpolated gaps and checked the plausibility of doing so. Crucially, inflation was not a widespread problem before World War II in African polities, underscoring the validity of this procedure. For the period between 1960 and the early 1970s, the unskilled wage is usually taken to be the statutory minimum wage in industry as reported in the IMF country reports.[8] Where a regionally differentiated minimum wage existed, we took the simple average of all regions. In cases where a minimum wage did not exist, we used the remuneration of predominantly low-skilled worker categories. In cases where the public sector was the dominant employer in the formal sector (often through large parastatal enterprises), we used public sector wages of the lowest pay scale. Where possible, we took supplemental payments in kinds and monetary bonuses into account. In cases where small gaps in coverage between years existed, we interpolated the data. We converted hourly or monthly wages to daily wages using an eight-hour working day, and 23 (for French ex-colonies) or 25 (for most British ex-colonies) working days per month, as was often indicated in the sources.
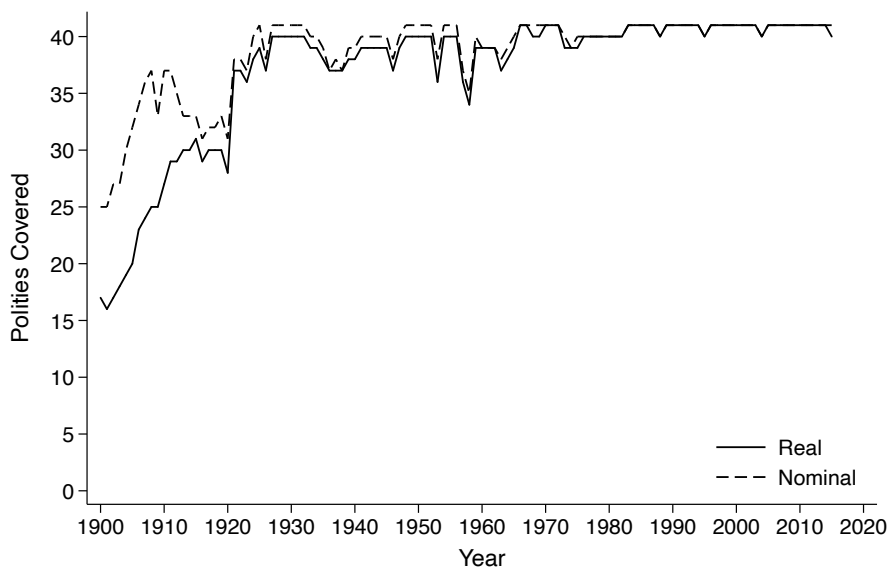
Figure 2.1: Coverage of nominal and real fiscal data in our new data set, balanced sample, 1900-2015

From the mid-1970s to the late 1990s, many countries stopped adjusting their minimum wage scales and the legal minimum wage can not be considered economically meaningful in many cases. From the early 2000s onwards, legislation has in many countries (partially) caught up with inflation and minimum wage rates (as reported by the ILO) can often be considered meaningful again. We used the Kaitz ratio (minimum to mean wage) as reported in Bhorat et al. (2017) to determine when this was the case. Periods for which minimum wages cannot be considered

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[7]Some polities did not exist in 1900 and thus enter later.

[8]Note that it does not matter for our purposes if wages are administratively set, as long as labor is actually remunerated at this rate.

Table 2.1: Data coverage (in %) and starting year by country

Country	Nominal Data		Real Data	
	First Year	Coverage	First Year	Coverage
Algeria	1900	100%	1900	100%
Angola	1900	96%	1900	95%
Benin	1900	99%	1909	99%
Botswana	1900	100%	1900	100%
Burkina Faso	1920	81%	1920	81%
Burundi	1924	91%	1924	91%
Cameroon	1900	94%	1900	94%
Central African Republic	1905	97%	1915	99%
Chad	1904	92%	1915	93%
Democratic Republic of the Congo	1900	100%	1905	100%
Egypt	1900	100%	1900	100%
Gabon	1904	98%	1915	98%
Gambia	1900	100%	1900	100%
Ghana	1900	99%	1900	99%
Guinea	1900	97%	1900	97%
Guinea-Bissau	1902	96%	1960	95%
Ivory Coast	1901	100%	1903	100%
Kenya	1900	99%	1904	99%
Lesotho	1900	100%	1911	100%
Madagascar	1900	100%	1901	100%
Malawi	1904	98%	1904	98%
Mali	1900	97%	1900	97%
Mauritania	1905	97%	1909	97%
Morocco	1920	100%	1920	100%
Mozambique	1900	97%	1913	94%
Namibia	1900	97%	1921	99%
Niger	1908	98%	1908	98%
Nigeria	1900	99%	1900	99%
Republic of Congo	1900	99%	1915	99%
Rwanda	1924	90%	1924	90%
Senegal	1900	98%	1900	98%
Sierra Leone	1900	100%	1900	100%
South Africa	1900	99%	1900	99%
Sudan	1906	100%	1906	100%
Swaziland	1904	100%	1911	100%
Tanzania	1900	97%	1900	95%
Togolese Republic	1900	95%	1900	95%
Tunisia	1900	100%	1900	100%
Uganda	1901	100%	1906	100%
Zambia	1907	86%	1926	98%
Zimbabwe	1900	92%	1900	88%
Average	1903	97%	1908	97%

Notes: Coverage is measured from first year in sample until 2015. Burkina Faso dissolved between 1933-1947. All sources for each country-year documentation are documented in the appendix.

economically binding are bridged where appropriate by extrapolating between the early 1970 and 2000 benchmarks using the dynamics of (1) mean wages in low-skill intensive sectors (food processing, textiles); (2) mean wages in total manufacturing industries; (3) consumer price indices; (4) mean public sector wages (but only rarely). (1) and (2) are supplied by UNIDO, (3) and (4) in most cases by the IMF country reports. The use of (3) is justified by empirical evidence based on a sample of African countries showing that on average 70% of increases in inflation were passed through to nominal wages (Mazumdar and Mazaheri, 2000).

We document the sources of the wage data in a separate data appendix on our website. Putting nominal tax and wage date together provides us with comprehensive coverage, as shown in Figure 2.1. Figure 2.6 suggests that for the periods where we have both GDP data and our deflator, the correlation between our measure of fiscal capacity (in wage days of an urban laborer per capita) and an alternative measure (revenue as a share of GDP) is extremely high.

2.3 Additional figures on the evolution of taxation over the century
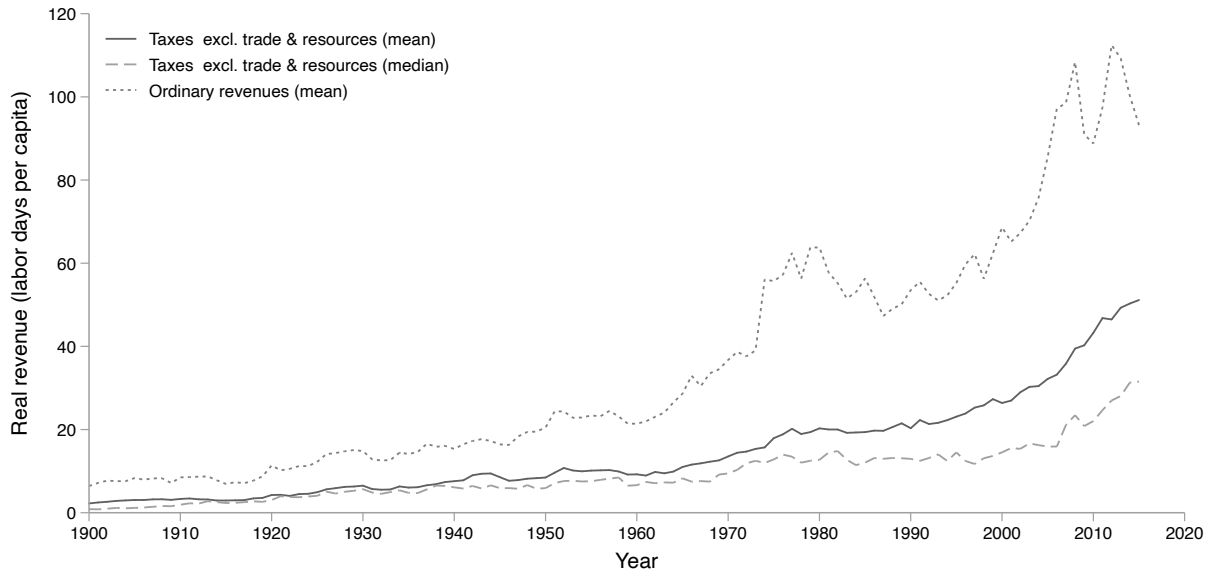
2.3.1 Full sample

Figure 2.2: Real taxation and total revenues, full sample, annual means and median

2.3.2 Direct taxes only
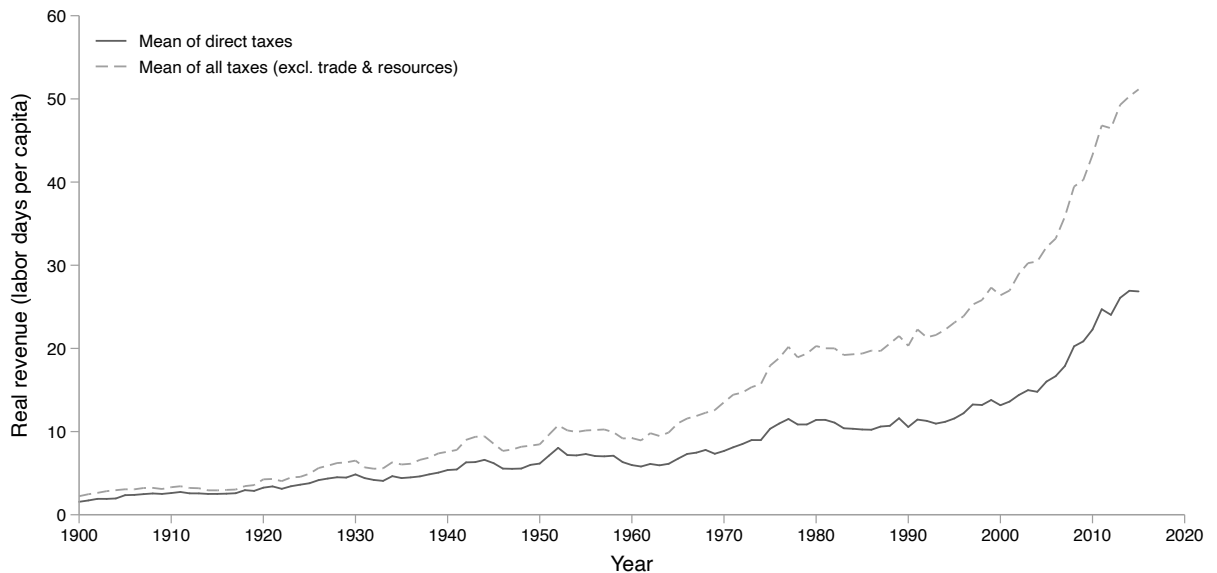
Figure 2.3: Direct taxes and all taxes, full sample

2.3.3   Forced labor

(a) Balanced sample

(b) Full sample
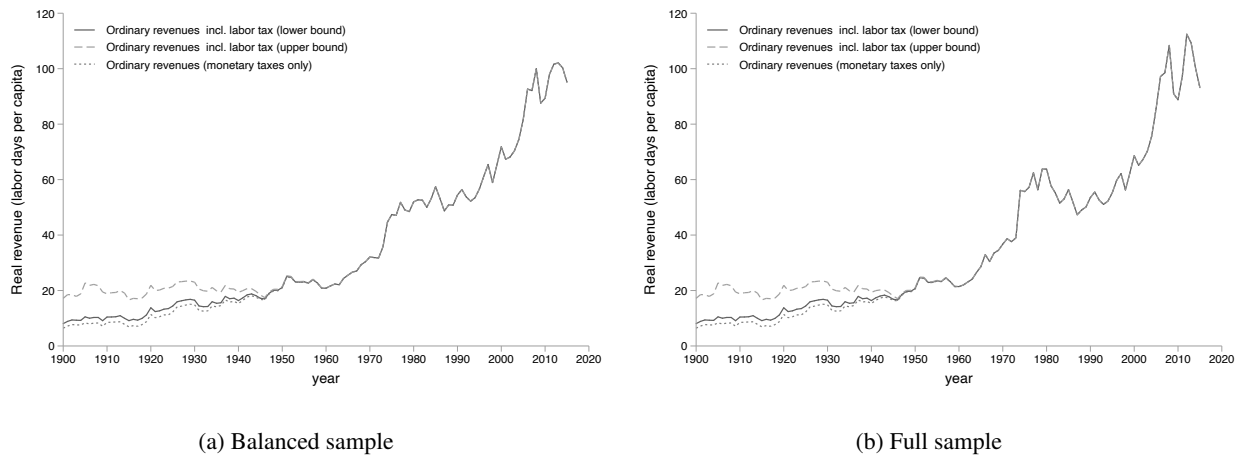
Figure 2.4: Ordinary revenues including forced labor estimates

2.4   Trade taxation and trade potential in Sub-Saharan Africa

(a) Full sample

(b) Sub-Saharan Africa only
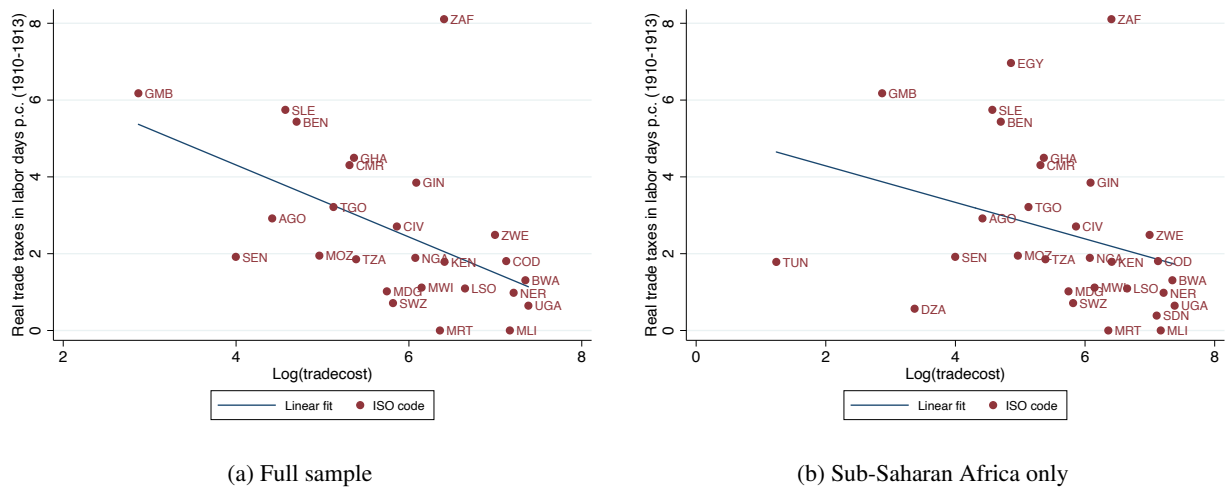
Figure 2.5: Relationship between trade taxation and trade costs

Note: Trade potential is measured as the average of the least-cost paths from urban settlements in the colony via colonial ports to ports in the metropole. The calculation is based on a cost raster that we created from a set of publicly-available raster and shape files on terrain. In particular, we differentiate the following four types of terrain with the respective cost in brackets: Ocean (1), sue canal (2), rivers (30), land (575). To approximate the relative size of settlements within a country in 1910, we rely mostly on OECD's Africapolis project and UN Population Division data. Unfortunately, these refer to 1950 rather than 1910. However, we consider using weights resulting from these population data (rather than no weights) a better approximation. When no population figures were available (Basutoland, Botswana, Eswatini), we chose the distance from the colonial capital.

2.5   Validation of fiscal capacity measure

2.5.1   Tax rates

Table 2.2: Tax collection and head tax rates

Dependent variable	Real tax collection per capita , excluding trade & resource taxes					
	British colonies			French colonies	pooled	
	(1)	(2)	(3)	(4)	(5)	(6)
Nominal head tax	0.16*	0.13*	0.23**	0.07**		
	(0.07)	(0.07)	(0.08)	(0.03)		
Real head tax					0.01***	
					(0.00)	
Real head tax w/o interpolation						0.01***
						(0.00)
Period fixed effects		✓	✓	✓	✓	✓
Polity fixed effects			✓	✓	✓	✓
Observations	277	277	276	127	407	321
Adjusted R^2	0.16	0.43	0.74	0.85	0.78	0.79

Note: All regressions are OLS. Tax data are for 10 British and 11 French territories. The real head tax is the nominal head tax deflated by the nominal daily wage variable. Standard errors are clustered at polity and time dimensions and are shown in parentheses; * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

2.5.2   Fiscal capacity measure versus revenue share in GDP

Figure 2.6: Comparison of deflators: Taxes deflated by wages and taxes as share of GDP

(a) Evolution over time, balanced sample

(b) Evolution over time, full sample

(c) Correlation, annual data, balanced sample

(d) Correlation, annual data, full sample

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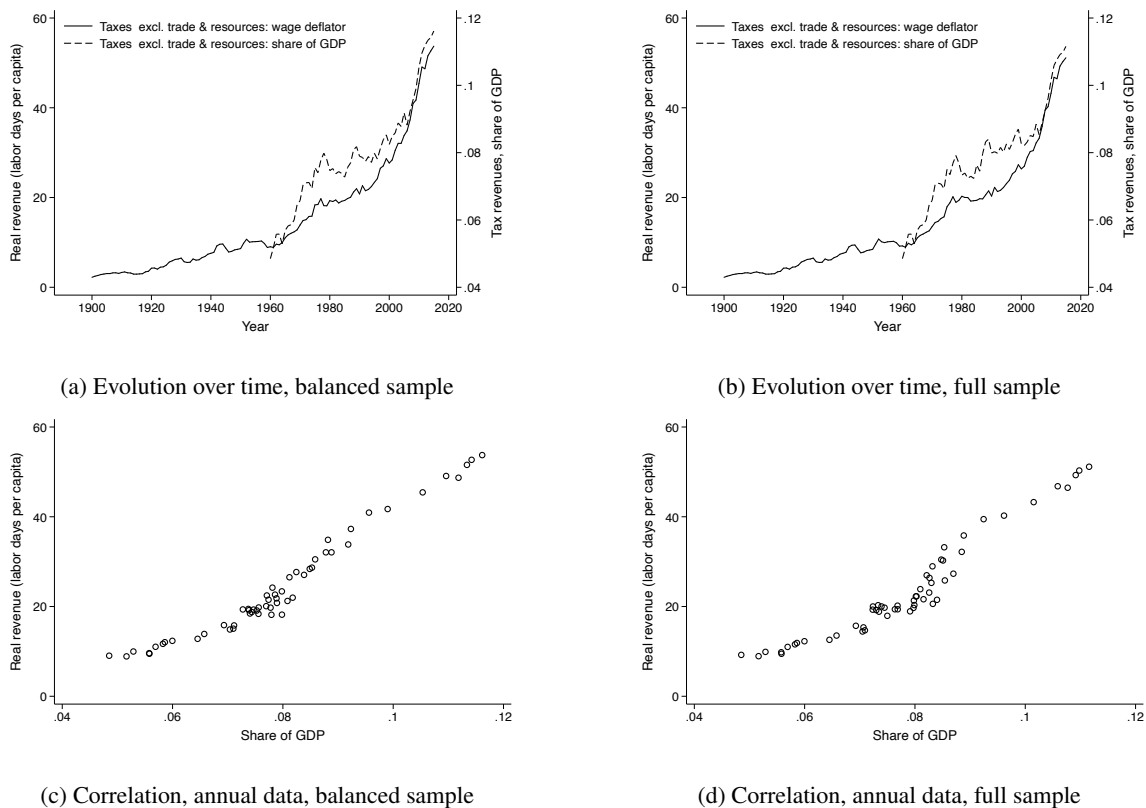
3 Sources and description of covariates

3.1 Covariates: Main variables

Table 3.1: Empirical implementation

Hypothesis	Explanatory variable(s)	Source
Government turnover	Change in party that provided chief executive or change in autocratic regime	Varieties of democracy (V-DEM) database (Coppedge et al., 2020)
	Number of leader changes	Archigos project (Goemans et al., 2009); own coding for colonial period using historical encyclopedias
Cohesive institutions	Liberal democracy index (a measure of constraints of executive and minority rights)	Varieties of democracy (V-DEM) database (Coppedge et al., 2020)
Wars	Incidence of armed conflicts, civil or international	UCDP/PRIO database (Gleditsch et al., 2002) & own coding for colonial polities based on Brecke (1999)
Alternative revenues		
Access to aid	Alliance similarity (Signorino and Ritter, 1999) with permanent members of the UN Security Council interacted with budget balance of UNSC members (for sovereign polities); metropolitan budget balance (for colonies)	Own calculation based on political alliance similarity from Häge and Hug (2016) and budget data for donors from Mitchell (2003).
Access to credit markets	Ability of polity to issue debt interacted with inverse of global interest rate for colonial polities; inverse of global interest rate for sovereign polities	Own coding based on secondary and primary sources. Global interest rate: Bank of England rate
Resources	Resource prices weighted by polity's export basket following Bazzi and Blattman (2014)	Own calculation until 1956 based on colonial trade statistics and world market prices; Bazzi and Blattman (2014) from 1957 onwards

Notes: UCDP/PRIO abbreviates "Uppsala Conflict Data Program/Peace Research Institute Oslo".

3.2 Covariates: Controls

- **Droughts** : Share of population affected by a drought event, calculated using data from EM-DAT (Guha-Sapir, 2020) and Spinoni et al. (2019).

- **Disasters** : Share of population affected by natural disaster, excluding drought, from EM-DAT (Guha-Sapir, 2020), supplemented by data from United Nations Office for Disaster Risk Reduction (2020) and NOAA (2020).

- **Hyperinflation episodes** : Dummy taking value of 1 if consumer price inflation exceeds 40%. Data and categorization from Reinhart and Rogoff (2009); missing data interpolated using GDP deflator or colonial consumer baskets from Frankema and van Waijenburg (2012).

- **Sovereign debt default** : Dummy assigned value of 1 if polity is in external default. Data and categorization from Reinhart and Rogoff (2009); missing data interpolated using share of all debt in default from Beers and Mavalwalla (2018)

- **Independent statehood** : Dummy assigned value of 1 if polity is sovereign state following the 'state system membership' definition in the Correlates of War Project (2016); some modification based on historical records, such as continuous sovereignty for Liberia.

- **Socialist economic systems** : Dummy assigned value of 1 if polity attempts to control prices and central allocation of inputs under socialist ideology takes place (own coding, various sources).

- **Territorial changes** : Dummy assigned value of 1 if polity loses territory (various sources, including Tir et al., 1998).

- **Real GDP growth** : Interpolated between benchmarks for colonial times (data for British colonies from Jerven 2019; data for other colonies from Prados de La Escosura 2012). For sovereign era, data are from Inklaar et al. (2018).

- **Central bank lending** : Index on statutory rules that limit lending from the central bank to the government (Romelli, 2018).

- **Capital liberalization** : Dummy assigned value of 1 if polity has liberalized capital flows through the capital or current account. Data are from Quinn and Toyoda (2008).

3.3   Other covariates of interest

- **Settler data:** Data are from Easterly and Levine (2016).

- **Ethnic fractionalizaton:** Data are from Montalvo and Reynal-Querol (2005).

3.4   Validation of access measures

Table 3.2: Validation of access measures

	ODA (as share of nom. GDP)		Debt issuance (yes/no)		Logarithm (real resource revenue)	
	continuous	binned	continuous	binned	continuous	binned
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure to foreign aid	4.21*					
	(2.39)					
Exposure to foreign aid (medium)		0.47				
		(0.45)				
Exposure to foreign aid (high)		1.99**				
		(0.98)				
Credit market access			0.61***			
			(0.18)			
Credit market access (medium)				0.11**		
				(0.04)		
Credit market access (high)				0.13***		
				(0.04)		
Real resource prices					0.02***	
					(0.01)	
Real resource prices (medium)						7.16*
						(3.99)
Real resource prices (high)						20.69**
						(8.54)
Polity fixed effects	✓	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.39	0.40	0.52	0.52	0.61	0.46
Observations	416	416	585	585	873	873

Note: ODA abbreviates 'overseas development aid'. Indicative data on debt issuance is taken from French colonial archives for the period prior to 1960, IBRD documentation for the 1960s, and the Global Debt Database from 1970 onward. We approximate aid flows from the (former) metropolis with bilateral aid data published by the OECD. All regressions are OLS. Standard errors are clustered at the polity level and are shown in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4 Summary statistics

Table 4.1: Summary statistics I (1900–2015 panel, five-year periods)

Variable	Obs.	Mean	Std. dev.	Min.	Max.
Fiscal variables					
Real per capita tax revenues excl. taxes on trade and resources	926	15.189	22.689	.004	253.602
Change of real per capita tax revenues, excl. taxes on trade and resources	873	2.245	7.875	-47.598	117.508
Real per capita tax revenues incl. forced labour (lower bound)	926	15.796	22.491	.436	253.602
Real per capita tax revenues incl. forced labour (upper bound)	926	18.024	22.212	.436	253.602
Real per capita ordinary revenues	926	28.647	37.606	.712	452.608
Tax revenues, share of GDP	435	.079	.047	.006	.256
Main controls					
Real GDP growth, average over period	1022	.03	.034	-.138	.289
Hyperinflation episode	1058	.367	.482	0	1
Sovereign debt default	1058	.535	1.404	0	6
Independent state	1058	.497	.5	0	1
Socialist economic system	1058	.056	.23	0	1
Territorial change	1058	.002	.043	0	1
Drought-affected population	1058	.36	1.088	0	15
Coding for colonial and pre-colonial histories					
(Former) British colony	1058	.37	.483	0	1
(Former) France colony	1058	.413	.493	0	1
(Former) Portugal colony	1058	.065	.247	0	1
(Former) Belgium colony	1058	.065	.247	0	1
Executive turnover					
Change in government (count over 5 year period)	1058	.343	.659	0	4
Change in chief executive (count over 5 year period)	1058	1.096	1.223	0	8
Decolonization	1058	.069	.254	0	1
Cohesive institutions					
Settler share (Easterly & Levine)	1058	.017	.031	0	.117
Ethnic fractionalisation (Montalvo & Reynal-Querol)	1058	.626	.257	.05	.959
Liberal democracy score (VDEM)	1052	11.789	11.513	.8	66.8
Deliberative democracy score (VDEM)	1052	10.899	13.232	.2	71.22
Egalitarian democracy score (VDEM)	1052	11.556	10.818	1.02	55.42
Participatory democracy score (VDEM)	1052	8.722	9.21	.3	56.06
Polyarchy score (VDEM)	1058	16.236	15.883	.74	79.88
Armed conflict					
Conflict incidence (PRIO)	1058	.265	.441	0	1
International war incidence (PRIO)	1058	.121	.326	0	1
Civil war incidence (PRIO)	1058	.159	.366	0	1
External aid					
Exposure to foreign aid	1050	-.14	.291	-1.127	.653
Exposure to foreign aid, weighted alliances	1050	-.118	.25	-.831	.653
Exposure to metropolitan aid	1050	-.113	.197	-.826	.748
Exposure to foreign aid, UN voting, sq. distances	1039	-.086	.274	-.949	.653
Exposure to foreign aid, UN voting, abs. distances	1039	-.062	.242	-.826	.653
K-index, UN voting, sq. distances	1039	-.053	.208	-.826	.653
P-index, UN voting, sq. distances	1039	-.008	.249	-.826	.653
Aid received, UNSC veto powers, US Dollar	509	121.889	232.109	-.8	2350.6
Real aid received, (former) metropolis, local currency	655	23.959	43.441	-2.098	559.976
Aid received , former metropolis, share of GDP	432	.022	.027	-.003	.212
Resource prices and revenue					
Real resource prices	1058	13.042	16.548	.988	203.891
Real resource prices, variable export shares, trade-weighted index	1051	11.586	14.251	.661	189.792
Real resource prices, fixed export shares, no trade weighting	1058	96.484	51.25	21.259	614.768
Real resource prices, fixed export shares, no trade weighting	1051	88.019	51.798	15.609	572.256
Nominal resource prices, variable export shares, trade-weighted index	1051	30.736	78.843	.23	1548.702
Real resource revenues, local currency	926	8.938	36.836	0	473.07
Real resource revenues, local currency	926	8.938	36.836	0	473.07
Share of oil in exports	1051	.071	.209	0	.997
Real mineral prices, variable export shares, trade-weighted index	868	118.548	635.667	0	9464.533
Capital markets and debt					
Credit market access	1058	.109	.201	0	1
Debt issuance, amount, incl. French colonies	654	.01	.087	-.72	.877
Debt issuance, dummy, incl. French colonies	654	.372	.342	0	1
Liberalized capital flows	191	.539	.5	0	1
Central bank lending	435	.472	.158	0	1

Table 4.2: Growth rates of real tax revenues excluding trade and resource taxes (in %)

	Average	Standard deviation
1900–1914	6.1	15.8
1919–1939	4.2	3.3
1946–1959	0.9	4.5
1960–1979	4.5	3.8
1980–1999	2.0	3.9
2000–2015	4.9	4.3
World War I	3.1	15.8
World War II	2.6	10.7

Notes: Column 'average' displays the average of the mean growth rates of the countries in the balanced sample. Column 'standard deviation' displays the average of the standard deviations of growth rates of the countries in the balanced sample.

5 Robustness

5.1 Comparison of results based on five-year panel with those from annual panel data

Figure 5.1: Five-year panel versus annual data: point estimates and 10% confidence intervals
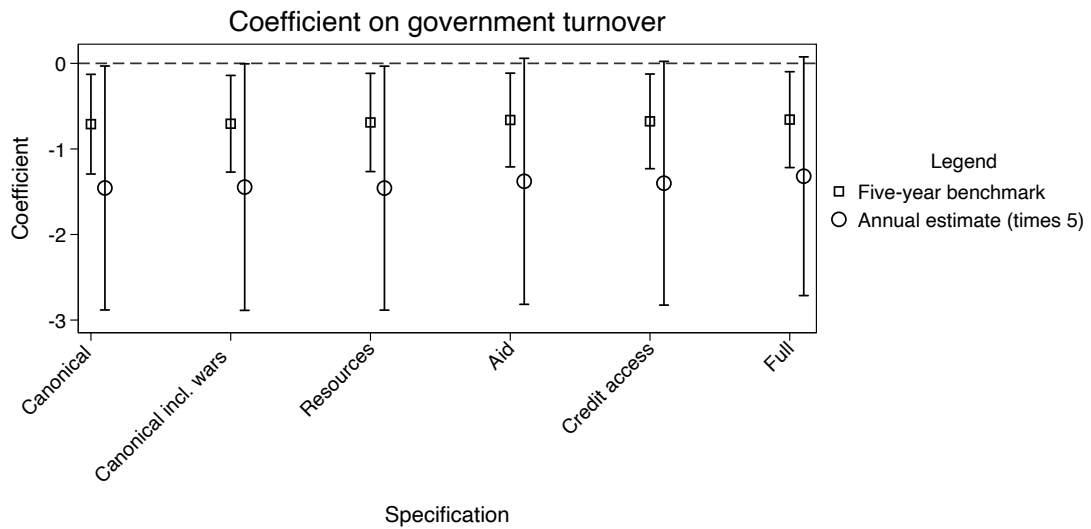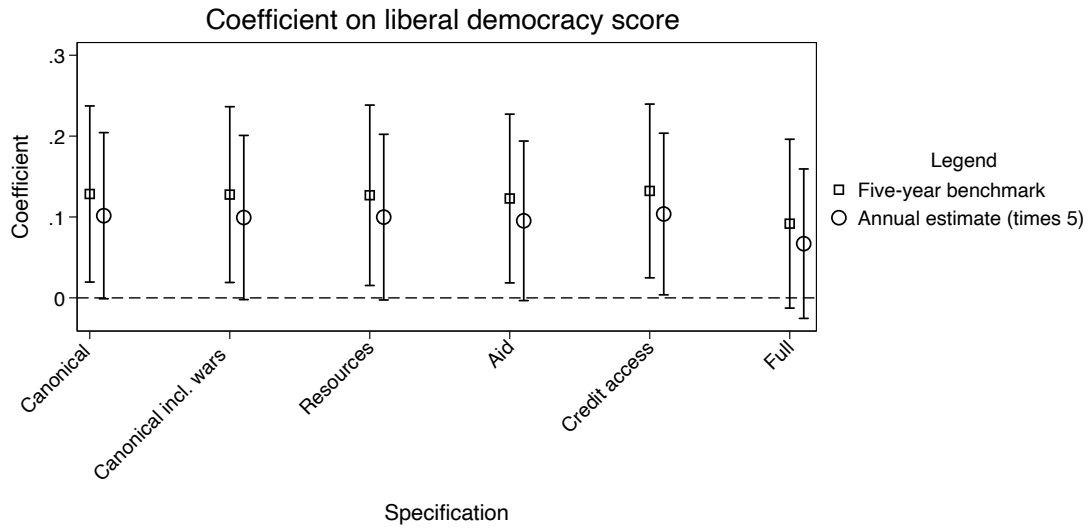
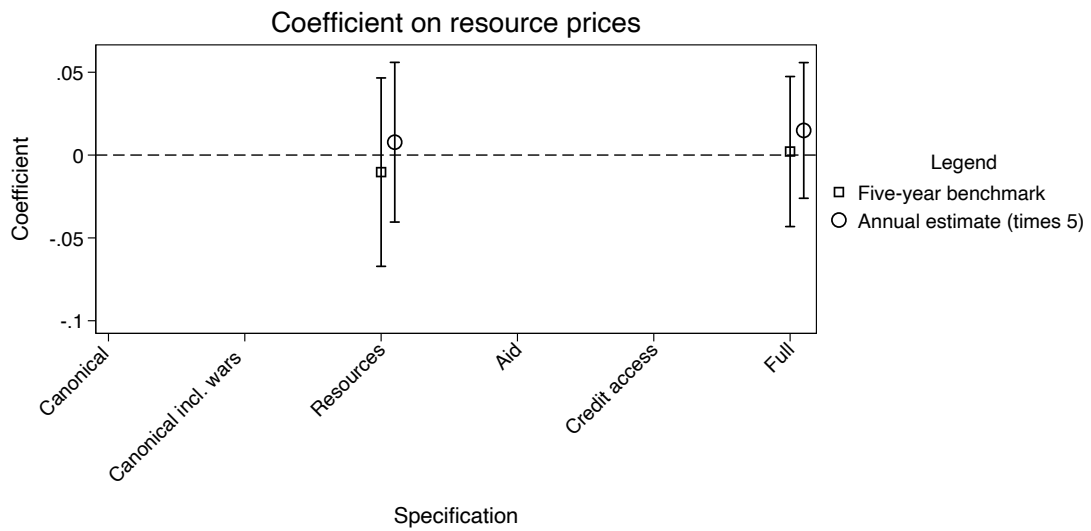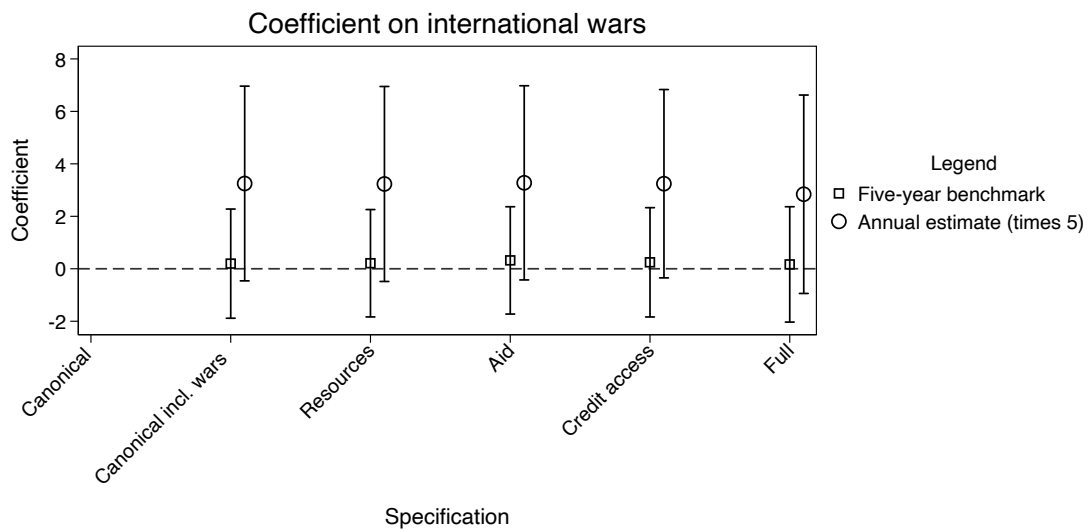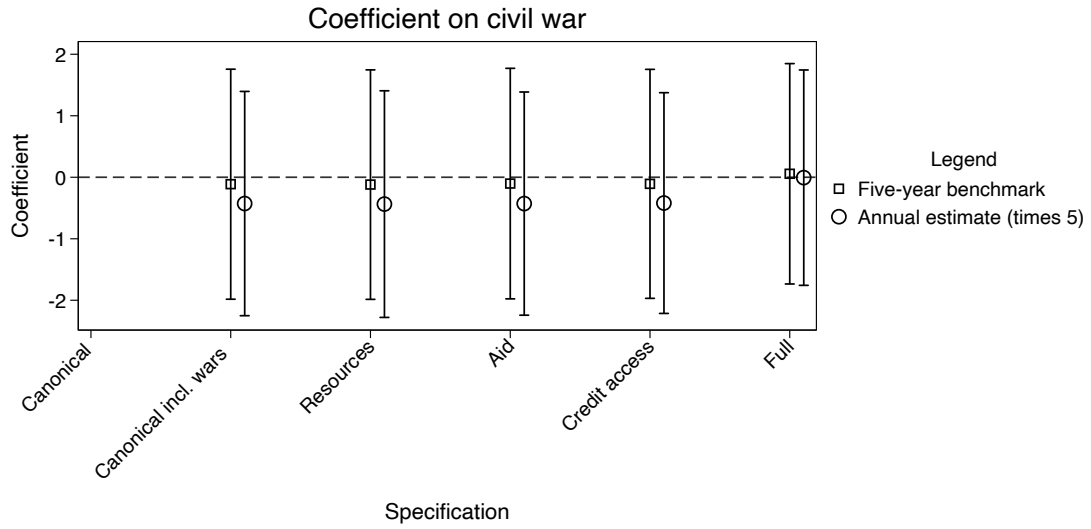Figure 5.1(continued): Five-year panel versus annual data: point estimates and 10% confidence intervals

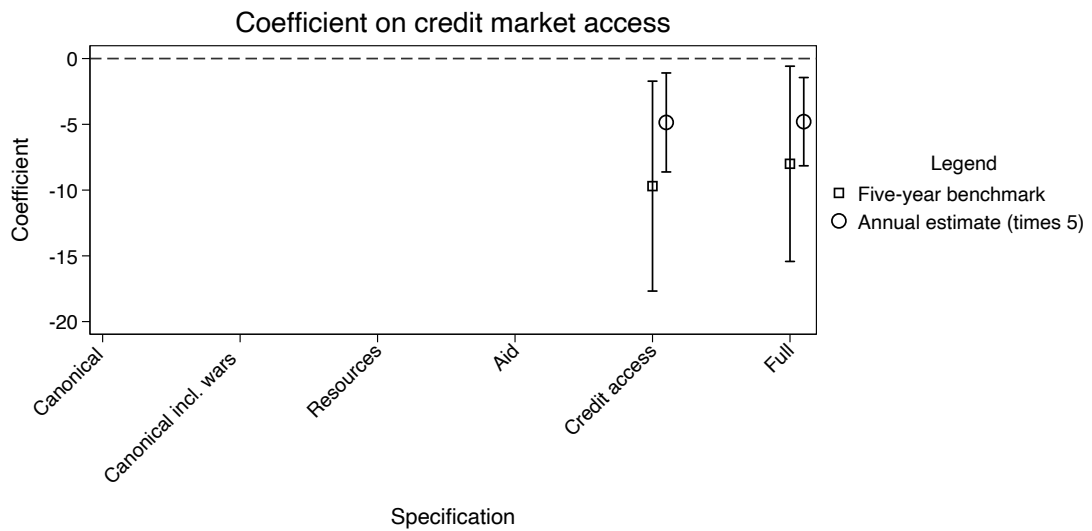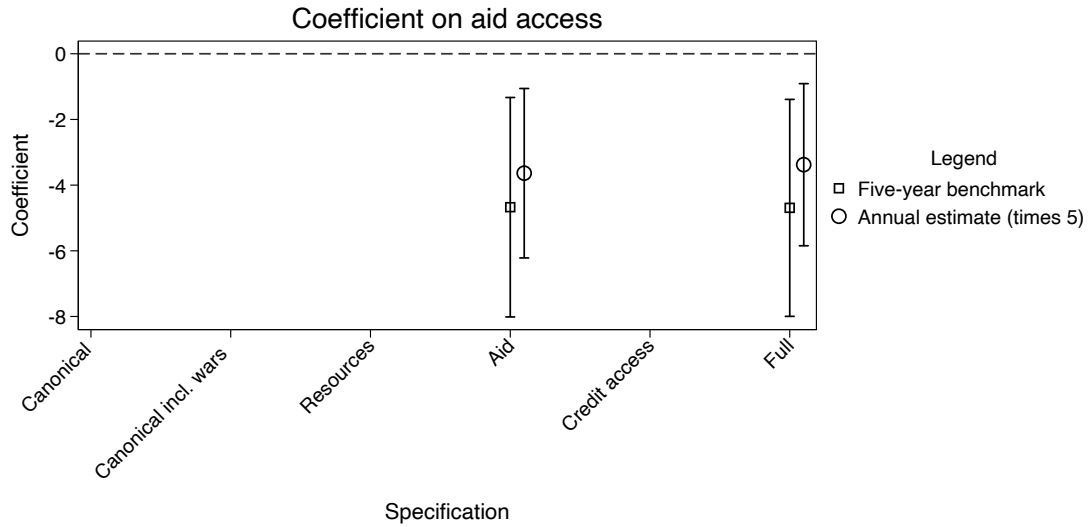Figure 5.1(continued): Five-year panel versus annual data: point estimates and 10% confidence intervals

5.2   Specification in levels

Throughout the paper, we focus on investment in fiscal capacity and thus difference the dependent variable. Table 5.1 shows that the main results are qualitatively similar in levels by providing the results from estimating the following equation:

$$\text{fiscal capacity}_{i,t} = \alpha + \sum_c \beta_c \text{canonical}_{c,t} + \sum_e \beta_e \text{extraversion}_{e,t} + Z_{i,t} + \mu_i + \gamma_t + \epsilon_{i,t} \tag{1}$$

Table 5.1: **Effects of canonical and extraversion forces on fiscal capacity (specification in levels)**

	Dependent variable: Real tax collection per capita, excluding trade & resource taxes						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Canonical factors		External finance			Full specification	
			Resources	Aid	Credit	with controls	standardized
Government turnover	-4.19***	-3.84***	-3.66***	-3.63***	-3.73***	-3.06***	-0.088***
	(1.30)	(1.22)	(1.08)	(1.16)	(1.18)	(0.82)	
Liberal democracy score	0.34	0.30	0.29	0.28	0.32	0.26	0.137
	(0.24)	(0.25)	(0.24)	(0.23)	(0.24)	(0.24)	
Civil wars		-4.75	-4.80*	-4.76	-4.73	-3.70	-0.058
		(2.89)	(2.81)	(2.84)	(2.84)	(2.76)	
International wars		-5.00	-4.78	-4.68	-5.01	-4.85	-0.043
		(5.26)	(4.85)	(5.16)	(5.24)	(4.63)	
Resource exports			-0.13			-0.11	-0.087
			(0.13)			(0.11)	
Exposure to foreign aid				-18.30**		-14.58**	-0.189**
				(7.40)		(6.31)	
Credit market access					-36.33*	-21.28	-0.194
					(20.59)	(14.92)	
Polity fixed effects	✓	✓	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓	✓	✓
Controls						✓	✓
Adjusted R^2	0.56	0.56	0.56	0.57	0.57	0.58	0.58
Observations	926	926	926	926	926	925	925

Note: Sample: African polities, 1900–2015 (5 year averages). Controls include droughts, independent statehood, socialist economic systems, territorial changes, hyperinflation episodes, real GDP growth, and sovereign debt default. All regressions are OLS. Standard errors are clustered at the polity level and are shown in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.3   Sample selection and controls

Table 5.2: **Benchmark specification with varying sample composition**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Dependent variable: Change in real tax collection per capita excluding trade & resource taxes					
	Balanced sample	Sub-Saharan Africa only	Sample excludes...					
			...those never colonized	...socialists	...high inflation phases	...civil conflict periods	...severe natural disaster periods	...periods with severe draughts
Government turnover	-0.63*	-0.65*	-0.65*	-0.52	-0.97**	-0.59	-0.70**	-0.78**
	(0.33)	(0.38)	(0.33)	(0.38)	(0.41)	(0.42)	(0.32)	(0.38)
Liberal democracy score	0.10	0.11	0.10	0.09	0.07	0.11*	0.11	0.06
	(0.06)	(0.07)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.08)
International wars	0.19	1.14	0.49	0.07	0.70	-0.13	0.12	-0.86
	(1.56)	(1.32)	(1.46)	(1.59)	(1.52)	(1.73)	(1.32)	(1.29)
Cvil wars	0.15	0.55	0.23	0.12	-0.31		0.27	-0.52
	(1.14)	(1.17)	(1.10)	(1.12)	(1.07)		(1.18)	(0.89)
Real resource prices	0.02	0.05	0.00	-0.00	-0.00	-0.00	0.00	-0.01
	(0.04)	(0.06)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Exposure to foreign aid	-4.64**	-4.73**	-4.70**	-4.49**	-6.44***	-5.08***	-4.53**	-5.76***
	(1.90)	(1.86)	(1.95)	(1.95)	(2.33)	(1.73)	(2.14)	(1.71)
Credit market access	-8.89*	-5.46	-8.32*	-8.01*	-5.89	-5.39	-9.30**	-6.52
	(4.67)	(5.05)	(4.52)	(4.59)	(4.83)	(4.27)	(4.61)	(4.14)
Polity fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.21	0.22	0.20	0.20	0.22	0.20	0.22	0.20
Observations	828	777	849	824	713	741	815	771

Note: All regressions are OLS. Standard errors are clustered at the polity level and are shown in parentheses; $*p<0.1$, $** p<0.05$, $*** p<0.01$.

Table 5.3: **Benchmark specification showing controls**

Dependent variable:	Δ real tax collection per capita (excl. trade & resource taxes)		Δ real tax collection per capita (excl. trade & resource taxes) + forced labour (lower bound)	+ forced labour (upper bound)	Δ total ordinary revenues
	(1) Benchmark controls shown	(2) Potentially bad controls omitted	(3)	(4)	(5)
Liberal democracy score	0.09	0.12*	0.09	0.09	0.16
	(0.06)	(0.06)	(0.06)	(0.07)	(0.11)
Government turnover	-0.66*	-0.65*	-0.68**	-0.85**	-0.16
	(0.33)	(0.33)	(0.33)	(0.37)	(0.53)
Civil wars	0.06	0.02	0.12	0.18	0.20
	(1.07)	(1.12)	(1.08)	(1.09)	(1.36)
International wars	0.17	0.33	0.08	0.41	1.16
	(1.31)	(1.28)	(1.30)	(1.29)	(1.68)
Real resource prices	0.00	-0.00	-0.00	-0.03	0.00
	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)
Exposure to foreign aid	-4.69**	-4.45**	-4.98**	-3.47	-6.91*
	(1.97)	(2.16)	(2.01)	(2.59)	(3.93)
Credit market access	-8.00*	-8.31*	-7.64	-11.89**	-5.09
	(4.42)	(4.64)	(4.71)	(5.29)	(5.31)
Socialist economic system	0.38	0.01	0.41	0.33	0.11
	(0.80)	(0.83)	(0.80)	(0.83)	(1.21)
Territorial change	-4.38**	-6.36***	-4.50**	-4.44*	-1.61
	(2.06)	(2.13)	(2.08)	(2.33)	(3.01)
Hyperinflation episode	-1.02	-1.17*	-0.92	-0.52	-0.47
	(0.64)	(0.65)	(0.64)	(0.65)	(0.98)
Real GDP growth	25.83**		25.44**	24.53**	63.63***
	(12.00)		(12.03)	(11.81)	(16.88)
Sovereign debt default	-0.53**		-0.52**	-0.49**	-0.89**
	(0.21)		(0.21)	(0.22)	(0.34)
Independent state	0.69	0.21	0.82	0.87	1.22
	(1.05)	(1.04)	(1.02)	(1.01)	(1.91)
Drought-affected population (lag)	-0.09	-0.06	-0.10	-0.13	-0.38
	(0.61)	(0.58)	(0.62)	(0.62)	(0.69)
Polity fixed effects	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓
Adjusted R^2	0.21	0.19	0.21	0.22	0.19
Observations	873	873	873	873	873

Note: All regressions are OLS. Standard errors are clustered at the polity level and are shown in parentheses; $* p<0.1$, $** p<0.05$, $*** p<0.01$.

5.4 Changing window sizes

In the results shown in the paper, we employed the following original window (Ow):[9]

$$Ow = \{1900 - 1904, 1905 - 1909, 1910 - 1914, ...\}$$

To test the stability of our estimates with respect to moving the windows, we shifted the start and end year of each window forward by $t = 1, .., 4$. For example, for $t = 1$ the new windows are $Ow_{+1} = \{1901 - 1905, 1906 - 1910...\}$.

The following plots show the point estimate for each variable of interest for each specification in the benchmark table and each of the possible windows. The specifications are on the x axis (and five estimates are presented according to the moving window), while the point estimate and a 10% confidence interval are presented on the y axis.

Figure 5.2: Point estimates and 10% confidence interval for alternative windows

_____
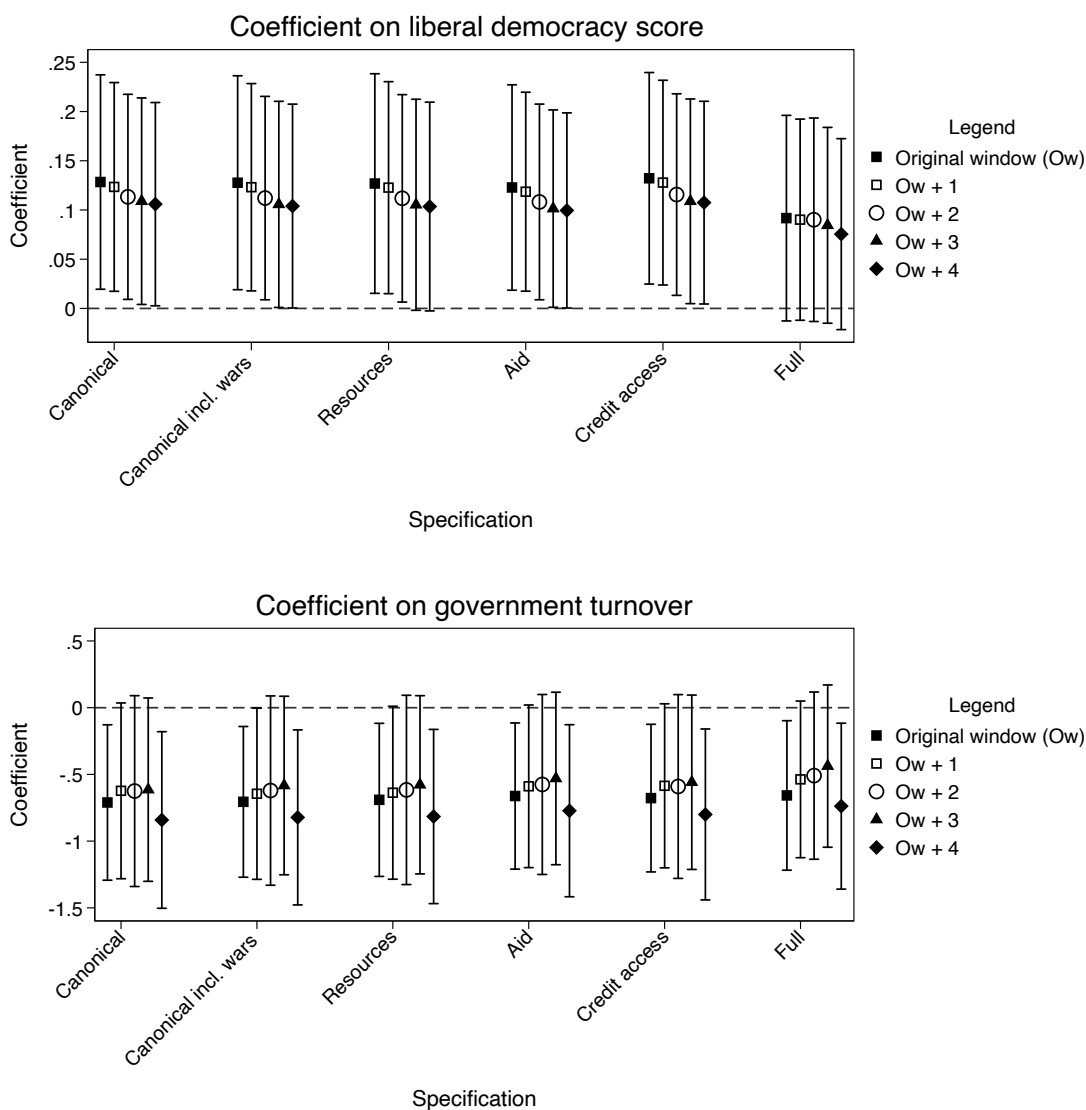
[9]Note that our last window is 2010-2015 instead of 2010-2014 to make use of all the data avaialable.

Figure 5.3: Point estimates and 10% confidence interval for alternative windows (continued)

Coefficient on civil war
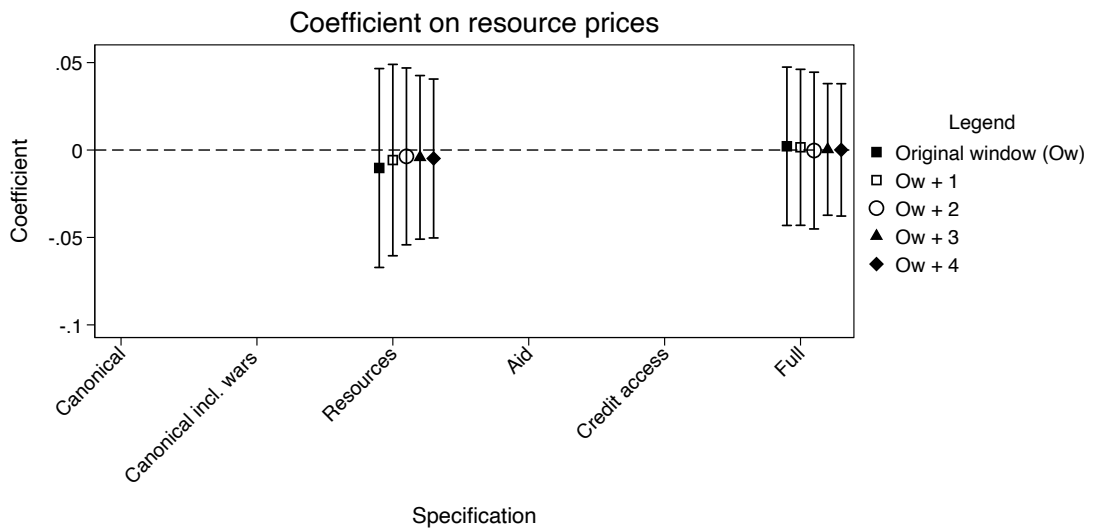

Coefficient on international wars

Coefficient on resource prices

Figure 5.4: Point estimates and 10% confidence interval for alternative windows (continued)

Coefficient on aid access

Coefficient on credit market access
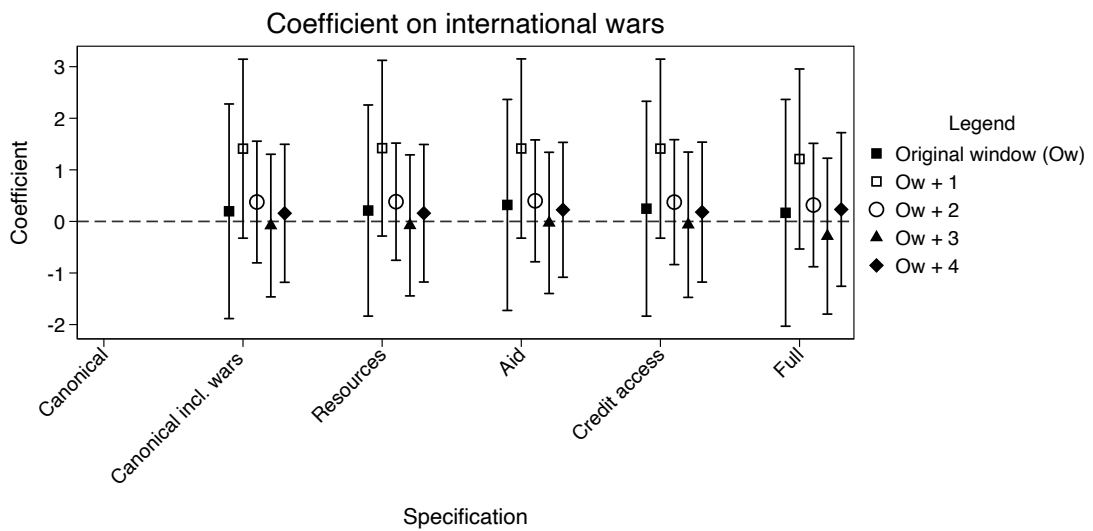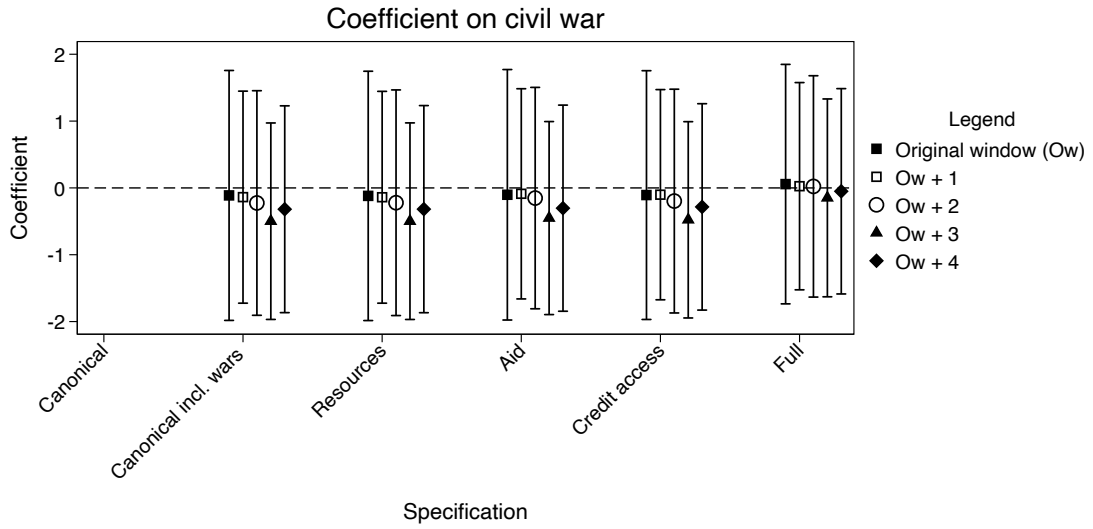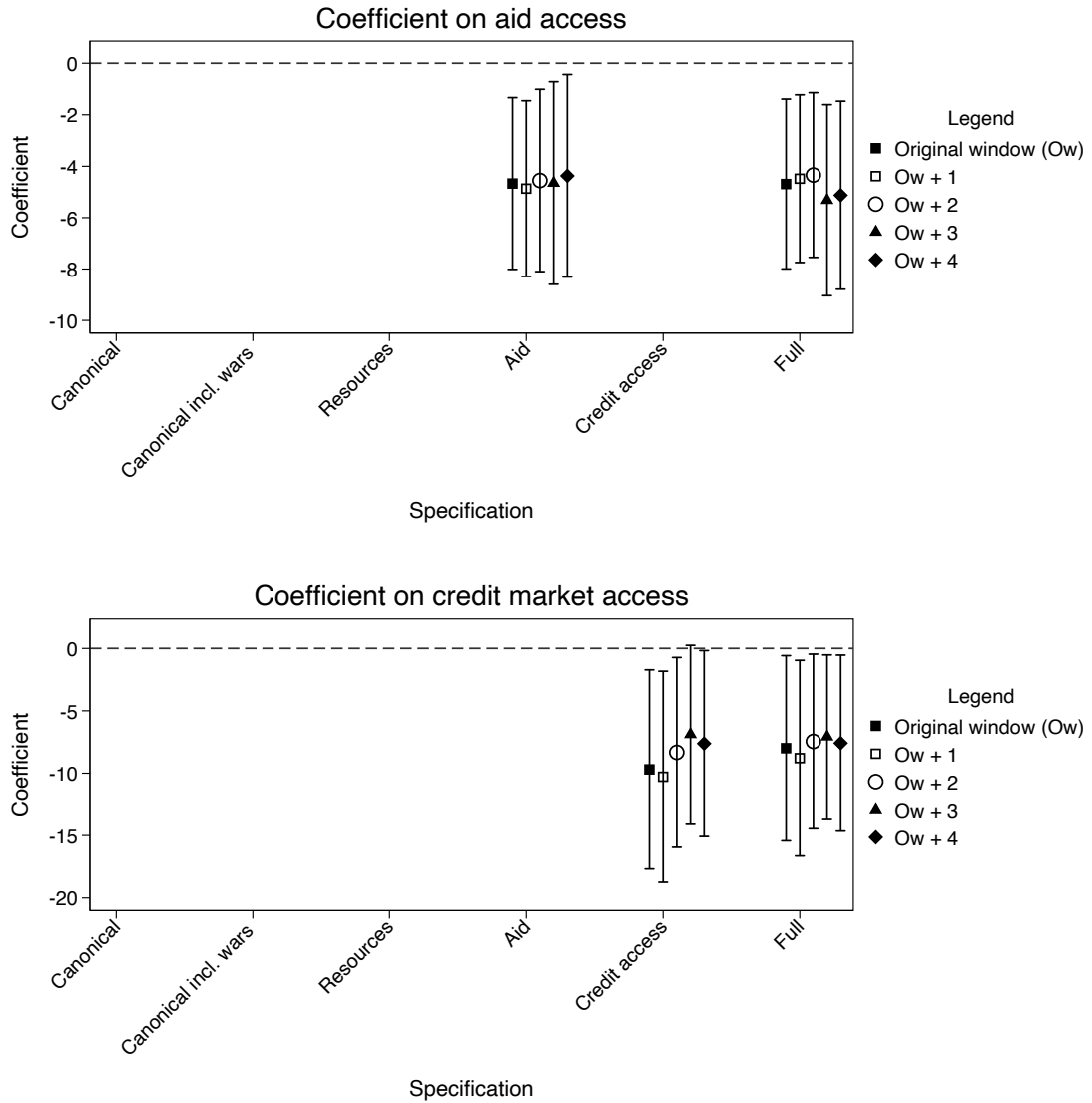
5.5 Alternative democracy measures

Figure 5.5: Point estimates and 10% confidence interval for alternative democracy measures
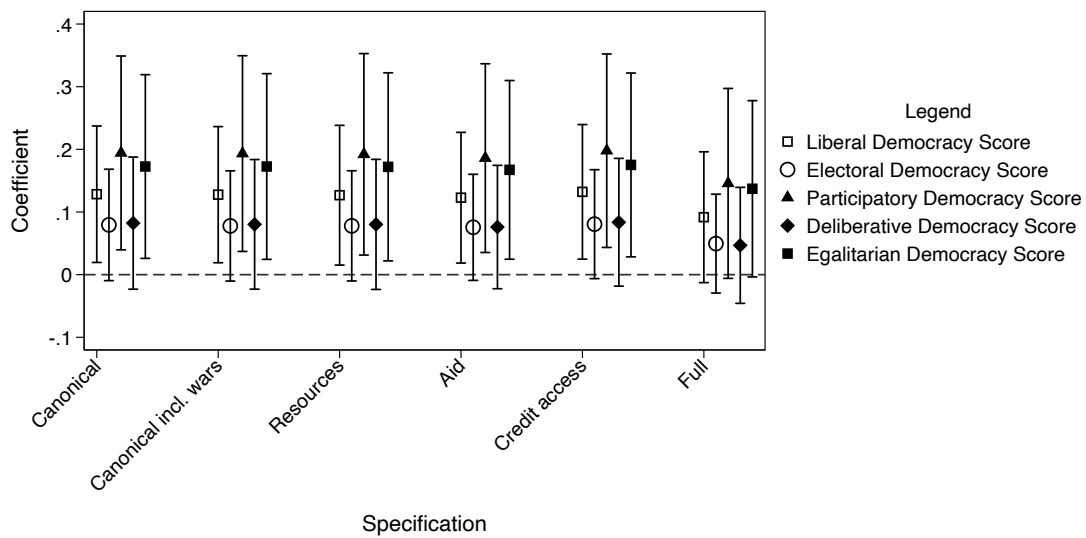
5.6 Alternative access measures

Table 5.4: **Exposure to aid – Alternative access measures**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Dependent variable: Change in real tax collection per capita excluding trade & resource taxes			
	Baseline	Weighted	Exposure to	UN General Assembly voting patterns			
	exposure	with material	metropolitan	S&R distance weighting		Index	
	measure	capabilities	aid	squared	absolute	Cohen's κ	Scott's π
Exposure to foreign aid	-4.69**						
	(1.97)						
Exposure to foreign aid, weighted alliances		-4.78**					
		(1.88)					
Exposure to metropolitan aid, weighted alliances			-4.43*				
			(2.46)				
Exposure to foreign aid, UN voting, sq. distances				-5.40***			
				(1.98)			
Exposure to foreign aid, UN voting, abs. distances					-6.28***		
					(2.12)		
κ-index, UN voting, sq. distances						-5.52**	
						(2.46)	
π-index, UN voting, sq. distances							-4.75*
							(2.47)
Other main independent variables included	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓
Polity fixed effects	✓	✓	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.21	0.21	0.21	0.21	0.21	0.21	0.21
N	873	873	873	870	870	870	870

Notes: See Table 5.3 in main paper for a description of the controls (all are included but not shown in these regressions). Exposure to foreign aid is a Signorino and Ritter (1999) similarity index of alignment between an African polity's alliance system and that of the permanent members of the UN Security Council, interacted with the fiscal position of the UN Security Council member. Model (2) weights this index by material capabilities. Exposure to metropolitan aid in model (3) is a similarity index of alignment between an African polity's alliance system and that of the colonial metropolis, interacted with the fiscal position of the metropolis. Models (4) and (5) use a Signorino and Ritter (1999) similarity index between the votes cast by an African polity in the UN General Assembly and those of the permanent members of the UN Security Council, interacted with the fiscal position of the UN Security Council member. Model (6) uses each African polity's UN General Assembly voting patterns to compute Cohen (1968)'s κ. Model (7) uses these votes to compute Scott (1955)'s π. All aforementioned similarity indices are as computed in Häge and Hug (2016). All regressions are OLS; Standard errors are clustered at the polity level (46 polities) and are shown in parentheses: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Table 5.5: **Exposure to resource prices – Alternative indicators**

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Change in real tax collection per capita excl. trade & resource taxes					
	Trade weighting				No trade weighting	
	fixed shares (benchmark)	fixed shares (lagged)	variable shares	var. shares (nominal)	fixed shares	variable shares
Real resource prices	0.00					
	(0.03)					
Real resource prices (lagged)		-0.03				
		(0.04)				
Real resource prices (variable export shares, trade weighted index)			0.01			
			(0.04)			
Nominal resource prices (variable export shares, trade weighted index)				0.01		
				(0.01)		
Real resource prices (fixed export shares, no trade weighting)					-0.00	
					(0.01)	
Real resource prices (fixed export shares, no trade weighting)						0.00
						(0.01)
Other main independent variables included	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Polity fixed effects	✓	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.21	0.21	0.21	0.21	0.21	0.21
Observations	873	873	873	873	873	873

Note: See Table 5.3 in main paper for a description of the controls (all are included but not shown in these regressions). Real resource prices are (real) world market prices for commodities weighted by polity-specific fixed export shares and interacted by a polity's trade share, unless otherwise noted in the table. Export shares refer to a commodity's share in a polity's export basket. Trade share refers to the aggregate weight of primary commodities in a polity's export basket. All regressions are OLS. Standard errors are clustered at the polity level (46 polities) and are shown in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 5.6: **Exposure to resource prices by exporter types and time periods**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: Change in real tax collection per capita excl. trade & resource taxes						
	Benchmark	Exporter type				Time period	
		Large exporter	Large exporter (lag)	Oil exporter	Oil exporter (lag)	before 1960	after 1960
Real resource prices	0.00	-0.00		0.05		0.02	0.04
	(0.03)	(0.03)		(0.06)		(0.04)	(0.06)
Real resource prices (lagged)			-0.03		0.03		
			(0.04)		(0.05)		
Large exporter (= 1)		0.66	1.31				
		(1.00)	(1.33)				
Large exporter × real resource prices		0.04					
		(0.06)					
Large exporter × real resource prices (lagged)			0.00				
			(0.06)				
Oil exporter (= 1)				1.83	3.14*		
				(1.52)	(1.84)		
Oil exporter × real resource prices				-0.10			
				(0.07)			
Oil exporter × real resource prices (lagged)					-0.16**		
					(0.07)		
Marginal effect (at means) if...							
...moderator = 0	-	-0.00	-0.03	0.06	0.03	-	-
...moderator = 1	-	0.04	-0.03	-0.04**	-0.12***	-	-
Other main independent variables included	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓
Polity fixed effects	✓	✓	✓	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓	✓	✓	✓
Adjusted R^2	0.21	0.21	0.21	0.21	0.22	0.04	0.22
Observations	873	873	873	873	873	385	486

Note: See Table 5.3 in the main paper for description of the controls (all included but not shown in these regressions). Large exporters are defined as polities exporting more than 25% of global trade value for any commodity. Regressions are OLS. Standard errors are clustered at the polity level (46 polities) and are shown in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Marginal effects calculated with delta method.

5.7   Leader turnover

Table 5.7: Determinants of African fiscal capacity: **Leader turnover**

	(1)	(2)	(3)	(4)
		Dependent variable: Change in real tax collection per capita excluding trade & resource taxes		
	Decolonization	**Moderation through external finance (coefficients)**		
	Decolonialization	Aid	Credit	Resources
Leader turnover (ΔLeader)	0.05	0.14	0.16	0.37
	(0.18)	(0.41)	(0.26)	(0.23)
Decolonization	-2.02*	-2.16*	-2.15**	-2.09*
	(1.17)	(1.18)	(1.03)	(1.12)
ΔLeader $\times$ aid access (med)		-0.33		
		(0.44)		
ΔLeader $\times$ aid access (high)		0.02		
		(0.53)		
ΔLeader $\times$ credit market access (med)			-0.02	
			(0.41)	
ΔLeader $\times$ credit market access (high)			-0.36	
			(0.38)	
ΔLeader $\times$ resource prices (med)				-0.58
				(0.40)
ΔLeader $\times$ resource prices (high)				-0.40
				(0.34)
		Moderation through external finance (marginal effects)		
Marginal effects for government turnover at				
...low level of moderator		0.14	0.16	0.37
...medium level of moderator		-0.19	0.14	-0.20
...high level of moderator		0.16	-0.20	-0.03
Moderator coefficient				
- medium		0.75	-0.88	0.41
- high		-1.36	-0.67	0.35
Polity fixed effects	✓	✓	✓	✓
Period fixed effects	✓	✓	✓	✓
Controls	✓	✓	✓	✓
Hainmueller et al. Wald test (*p*-value)		0.59	0.00	0.55
Observations	873	873	873	873
Adjusted R^2	0.20	0.20	0.20	0.20

Note: See Table 4.1 and Table **??** in the online appendix for summary statistics and Section 4.1 in the main paper for variable definitions. The same controls and main covariates as in column (6) in Table 5.3 in the main paper are included but not shown. Standard errors are clustered at polity level and are shown in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

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