

# Enhancing Tax Capacity: Revenue Gains from Strengthening Tax Administration

Jean-Marc Atsebi, Nikolay Gueorguiev, Manabu Nose

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**Enhancing Tax Capacity: Revenue Gains from Strengthening Tax Administration****Prepared by Jean-Marc Atsebi, Nikolay Gueorguiev, and Manabu Nose\***

Authorized for distribution by Nikolay Gueorguiev

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**ABSTRACT:** Building on previous studies, we propose a robust estimation strategy to uncover the causal effects of tax administration strength on tax revenue in 121 countries over the period 2014–2022. Our novel approach utilizes a unique expert survey to construct an Operational Strength Index of tax administration, using the International Survey on Revenue Administration (ISORA), and employs an instrumental variable strategy based on the IMF Fiscal Affairs Department’s Capacity Development programs. We find that strengthening tax administration significantly boosts tax revenue, particularly in emerging and developing economies, and especially in countries with lower levels of informality, stronger institutions, and higher financial development. These findings carry important policy implications for governments and development partners aiming to enhance tax administration capacity and strengthen public finances overall.

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WORKING PAPERS

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# I. Introduction

Tax revenue mobilization remains a central challenge in many countries, particularly those facing substantial development needs and elevated debt levels, or aiming to avoid it. In many developing countries, tax revenue persists below 15 percent of GDP (Gaspar et al., 2016; Bellon and Warwick, 2025; IMF, 2025), highlighting the limits of relying on economic growth to boost tax revenue. Okunogbe and Tourek (2024) show evidence of a lack of correlation between changes in tax-to-GDP and changes in GDP per capita among developing countries over the past 30 years.

Strengthening tax capacity should be part of a deeper process of state building, which requires coordinated investments in tax policy, revenue administration (including both tax and customs), as well as broader institutional and legal reforms (Benitez et al., 2023; IMF, 2025). In particular, cross-country disparities in tax-to-GDP ratios are closely linked to mixed success in building tax administrations (Besley and Persson, 2014), and evidence shows that stronger tax administrations lead to higher tax compliance (Baer et al., 2025), which in turn can increase revenue. This is especially true given the institutional features and structural characteristics of developing countries, including weak tax enforcement, informality, and limited banking systems, which severely limit governments' tax capacity (Gordon and Li, 2009; Gaspar et al., 2016; Kleven et al., 2016; Jensen, 2022; Bellon and Warwick, 2025). These challenges underscore the necessity for fundamental improvements in the tax system and tax administration capacity (Okunogbe and Tourek, 2024; IMF, 2025)—an urgency heightened by the fiscal impact of the COVID-19 pandemic, rising debt vulnerabilities, and acute development needs.

In this context, Chang et al. (2020) and Adan et al. (2023) have analyzed the relationship between tax administration strength and tax revenue in a cross-country analysis, aiming to estimate the potential revenue gains from improved tax administration. While informative, these studies left significant room for improvement. Methodologically, estimating the revenue gains of tax administration reform using cross-country data presents significant challenges. Above all, the measurement of tax administration reform poses a hurdle for the serious empirical identification of the effects of these reforms. A significant limitation comes from the slow-moving nature of the tax administration strength measures (Appendix Table AII.2), which led to the assumption that tax administration's operational strength remained constant over time in earlier studies. In addition to making a very strong assumption that tax administration is time-invariant over 2010–2019, Chang et al. (2020) employed a two-step approach that suffers from omitted variable bias by inadequately mixing the effects of tax administration with unobservable factors such as tax morale, geographical characteristics, and historical legacies. Adan et al. (2023) attempted to mitigate some biases through the Hausman-Taylor random effects estimator combined with a pre-test procedure used to identify internal instruments (Chatelain and Ralf, 2021). However, this latter approach still relied on the assumption that a country's tax administration strength remains time-invariant and uncorrelated with individual and unobserved country effects—a necessary condition for the random effects model to be valid. Furthermore, both studies fail to address simultaneity bias, which arises from the possibility that tax administration reforms can also be influenced by the level of tax revenue (Ebeke et al., 2016). Finally, causal identification has proven challenging due to (i) the absence of convincing exogenous variation that could serve as an instrumental variable (IV) for tax administration strength and (ii) a comprehensive tax policy variable that could accurately record the timing and yield of tax policy reforms. The interventions often span a complex package intertwined with tax policy and administration reform initiatives occurring over several years, making it difficult to isolate their individual impacts. This underscores the need for improved methodologies to accurately capture the dynamic nature of tax administration reforms and their associated revenue gains.

In this paper, a key objective is to improve the accuracy of estimated revenue gains from tax administration reform by addressing the aforementioned empirical challenges. Our contributions are fivefold. First, a significant improvement in our research methodology is the adoption of an IV strategy to address the simultaneity bias of tax administration strength. We use the intensity of the IMF's Fiscal Affairs Department (FAD) Capacity Development (CD) programs in tax administration, measured by the cumulative Full-Time Equivalent (FTE) used over the past four or five to two years prior to the observation dates. This instrument is highly relevant, as it is likely correlated with our measure of tax administration strength—the Operational Strength Index (OSI), especially in Emerging Markets and Developing Economies (EMDEs).<sup>1</sup> Countries receiving sustained IMF support for tax administration reforms are likely to improve their OSI, which in turn may affect tax revenue. Also, the instrument can potentially satisfy the exclusion restriction, as we focus specifically on past FAD CD programs related to tax administration, with exogeneity ensured by using lagged CD intensity—measured as the cumulative FTE used over two to five years earlier. Second, we develop and administer a unique survey of 30 tax administration experts from FAD to improve the measures of tax administration strength. The insights gained from this survey are essential in constructing a more granular tax administration's OSI across different countries. We design a Delphi method (Powell, 2003; Pulipati and Mattingly, 2013; Ameyaw et al., 2016; Gao et al., 2018; Kermanshachi et al., 2020), a process that involves (i) gathering expert feedback to refine the measures of tax administration strength and improve their practicality, granularity, and consistency across the International Survey on Revenue Administration (ISORA) vintages;<sup>2</sup> and (ii) designing and administering an expert weighting survey to assess the relative importance of each tax administration practice or structural foundation in raising tax revenue. Third, we exploit within-country variations by controlling for time-invariant unobservable factors that affect tax revenue and relaxing the strong assumption that the strength of tax administration is invariant over time by estimating fixed effects model.<sup>3</sup> Fourth, we also improve the control for tax policy changes by using a novel database on revenue yields from tax policy changes—the Global Tax Policy and Revenue Evaluation Database (TAPRED)—built using a narrative approach and large language models (LLM) by Atsebi et al. (forthcoming).<sup>4</sup> Fifth, in addition to the methodological improvements, we conduct various robustness checks to address potential measurement errors in the OSI. We also provide new evidence of the differentiated effects of tax administration strength on tax revenue through several sensitivity analyses, where the effects are assessed against a country's level of development, informality, financial development, institutions, governance quality, and tax types.

Our key findings are as follows. First, we provide strong evidence that improvements in tax administration capacity significantly increase tax revenue, with a more pronounced effect in EMDEs where tax administration inefficiencies are more prevalent. Specifically, our IV estimates show that, for instance, increasing OSI from the 33<sup>rd</sup> to 67<sup>th</sup> percentile of the OSI's country distribution raises the tax-to-GDP ratio by 1.2 percentage points (ppts) in the full sample and 1.7 ppts in EMDEs—enough to close 25–35 percent of the total tax gap identified

<sup>1</sup> The OSI measures the overall strength of tax administration practices, institutional frameworks, and structural foundations (see Section II.1.b).

<sup>2</sup> The ISORA dataset is the collaboration of the Inter-American Center of Tax Administrations (CIAT), the Fiscal Affairs Department (FAD) of the IMF, the Intra-European Organisation of Tax Administrations (IOTA), and the Organisation for Economic Co-operation and Development (OECD). More information about the survey, questionnaires, ISORA data and related publications can be found following this link: <https://data.rafit.org/?sk=BA91013D-3261-42F8-A931-A829A78CB1EC>.

<sup>3</sup> The OSI index itself has been updated with the latest International Survey on Revenue Administration (ISORA) survey conducted in 2023, which provides more within-country variations that we can exploit (Appendix Table A1.3).

<sup>4</sup> TAPRED is a novel LLM-powered narrative database collecting tax policy changes and their revenue yields from 5,200 IMF Staff Reports and MEFPs across 189 countries (1998–2024). It captures detailed attributes of each tax policy measure or package—including type, timing, base vs. rate, rationale, implementation status, and estimated revenue impact (in percent of GDP)—and classifies measures by direction, one-off nature, and whether based on forecasts.

by Benitez et al. (2023).<sup>5</sup> Second, the intensity of past FAD CD in tax administration is a strong predictor of current OSI. It is more likely to reflect the broader impact of development partners supporting tax administration reforms, as FAD CD is typically implemented alongside support from multiple partners. Third, in addition to the effects of OSI, we find that several key control variables—tax policy changes, tax staff, and macro and structural factors exhibit the expected strong relationships with tax revenue. This is important for the ability to back-cast—explain the contributions of various factors to observed historical tax revenue changes. Fourth, we unveil some important sensitivity findings: (i) the revenue gains from strengthening tax administration are more than twice as large in Emerging Markets (EMs) compared to Low-income countries (LICs) where the impediments to revenue collection are more prevalent.<sup>6</sup> They are also lower in Advanced Economies (AEs) where tax systems are already highly developed, with well-functioning institutions and high levels of compliance; (ii) while the impact of OSI on tax revenue will still be positive regardless of the level of informality, the revenue gains from improved tax administration will be higher as informality declines; (iii) the impact of OSI could be mediated by the level of financial development in a country, highlighting the importance of financial development in enabling tax administration to collect more revenue; (iv) the revenue gains increase with institutions and governance quality; (v) the largest gains from strengthening tax administration are seen in indirect taxation, while direct taxes and non-tax revenue exhibit more muted responses. Finally, our findings are robust to the (i) use of alternative measures of OSI, including using its lagged value and an equal-weighted OSI, (ii) income group-year fixed effects to account for macroeconomic shocks, structural differences, and policy responses to shocks that may systematically vary across income groups over time, (iii) alternative samples by excluding specific groups of countries, such as outliers in terms of both level and change of OSI as well as the level of the tax-to-GDP ratio, fragile and conflict-affected states (FCS), small island countries, and resource-rich countries, and (iv) alternative specification of control variables.

Overall, our analysis provides a more rigorous identification of the impact of strengthening the tax administration in a cross-country setting, thereby complementing and extending insights from country-specific experimental and quasi-experimental studies. While papers such as Khan et al. (2016) on financial incentives for tax collectors, Pomeranz (2015) and Naritomi (2019) on third-party information, Basri et al. (2021) and Atsebi et al. (forthcoming) on large or medium-size taxpayers offices provide credible causal evidence of particular tax administration reforms in individual countries, our study shows that strengthening tax administration matters systematically at the global level. By scaling up from micro to cross-country analysis, we deepen the understanding of the broader dynamics at play.

This paper is organized as follows. Section II explains data, and Section III provides stylized facts. Section IV describes the empirical strategy. Sections V, VI, and VII present the baseline results, robustness checks, and the sensitivity analyses, respectively. Section VIII concludes and discusses some policy implications.

<sup>5</sup> Used as an illustration, moving from the 33<sup>rd</sup> to the 67<sup>th</sup> percentile in OSI implies a 0.14 increase of the index—well above recent experience. Between 2017 and 2022, the median change was near zero, and the 75<sup>th</sup> percentile only 0.04. A 0.14 rise corresponds to the 95<sup>th</sup> percentile of observed changes, signaling a major reform that would take several years.

<sup>6</sup> This finding is in line with the “15 percent tax-to-GDP tipping point” evidence in Gaspar et al. (2016) and Bellon and Warwick (2025), highlighting the critical role of building tax capacity together with state capacity (institutions, stability, public trust, financial development, etc.)



## II. Data

### 1. Constructing Measures of the Strength of Tax Administration

We use ISORA data to build indices of the overall tax administration strength. ISORA surveys countries' tax administration features through both numerical and categorical survey questions (606 questions in the latest vintage) on a wide spectrum of practices and structural foundations agreed on by four partner international organizations. The data are collected through a voluntary self-assessment, where countries respond to an online questionnaire. Over the years, coverage has increased over time, including 38 AEs, 78 EMs, and 50 LICs. We only use the vintages ISORA 2016, ISORA 2018, and ISORA 2023, given the major revision of the survey for ISORA 2020 and ISORA 2021 vintages.<sup>7</sup> We have harmonized the indicators to ensure consistency across ISORA vintages and over time, despite changes introduced in the surveys (e.g., some indicators were dropped or added).

#### a. A Delphi Method to Select Indicators and Weigh Indices

We have significantly revised the measures of tax administration strength relative to those used in Chang (2020) and Adan et al. (2023) to make them more comprehensive, granular, and consistent across different ISORA vintages. Following the paper by Adan et al. (2023), an initial version of the Tax Administration Yield and Assessment Tool (TAYAT), incorporating that paper's results, was piloted in eight countries (Albania, Cabo Verde, Georgia, Malawi, Maldives, Mongolia, Sri Lanka, Uzbekistan) by 13 IMF tax administration experts. These pilots revealed significant room for improvement in the measures of tax administration performance in terms of desired granularity and coverage of key aspects of tax administration. Moreover, key practices and structural foundations such as tax enforcement, human resource management and development, and coverage of high-net-worth individuals could be addressed better as well.

To address these issues, we employ an iterative process consisting of the three-step Delphi Method. A group of five IMF experts with extensive experience in tax administration was convened to guide this process until an agreement is reached (Powell, 2003; Ameyaw et al., 2016; Gao et al., 2018). Their role was to incorporate feedback from the pilot cases, including: (i) selecting relevant ISORA indicators and classify them to improve their practicality, granularity, and consistency across ISORA vintages; (ii) designing and piloting an expert weighting survey to assess the relative importance of each practice or structural foundation in raising tax revenue; and (iii) supporting the administration of the survey with a larger group of experts.

For step (i), each expert provided feedback on the initial set of indicators and questions—highlighting omitted important questions, suggesting reclassifications between categories, and dropping irrelevant questions—while addressing the issues raised during the pilots. We consolidated the feedback and shared it with all experts. In the second round, the experts offered further input, and a final meeting was held to resolve outstanding issues. In step (ii), the experts discussed the design of the weighting survey, including how to measure relative importance, whether to use a top-down or bottom-up approach, and whether to provide weights for both top-

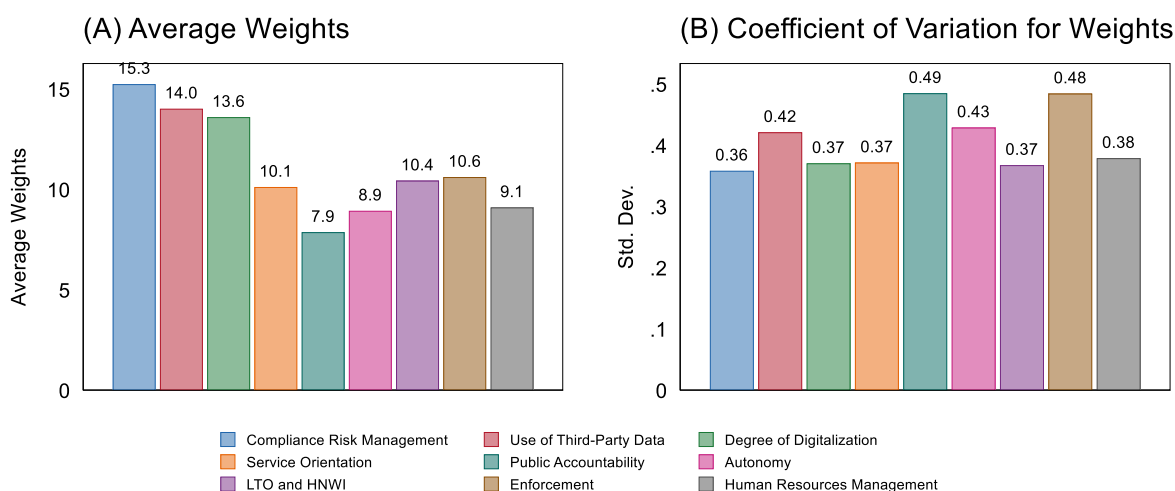
<sup>7</sup> The six available vintages for analysis include ISORA 2016, ISORA 2018, ISORA 2020, ISORA 2021, ISORA 2022, and ISORA 2023, covering respectively, the years 2014–15, 2016–17, 2018–19, 2020, 2021, and 2022. Until ISORA 2021, the survey was run biennially. Following the ISORA 2018, a major revision of the questionnaire has resulted in a smaller set of questions asked annually, and additional questions to be asked every four years. The recent survey structure prevents us from using the ISORA 2020 and 2021 vintages for our analysis. ISORA 2023 follows the same structures as the first two vintages. See Crandall et al. (2021) for a comprehensive description of the results of the ISORA 2018. For countries that have not participated in a particular ISORA survey, we fill the missing values using data from the closest available ISORA vintages.

level indicators and more detailed ones. The five experts piloted the survey to ensure that the structure and questions were clear before expanding to the larger group of experts. Finally, for step (iii), we decided to conduct the expert weighting survey once and obtained a 42 percent response rate.<sup>8</sup>

### b. The Novel Structure and Relative Weights of the OSI

Our OSI is based on nine sub-indices reflecting specific tax administration practices (both administrative and operational) as well as structural foundations (laws, regulations, and policies) that underpin those practices. The nine indices are: (i) Compliance Risk Management (CRM); (ii) Use of Third-Party Data (UTD); (iii) Degree of Digitalization (DIG); (iv) Service Orientation (SOR); (v) Public Accountability (PAC); (vi) Autonomy (AUT); (vii) Large Taxpayers Office and High-Net-Worth Individuals (LTO and HNWI); (viii) Tax Enforcement (ENF); and (ix) Human Resources Management and Development (HRM). Definitions for each index are provided in Appendix Table AI.1. These sub-indices are compiled using responses to a series of mostly “yes/no” survey questions.<sup>9</sup> Compared to the 66 questions used by Chang et al. (2020) and Adan et al. (2023), our new approach is more comprehensive and provides more granularity, incorporating 193 questions. In addition, we create 41 disaggregated indices (sub-categories) and 152 more detailed indices (sub-subcategories). A summary of the number of questions and aggregated/disaggregated sub-indices is presented in Appendix Table AI.2.

Figure 1. Average Practice and Structural Foundation Weights and Coefficients of Variations



Source: Authors' calculations based on the Weighting Survey (30 expert respondents).

Notes: Panel (A) shows the average weights for each practice or structural foundations, and Panel (B) shows their respective coefficient of variation.

<sup>8</sup> Although our initial intention was to run the survey at least twice to resolve disagreements to the utmost extent, we found it more feasible to conduct the expert weights survey only once and take the sample average of the weights. With sufficient responses from the expert group (30 experts responded), this meets our objective for obtaining statistical significance.

<sup>9</sup> Changes in questions across ISORA vintages—including added or removed questions, wording refinements for clarity, enhanced guidance for standardized interpretation, and adjustments in structure and flow—introduce inconsistencies over time. For example, some questions used to construct the indices were not included in the 2016 and 2017 ISORA vintages. To address this, we fill in the gaps using responses from the 2023 ISORA vintage.

An important challenge in constructing the sub-indices is to account for the relative importance of each sub-index for raising tax revenue, as perceived by tax administration experts. To this end, we employed an expert weighting survey as noted above. The IMF experts were asked to prioritize the relative importance of each sub-index, sub-category, and sub-subcategory in raising tax revenue conceptually, independent of the specific characteristics of the country they work on. We asked the experts to distribute 100 points each among the nine indices (layer 1), the sub-categories within each of the nine indices (layer 2), and the sub-sub-categories within each sub-category (layer 3). Finally, we computed the global weights by multiplying the weights obtained at layers 1 to 3, which provides relative importance for each of the 193 questions used in the survey.

The full disaggregated global weights for 193 questions were used to construct the OSI. However, for conciseness, we present only the average weights at layer 1 in Figure 1. The survey shows that CRM, UTD, and DIG are the highest-rated practices, followed by ENF, LTO and HNWI, SOR, HRM, AUT, and PAC. Variations in expert opinion are moderate, with lower-rated practices such as PAC and ENF showing the greatest divergence (highest coefficients of variation), while other practices generally exhibit more consensus. In summary, we significantly enhance the OSI from earlier studies by incorporating more granular and comprehensive questions. Its construction now reflects the relative importance of each question in raising revenue, as determined through an expert weighting survey.

## 2. Other Variables

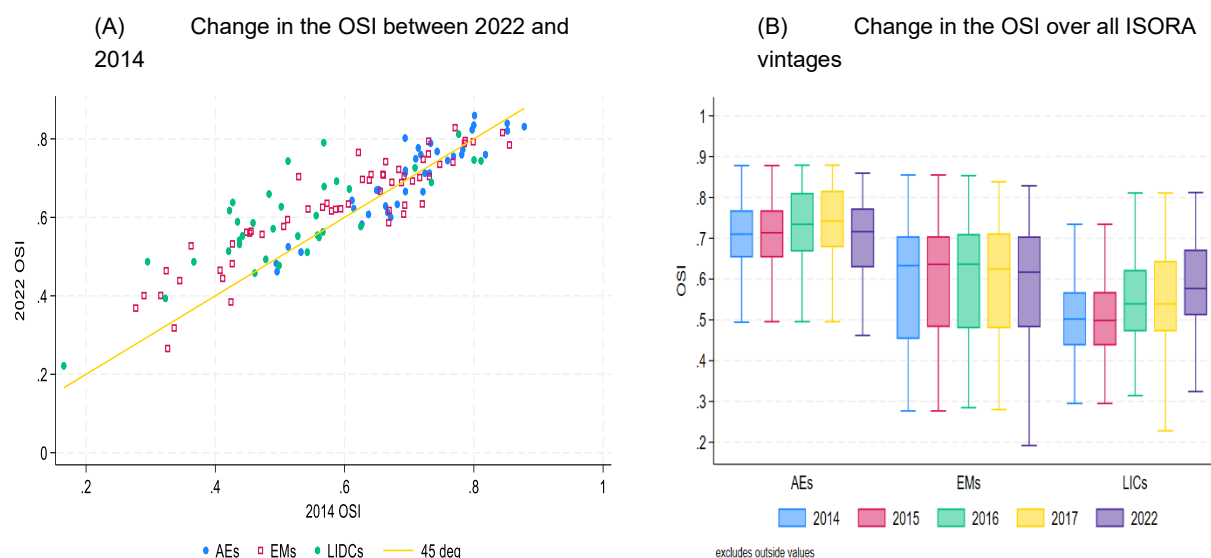
Our dependent variable is the tax-to-GDP ratio, excluding trade taxes and social security contributions, which is compiled from the IMF's WoRLD and WEO database. We exclude trade taxes and social security contributions to abstract from the volatility of commodity prices and resource revenues, as these revenues may be collected by agencies other than the tax administration. We also control for several macroeconomic, structural, and institutional factors impacting tax revenue, as identified in previous studies (Leuthold, 1991; Tanzi, 1992; Ghura, 1998; Gupta, 2007; Yohou, 2017; Mitra, 2017; IMF, 2015; IMF, 2018; IMF, 2019; Chang et al., 2020; Gwaindepi, 2022; Adan et al., 2023). They include i) macroeconomic variables such as per capita GDP and its square, inflation, trade openness, external debt to GDP, and terms of trade, ii) variables capturing the structure of the economy and quality of institutions such as oil exports to GDP, the share of agriculture to GDP, and control of corruption, and iii) a novel measure of revenue yields from tax policy changes from the TAPRED by Atsebi et al. (forthcoming). The data descriptions and sources are presented in Appendix Table A1.3. Summary statistics are shown in Appendix Table A11.1.

## III. Novel Stylized Facts

Figure 2 shows the changes in the overall strength of tax administration (OSI) by income groups across three ISORA vintages covering the years 2014, 2015, 2016, 2017, and 2022. As shown in Panel A, tax administration strength has significantly improved over time for EMs and LICs, with a very low initial OSI score in 2014. Compared with the 45-degree line (which indicates no change in the OSI between 2014 and 2022), the 2022 OSI is located above the level in 2014 in many EMs and LICs, indicating a convergence in the performance of tax administration. Panel B further shows the change in the distribution of the OSI score. While the OSI in AEs and EMs show limited improvement over time or even a slight decline in 2022, tax administration practices in LICs have been steadily strengthened over the past decade. Since 2016, the overall distribution of the OSI (median as well as 25<sup>th</sup> and 75<sup>th</sup> percentile values) has continued to shift upward in LICs, including the period after the COVID-19 pandemic (Panel B).

Further examination of the ISORA sub-indices provides a granular picture of which tax administration practices have driven such improvement. Figure 3 shows the average tax administration performance for our nine ISORA sub-indices reflecting specific aspects of tax administration practices and structural foundations over time. On average, AEs have the highest scores in all tax administration aspects, except for one (large taxpayers' office and high-net-worth individuals). Overall, the average scores of compliance risk management, degree of digitalization, service orientation, autonomy, and human resources and development tend to be relatively high, while the use of third-party data remains particularly low in LICs and EMs.

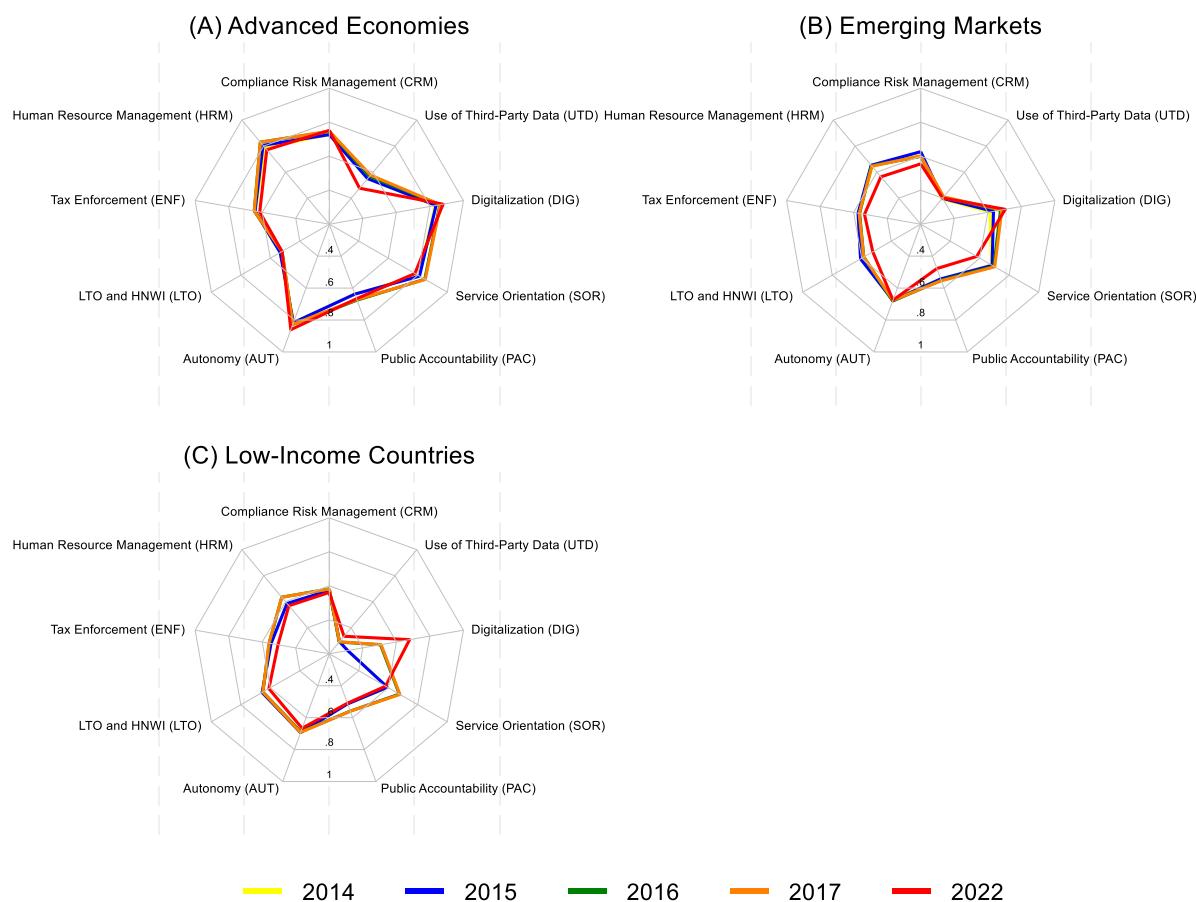
**Figure 2. Comparison of Tax Administration Strength by Income Groups, Across ISORA Vintages**



Source: Authors' calculations using ISORA.

EMs and LICs have made progress in digitalizing their tax administration over the past decade (Panels B and C), which has served as the main driver of improvement in the OSI. Starting from the low base, tax administrations in LICs have relied more heavily on digital technologies in recent years, catching up to the level of EMs, especially after the COVID-19 pandemic (Amaglobeli et al., 2023; Nose and Mengistu, 2023; Okunogbe and Tourek, 2024). In parallel, the use of third-party data in tax administration, which is closely related to digitalization, has slightly improved in LICs. The performance of other tax administration practices, such as service orientation, public accountability, and human resource management and development, has also improved slightly.<sup>10</sup> We also present, in Appendix II, the correlation between tax revenue and tax administration strength across different contexts (Appendix Tables AII.2 to AII.4).

<sup>10</sup> We also document a noticeable decline in most performance scores in the ISORA 2023 vintage, particularly in service orientation, human resource management, public accountability, and tax enforcement. Rather than signaling a deterioration in tax administration, these declines likely reflect improvements in data quality. The 2023 round introduced stricter verification and validation of country responses, reducing potential overreporting in earlier surveys. This underscores both the challenges of comparing ISORA 2023 with past vintages and the importance of accounting for survey design when interpreting cross-country indicators.

**Figure 3. Comparison of Average Tax Administration Practice and Structural Foundation**

Source: Authors' calculations using ISORA.

## IV. Empirical Methodology

### 1. Empirical Challenges and Bias

A key objective of this analysis is to improve the accuracy of the estimated revenue gains from tax administration strength (OSI) while addressing empirical challenges that may bias the results. These challenges are: (i) the limited time coverage of OSI restricts the panel to five years (2014–2017, 2022), with a significant gap between 2017 and 2022; (ii) the limited within-country variation in OSI—a slow-moving variable (Appendix Table AII.2)—constrains identification strategies;<sup>11</sup> (iii) possible simultaneity bias, as tax revenue can influence tax administration reforms, while reforms can also impact tax revenue; (iv) possible omitted variable bias, where unobserved factors such as tax morale, geographical characteristics (e.g., resource endowment),

<sup>11</sup> However, the latest ISORA release introduces greater variation, which we exploit in this analysis.

historical legacies, and social trust may jointly affect OSI and revenue; and (v) measurement error, since OSI is computed based on self-reported data and may, in some cases, be overstated.<sup>12</sup>

Specifically, (i) and (ii) limit the within-country variation in OSI over time and prevent us from using the changes in tax administration strength as the key variable of interest. However, the latest 2023 ISORA vintage, which covers the year 2022, introduces greater within-country variation compared to earlier studies, allowing us to estimate a fixed effects model. Regarding (iii), Ebeke et al. (2016) show that tax administration reforms, such as the introduction of LTOs and Semi-Autonomous Revenue Authorities (SARAs), are more likely in countries with low revenue and IMF-supported programs, one of whose key objectives is revenue mobilization. This creates a negative feedback loop between OSI and tax revenue that could underestimate the OSI's true effect. As a result, tax administration reforms may appear to have a weaker positive impact on revenue than they actually do. Concerning (iv), omitting unobserved time-invariant characteristics correlated with OSI and tax revenue can also bias the results. Finally, regarding (v), the ISORA survey is a self-assessment, and some countries may overrate their tax administration strength. This leads to a downward bias in estimating the true effect of tax administration on revenue, as the perceived strength (which is overstated) does not translate into the expected revenue.

## 2. Empirical Strategy

In this study, we employ an instrumental strategy, focusing on exploiting within-country variations, while controlling for time-invariant unobservable factors that affect tax revenue. Thus, we relax the strong assumption that OSI is time-invariant and use panel fixed effects with an external instrument for OSI across five years. This strategy allows us to assess how changes in OSI impact changes in tax revenue within countries, addressing challenges (i) and (ii). The country fixed effects control for time-invariant unobservable factors correlated with both OSI and tax revenue, addressing challenge (iv). We also incorporate year fixed effects to account for common shocks, as well as several macroeconomic, structural, and institutional factors impacting tax revenue, as identified in previous studies (Leuthold, 1991; Tanzi, 1992; Ghura, 1998; Gupta, 2007; Yohou, 2017; Mitra, 2017; IMF, 2015; IMF, 2018; IMF, 2019; Chang et al., 2020; Gwaindepi, 2022; Adan et al., 2023), in both the baseline and robustness checks. Finally, we also improve the control for tax policy yield by drawing upon a novel LLM-powered narrative database developed by Atsebi et al. (forthcoming), which captures revenue yields from tax policy measures extracted from 5,200 IMF staff reports.<sup>13</sup> By providing a direct estimate of the impact of tax policy changes on revenue collection, it allows for a clearer distinction between the impacts of tax policy and tax administration.<sup>14</sup>

To address potential measurement errors in OSI, we propose an outlier analysis to identify countries that may underreport or overreport their OSI, which could bias our results. Although this will not fully eliminate bias from

<sup>12</sup> It is not uncommon for some countries to overestimate the strength of their tax administration, reporting a stronger capacity than observed in reality. This is confirmed by Adan et al. (2023), who compare ISORA indices with TADAT indices, showing that TADAT indices indicate a weaker tax administration than ISORA indices. Overall, this creates a downward bias in estimating the effects of strengthening tax administration on tax collection. To address this, we conduct several robustness checks by dropping countries with the highest and lowest ISORA indices, as well as the strongest and weakest reforms (i.e., large and small increases in the indices over time, respectively).

<sup>13</sup> Since our goal is to capture the within-year effect of tax policy changes on revenue, we include this variable contemporaneously. Our results remain robust when using lagged values of tax policy yield (available upon request).

<sup>14</sup> Earlier studies proxy tax policy by the difference between budgeted tax revenues in year (t) and actual revenues in year (t-1), both scaled by GDP. However, this measure is noisy: it conflates policy with macroeconomic shocks (e.g., commodity price swings, weather shocks), depends on potentially biased revenue forecasts, and may inadvertently capture contemporaneous tax administration reforms.

challenge (v), it will help exclude the most extreme cases. We also conduct robustness checks by excluding specific groups of countries, such as those with the top or bottom 10 percent of OSI or tax-to-GDP ratio, FCS, small island countries, and resource-rich countries, and the top and least tax administration reformers, respectively defined as those in the top and bottom 10 percent of OSI changes.

To address simultaneity bias, we use the intensity of the IMF's FAD CD programs in tax administration as an external instrument for OSI.<sup>15</sup> This intensity is quantified by the total FTE used in tax administration CD over a single year, aggregated across the past four or five to two years. This instrument is highly relevant as it is correlated with OSI—countries receiving sustained IMF support for tax administration reforms are likely to improve their OSI in the future, which in turn affects tax revenue.<sup>16</sup> We provide evidence of the relevance below. At the same time, the instrument can potentially satisfy the exclusion restriction, as we focus specifically on FAD CD programs related to tax administration.<sup>17</sup> These CD programs are designed to support institutional and administrative reforms rather than to directly influence tax policy decisions. As such, their impact on tax revenue is expected to operate primarily through their effect on the strength of tax administration, rather than through alternative channels. Moreover, to ensure the exogeneity of our instrument with current tax revenue, we focus on lagged CD intensity, measured as the cumulative FTE used over the past four or five to two years. This lag structure allows for a reasonable temporal distance between CD and tax revenue, thereby mitigating concerns that recent CD efforts could be driven by current or anticipated revenue performance and accounting for the time needed to implement tax administration reforms. We also control for tax policy changes and other macroeconomic factors to ensure that the instrument affects tax revenue primarily through its impact on the strength of tax administration. We estimate the following equations, where the first stage IV is given by Eq. (1) and the second stage IV is described by Eq. (2):

$$OSI_{i,t} = \alpha + \delta_1 FTE\_RA_{i,t} + \beta_1 X_{it} + \tau_t + \mu_i + \xi_{it} \quad (1)$$

$$Tax_{i,t} = \alpha + \delta_2 \widehat{OSI}_{i,t} + \beta_2 X_{it} + \tau_t + \mu_i + \varepsilon_{it} \quad (2)$$

where  $Tax_{i,t}$  is the tax-to-GDP ratio excluding trade taxes and social security contributions.  $OSI_{i,t}$  and  $\widehat{OSI}_{i,t}$  are a measure of the strength of tax administration and its predicted value from the first stage, respectively.  $FTE\_RA_{i,t}$  is our instrument used in the first stage equation (1). Its impact on OSI is captured by  $\delta_1$ . The revenue gain from OSI is captured by  $\delta_2$ .  $\tau_t$  are time fixed effects included to capture common shocks to tax revenue.  $\mu_i$  are country fixed effects, capturing time-invariant characteristics.  $\xi_{it}$  and  $\varepsilon_{it}$  are the error terms.  $X_{i,t}$  is a set of control variables identified by the existing literature to be good determinants of tax revenue.

<sup>15</sup> In our search for a valid instrument for tax administration strength, we considered using the OSI in neighboring countries, following the identification strategy in Caselli and Reynaud (2020) for fiscal rules, which assumes potential imitation effects and geographical diffusion of reforms. The idea is that countries may look to neighbors' experiences when designing tax administration reforms. However, the relevance condition was not met, so we did not use this approach in our analysis.

<sup>16</sup> Rather than interpreting the instrument as capturing the effects of the IMF's CD on tax administration strength, we argue that it more likely reflects the broader impact of development partners supporting tax administration reforms. This includes other IFIs and bilateral donors, since IMF CD is typically implemented alongside support from multiple partners, making it difficult to isolate the Fund's independent effect.

<sup>17</sup> We cannot test the exclusion restrictions because our model is just identified, meaning it has exactly one endogenous variable and one instrument.

## V. Baseline Results

This section presents the baseline results from estimating the effect of tax administration strength, as measured by the OSI, on the tax-to-GDP ratio (excluding trade taxes and social contributions), after controlling for macro and structural factors and revenue yields from tax policy measures. In fact, tax administration is expected to increase tax revenue through improved enforcement and voluntary compliance (Baer et al., 2025). The results are reported in Table 1. We compare panel fixed-effects OLS and IV estimates, considering both the full sample (including AEs) in columns (1), (3), and (5), and EMDEs in columns (2), (4), and (6), separately.

The OLS estimates, reported in Columns (1) and (2), suggest a weak and insignificant relationship between OSI and the tax-to-GDP ratio for the full sample. The relatively small effect size suggests that the OLS estimator may be underestimating the true effect due to simultaneity bias. To address potential endogeneity, we instrument OSI using the intensity of FAD CD in tax administration, measured as the cumulative FTE used over the past four to two years (years -4 to -2) and over the past five to two years (years -5 to -2).<sup>18</sup> The IV estimates, reported in Columns (3) through (6), reveal substantially larger and highly significant effects at the 1 percent significance level. In the full sample, the estimated coefficients of OSI range from 0.082 to 0.102. For instance, this indicates that an increase in OSI from 33<sup>rd</sup> to 67<sup>th</sup> percentile—moving from the lower third to the upper third of the OSI distribution—leads to an increase in tax-to-GDP ratio by 1.2 ppts.<sup>19</sup> In EMDEs, the estimated coefficients are larger, ranging from 0.118 to 0.143. In these countries, a similar increase in OSI raises the tax-to-GDP ratio by 1.7 ppts—enough to close 25–35 percent of the total tax gap identified by Benitez et al. (2023). Yet, these estimates are average effects and may not apply to all countries. Unlike previous studies, such as Adan et al. (2023) and Chang et al. (2020), our IV estimates yield somehow lower coefficients, even though we employ a more stringent and detailed measure of tax administration strength.<sup>20</sup> Specifically, Adan et al. (2023) find that an increase in OSI by an amount equivalent to moving from the lower third to the upper third of the OSI distribution is associated with an increase in tax revenue of 2.3 and 2.9 ppts for the full and EMDE samples, respectively. Similarly, Chang et al. (2020) show that the same increase in OSI raises tax revenue by 2.9 and 2.5 ppts for the full and EMDE samples, respectively. These earlier estimates exceed ours by 1.2–1.7 ppts for such an increase in OSI, underscoring the upward bias in previous studies. Nonetheless, our results still point to a sizable and economically meaningful effect—demonstrating that strengthening tax administration can play a direct and powerful role in boosting tax revenue.

<sup>18</sup> Based on the AIC and BIC values, it is preferable to use the intensity of FAD CD in revenue administration cumulated over the past five to two years as an instrument than using it over the past four to two years. AIC and BIC values are lower in columns (5) and (6) than in columns (3) and (4), for both the full sample and the EMDEs sample. We also tested shorter lag structures—specifically, CD intensity over the past three to two and two to one years—but the instruments with these lags were generally not as strongly correlated with the OSI. This suggests that tax administration reforms take time to yield results, and that strengthening tax administration requires a sustained and long-term effort. For robustness, we also report the results using CD intensity cumulated over alternative periods, including the past five/four to one years, and five/four to three years.

<sup>19</sup> Our preferred specifications are provided by Columns (5) and (6) where the AIC and BIC values are lower.

<sup>20</sup> If we were to apply the same methodology and data used in previous studies by Adan et al. (2023) and Chang et al. (2020), alongside our new, more stringent measure of OSI—which tends to yield lower values and relies on more granular practices and structural foundations—our estimates would typically be expected to be higher to account for the new measure. However, despite this expectation, we find that our IV estimates are lower than those in previous analyses. Even if our IV coefficients were similar to those in the previous studies, there would still be an upward bias in their estimates, as we use more stringent measures of tax administration. This is due to the panel-fixed effects IV method, which corrects the upward bias observed in earlier studies and accounts for the effects of time-invariant country characteristics.



Table 1. Baseline Results

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0059<br>(0.0028)     | 0.0098<br>(0.0049)     | 0.1015***<br>(0.0059)       | 0.1428***<br>(0.0100)         | 0.0821***<br>(0.0053)       | 0.1177***<br>(0.0183)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3020***<br>(0.0408)  | 0.2936***<br>(0.0415)  | 0.3320***<br>(0.0084)       | 0.3257***<br>(0.0199)         | 0.3259***<br>(0.0128)       | 0.3196***<br>(0.0122)         |
| #Tax Staff/LaborForce                    | 0.4465***<br>(0.1043)  | 0.5019***<br>(0.1309)  | 0.5339***<br>(0.0812)       | 0.5943***<br>(0.1028)         | 0.5161***<br>(0.0840)       | 0.5768***<br>(0.1108)         |
| Sq(#Tax Staff/Labor Force)               | -2.0220***<br>(0.3939) | -2.4303***<br>(0.5067) | -2.2606***<br>(0.3449)      | -2.5973***<br>(0.4755)        | -2.2121***<br>(0.3560)      | -2.5658***<br>(0.4953)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0176<br>(0.0147)     | 0.0232<br>(0.0125)     | 0.0186<br>(0.0175)          | 0.0302***<br>(0.0137)         | 0.0184<br>(0.0176)          | 0.0288**<br>(0.0141)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017<br>(0.0010)    | -0.0023*<br>(0.0008)   | -0.0018<br>(0.0012)         | -0.0028***<br>(0.0010)        | -0.0018<br>(0.0012)         | -0.0027***<br>(0.0010)        |
| Trade openness (% of GDP), lagged        | 0.0191***<br>(0.0032)  | 0.0224***<br>(0.0047)  | 0.0169***<br>(0.0036)       | 0.0181***<br>(0.0055)         | 0.0173***<br>(0.0036)       | 0.0189***<br>(0.0052)         |
| External debt (% of GDP), lagged         | -0.0000<br>(0.0004)    | -0.0165***<br>(0.0026) | -0.0008<br>(0.0006)         | -0.0154***<br>(0.0018)        | -0.0006<br>(0.0006)         | -0.0156***<br>(0.0018)        |
| Inflation, lagged                        | -0.0249***<br>(0.0034) | -0.0255***<br>(0.0040) | -0.0270***<br>(0.0020)      | -0.0328***<br>(0.0049)        | -0.0266***<br>(0.0021)      | -0.0314***<br>(0.0054)        |
| Terms of Trade (2000=1), lagged          | 0.0185*<br>(0.0074)    | 0.0201**<br>(0.0070)   | 0.0144<br>(0.0101)          | 0.0158<br>(0.0093)            | 0.0152<br>(0.0101)          | 0.0166<br>(0.0096)            |
| Oil exports (% of GDP), lagged           | -0.1132***<br>(0.0112) | -0.1415***<br>(0.0154) | -0.0948***<br>(0.0141)      | -0.1161***<br>(0.0218)        | -0.0986***<br>(0.0125)      | -0.1209***<br>(0.0187)        |
| Log (Agri, % of GDP), lagged             | -0.0076<br>(0.0048)    | -0.0106<br>(0.0038)    | -0.0130**<br>(0.0052)       | -0.0168***<br>(0.0048)        | -0.0119*<br>(0.0054)        | -0.0156***<br>(0.0051)        |
| Control Corruption, lagged               | 0.0024<br>(0.0014)     | 0.0034<br>(0.0039)     | 0.0007<br>(0.0015)          | 0.0018<br>(0.0044)            | 0.0010<br>(0.0015)          | 0.0021<br>(0.0044)            |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.216                  | 0.273                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3472.9                     | -2772.9                       | -3490.8                     | -2800.2                       |
| BIC                                      | —                      | —                      | -3455.8                     | -2756.7                       | -3473.7                     | -2784.0                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 36.230                      | 24.179                        | 43.229                      | 29.060                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 10.769                      | 11.742                        | 12.843                      | 14.545                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ .

The notable difference between the OLS and IV estimates suggests that OLS underestimates the effect of OSI due to the simultaneity bias between OSI and tax revenue, which creates a downward bias. The IV results provide strong evidence that improvements in tax administration capacity significantly increase tax revenue, with a particularly pronounced effect in EMDEs where there is more room for improvements in tax administration. The relatively lower coefficients observed in the full sample, which includes AEs, likely reflect structural differences in tax administration efficiency and baseline revenue mobilization capacity.<sup>21</sup> In AEs, tax

<sup>21</sup> Due to limited data, we cannot estimate the effects of OSI on the tax-to-GDP ratio for AEs alone, as we did for EMs and LICs. However, the results, including AEs, provide valuable insights into the potential effects of strengthening tax administration on revenue mobilization in AEs.

systems are already highly developed, with well-functioning institutions and high levels of voluntary compliance. As a result, marginal improvements in tax administration may yield relatively smaller gains in revenue collection compared to EMDEs.

**Table 2. First Stage. Baseline Results**

|                                             | (1)<br>IV All<br>[-4 to -2] | (2)<br>IV EMDEs<br>[-4 to -2] | (3)<br>IV All<br>[-5 to -2] | (4)<br>IV EMDEs<br>[-5 to -2] |
|---------------------------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Intensity of FTE used in RA (time in years) | 0.0172***<br>(0.0037)       | 0.0182**<br>(0.0053)          | 0.0150**<br>(0.0032)        | 0.0158***<br>(0.0044)         |
| Tax Policy Yield, exc. Trade Tax and SSC    | -0.0626<br>(0.5742)         | -0.0096<br>(0.6356)           | -0.0539<br>(0.5769)         | 0.0167<br>(0.6407)            |
| #Tax Staff/LaborForce                       | -0.6612<br>(0.4824)         | -0.4153<br>(0.5738)           | -0.6100<br>(0.4839)         | -0.4009<br>(0.5728)           |
| Sq(#Tax Staff/Labor Force)                  | 1.4561<br>(1.5827)          | 0.3015<br>(2.0901)            | 1.2686<br>(1.5745)          | 0.2858<br>(2.0461)            |
| Active Taxpayer/Labor Force                 | 0.0003*<br>(0.0002)         | 0.0003<br>(0.0002)            | 0.0003*<br>(0.0002)         | 0.0003<br>(0.0002)            |
| Real GDP growth, lagged                     | -0.0008<br>(0.0005)         | -0.0008<br>(0.0005)           | -0.0008<br>(0.0005)         | -0.0008<br>(0.0005)           |
| Log (GDP per capita, USD), lagged           | -0.0174<br>(0.0612)         | -0.0463<br>(0.0833)           | -0.0173<br>(0.0609)         | -0.0418<br>(0.0828)           |
| Sq(Log (GDP per capita, USD)), lagged       | 0.0014<br>(0.0041)          | 0.0039<br>(0.0058)            | 0.0013<br>(0.0041)          | 0.0034<br>(0.0057)            |
| Trade openness (% of GDP), lagged           | 0.0340<br>(0.0233)          | 0.0463*<br>(0.0276)           | 0.0334<br>(0.0227)          | 0.0476*<br>(0.0268)           |
| External debt (% of GDP), lagged            | 0.0053*<br>(0.0028)         | -0.0096<br>(0.0229)           | 0.0056**<br>(0.0025)        | -0.0135<br>(0.0221)           |
| Inflation, lagged                           | 0.0214<br>(0.0434)          | 0.0502<br>(0.0475)            | 0.0162<br>(0.0438)          | 0.0448<br>(0.0481)            |
| Terms of Trade (2000=1), lagged             | 0.0407*<br>(0.0215)         | 0.0321<br>(0.0217)            | 0.0409*<br>(0.0212)         | 0.0325<br>(0.0213)            |
| Oil exports (% of GDP), lagged              | -0.2289***<br>(0.0863)      | -0.2262***<br>(0.0751)        | -0.2352***<br>(0.0858)      | -0.2371***<br>(0.0752)        |
| Log (Agri, % of GDP), lagged                | 0.0548***<br>(0.0185)       | 0.0504**<br>(0.0215)          | 0.0553***<br>(0.0184)       | 0.0503*<br>(0.0214)           |
| Control Corruption, lagged                  | 0.0113<br>(0.0150)          | 0.0024<br>(0.0181)            | 0.0132<br>(0.0149)          | 0.0043<br>(0.0180)            |
| Observations                                | 529                         | 424                           | 529                         | 424                           |
| Number of countries                         | 121                         | 99                            | 121                         | 99                            |
| within R-squared                            | 0.3343                      | 0.3543                        | 0.3451                      | 0.3637                        |
| Country FE                                  | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                     | Yes                         | Yes                           | Yes                         | Yes                           |

Notes: First-stage panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1 and 3 are regressions based on full sample, while columns 2 and 4 are regressions based on EMDEs only. In columns 1 and 2 (columns 3 and 4), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ .

The first stage results, presented in Table 2, confirm the relevance of our instrumental variable. The intensity of FAD CD in tax administration cumulated over the past four to two years (columns 1 and 2) and five to two years (columns 3 and 4) is a strong predictor of OSI, with coefficients that are positive and statistically significant at 1 percent significance level.<sup>22</sup> Indeed, as the intensity of FAD CD over the past four (five) to two years increases by one year, the OSI increases by up to 0.015–0.018. FAD CD is more likely to capture the broader impact of development partners supporting tax administration reforms, since FAD CD is typically implemented alongside

<sup>22</sup> We also test the correlation between our instrument and changes in the strength of tax administration, using TADAT indices. While the data is limited to 25 observations, the results show a positive relationship.

support from multiple partners. The instrument remains robust across both the full sample and EMDE subsample. In addition, the within R-squared (ranging between 0.33 and 0.36) suggests that the model explains a reasonable portion of the variation in OSI, with a slightly better fit for EMDEs compared to the full sample. Finally, the first stage F-statistics (Cragg-Donald and Kleibergen-Paap rk Wald tests) are well above the conventional threshold of 10 (see Table 1). These statistics indicate that our instrument is strongly correlated with the strength of tax administration.

Further to the effects of OSI, we also find that several key control variables exhibit the expected relationships with tax revenue, as shown in Table 1. Our findings on the control variables, while sometimes similar to those in Chang et al. (2020) and Adan et al. (2023), also show some divergences. These differences may stem from our inclusion of both OSI and time-invariant country characteristics, which are likely to be correlated with the control variables. This inclusion helps to address potential estimation biases present in earlier studies and contributes to the mixed literature on the determinants of tax revenue (Gupta, 2007).

First, our new narrative measure of tax policy yield shows a strong and statistically significant relationship with tax revenue. On average, a 1 ppt of GDP increase in expected revenue from tax policy changes raises actual tax revenue by around 0.32 ppt of GDP. While ideally this effect would be one-for-one, the lower estimate suggests that several factors are at play: the estimates of revenue yields from tax policy changes discussed in IMF staff reports may be overestimated; tax policy measures may not be fully or effectively implemented; and taxpayers may adjust behavior to avoid or evade taxes. Second, we find that tax administration capacity, as measured by the number of tax staff relative to the labor force, is positively associated with tax revenue, though with diminishing returns, as indicated by the negative squared term (Chang et al., 2020; Adan et al., 2023). Third, macroeconomic factors also play an essential role. Real GDP growth exerts a small positive effect. Trade openness significantly boosts tax revenue (Leuthold, 1991; Ghura, 1998; Gupta, 2007; IMF, 2018; Chang et al., 2020; and Adan et al., 2023). Terms of trade also show a positive and significant relationship with tax revenue, especially in EMDEs (Adan et al., 2023). Also, GDP per capita is positively associated with tax revenue in EMDEs, though with diminishing returns as indicated by the negative squared term (IMF, 2018; Chang et al., 2020). This shows that as countries grow richer, the marginal impact of development on tax revenue reduces. Conversely, external debt is negatively associated with tax revenue, particularly in EMDEs, reflecting a reduced incentive for raising revenues when external funding is available, which confirms the findings in Gupta (2007) but contrasts with those in Tanzi (1992), Chang et al. (2020), and Adan et al. (2023), which show either a positive or insignificant effect. Also, inflation consistently exerts a negative effect on tax revenue (Chang et al., 2020; Adan et al., 2023). Fourth, institutional and structural factors also shape tax collection efficiency. Oil-exporting countries exhibit significantly lower tax-to-GDP ratios, reinforcing the resource curse hypothesis and contrasting with the results in Chang et al. (2020) and Adan et al. (2023), who find an opposite effect. Agricultural dependence negatively correlates with tax revenue, consistent with challenges in taxing informal sectors, confirming the results in Ghura (1998), Gupta (2007), and Yohou (2017), and opposing the results in IMF (2018), Chang et al. (2020), and Adan et al. (2023), who show no significant effects. Fifth, we find no association between the size of active taxpayers, control of corruption, and tax revenue, similar to the findings in Adan et al. (2023) and Gupta (2007).<sup>23</sup> Overall, the results underline the

<sup>23</sup> Following Chang et al. (2020) and Adan et al. (2023), the size of active taxpayers is measured by the sum of taxpayers on register in PIT, CIT, tax withheld by employers from employees (e.g., PAYE), and VAT, without distinguishing the type of taxpayers. The data for active taxpayers are not reported for all tax types by all ISORA participants and may exclude employees that are not required to register for PIT. Such measurement error may possibly create attenuation bias in our estimates.

importance of both macroeconomic stability and structural factors in determining a country's ability to mobilize tax revenue.

To sum up, the IV results confirm a large and statistically significant positive effect of tax administration strength on tax revenue. The effect is particularly strong in EMDEs and highlights the critical role of institutional capacity in revenue mobilization. The first stage results validate our instrument, and the strong F-statistics mitigate concerns about instrument weakness. Thus, past FAD CD in tax administration, as well as CD from other partners, may have played a key role in strengthening tax administration. These findings underscore the importance of sustained reforms, long-term commitment, and continuity in CD programs in tax administration reforms to enhance domestic revenue mobilization, especially in EMDEs where tax collection remains a key constraint to fiscal sustainability.

## VI. Robustness Checks

We assess the robustness of our findings by exploring a wide range of alternative specifications. First, we employ different lag structures for the instrument, including the cumulative FTE used over the past five or four years (years -5/-4 to -1) and over the past five or four to three years (years -5/-4 to -3). Second, we use alternative measures of OSI, including using its lagged value and an equal-weighted OSI. Third, we incorporate income group-year fixed effects to account for macroeconomic shocks, structural differences, and policy responses to shocks that may systematically vary across income groups over time. Fourth, we examine alternative samples by excluding specific groups of countries, such as those with the top or bottom 10 percent of OSI or tax-to-GDP ratio, FCS, small island countries, and resource-rich countries. In addition, we drop the top and least tax administration reformers, respectively defined as those in the top and bottom 10 percent of OSI changes. Fifth, we also consider alternative specifications of the control variables. This includes testing specifications where only one control variable among those that are strongly correlated is retained and controlling for new variables such as informality, urbanization, age dependency ratio, education and health spending, and financial development (Gupta, 2007; Mitra, 2017; IMF, 2015; IMF, 2018; Elgin et al., 2021; Gwaindepi, 2022).

### 1. Alternative Lag Structures of the Instrument

To mitigate potential endogeneity concerns—namely, that tax administration strength may be influenced by contemporaneous or recent tax revenue—we use lagged values of the intensity of FAD CD in tax administration, measured by the cumulative FTE used over the past five or four to two years (years -5/-4 to -2) in the baseline. To balance the trade-off between instrument relevance and potential endogeneity, we test alternative lag structures for CD intensity. Specifically, we consider the cumulative FTE over the past five or four years (-5/-4 to -1) and over the past five or four to three years (-5/-4 to -3) as alternative lags.

The IV estimates, presented in Appendix Tables AIII.1 and AIII.2, consistently show a strong and statistically significant relationship between OSI and tax revenue across all lag structures. However, the magnitude of the effect varies with the timing of the instrument. Using CD intensity over the past five or four years (-5/-4 to -1) yields the largest estimates (Appendix Table AIII.1), while using the past five or four to three years (-5/-4 to -3) leads to slightly smaller estimates (Appendix Table AIII.2). While the former offers the strongest instrument relevance—as indicated by the Cragg-Donald and Kleibergen-Paap rk Wald F statistics—the latter is preferred based on model fit, with the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC)

values. Our baseline estimates strike the right balance, combining the highest precision (lowest standard errors) with a sound trade-off between instrument relevance and exogeneity.

## 2. Alternative Measures of OSI

In our baseline analysis, we use both the contemporaneous OSI and the expert-weighted OSI. To test the robustness of our findings, we also examine the effects of lagged OSI and equal-weighted OSI. A lagged OSI may better capture the delayed impact of tax administration strength on revenue while mitigating concerns about simultaneity bias. The expert-weighted OSI is constructed using subjective weights assigned by multiple experts, which also highlights some divergences in views (as reflected in the coefficient variations discussed in Section II.1.b).<sup>24</sup> To address this subjectivity, we also consider an alternative OSI that assigns equal importance to all tax administration practices and structural foundations in revenue mobilization, similar to Chang et al. (2020) and Adan et al. (2023). The equal-weighted OSI is more likely to account for the synergies and complementarities among different practices and structural foundations, recognizing that tax administration improvements often work best when implemented as a cohesive and well-sequenced package.

The results, reported in Appendix Tables AIII.3 and AIII.4, confirm that OLS estimates are generally downward biased and that OSI is strongly and positively associated with tax revenue at the 1 percent significance level in the IV regressions. Specifically, we find that lagged OSI has a larger positive effect on tax revenue. Similarly, using the equal-weighted OSI yields higher coefficients. However, model selection criteria (AIC and BIC) and statistical tests (F-test) indicate that our baseline specifications using contemporaneous OSI and expert-weighted OSI are preferred.

## 3. Controlling for Income Group-Year Fixed Effects

We also test the robustness of our findings by controlling for income group-year fixed effects to account for macroeconomic shocks, structural differences, and policy responses to shocks that may systematically vary across income groups over time. This is particularly relevant given the uneven impact of the COVID-19 pandemic and policy responses across countries at different levels of development (Ari et al., 2022; Aslam et al., 2022; Fordelone et al., 2022). By controlling for income group-year fixed effects, we account for broader income group-specific economic conditions or policy responses that are potentially correlated with tax administration strength, which were disrupted during the pandemic, and correct for possible omitted variable bias.

Our findings are reported in Appendix Table AIII.5, which shows that when controlling for income group-year fixed effects, the OSI coefficients in the IV regressions decrease in magnitude, though they remain statistically significant. This suggests that some of the variation in tax revenue previously attributed to OSI may have been influenced by broader income group-specific trends (as confirmed by the model selection criteria), such as the fiscal impact of the COVID-19 pandemic or structural differences in economic resilience and policy responses.

## 4. Alternative Samples

Our robustness checks include assessing the impact of OSI on tax revenue across different samples, conducted in three counts. (i) First, we exclude countries in the top or bottom 10 percent of OSI or tax-to-GDP

<sup>24</sup> While the equal-weighted OSI provides a useful benchmark, the expert-weighted OSI may better reflect the relative importance of different tax administration measures in practice.

ratio to prevent extreme cases or outliers from distorting our results. Countries with exceptionally strong or weak tax administration systems and revenue performance may introduce outliers—including those that overestimate the strength of their tax administration—that distort the overall relationship between OSI and tax revenue. (ii) Second, we further test the robustness of our findings by excluding FCS, small island countries, and resource-rich countries. These countries often exhibit distinct tax revenue level, volatility of tax revenue, and revenue mobilization strategy (Thomas and Trevino, 2013; IMF, 2018). FCS countries typically experience severe governance, security concerns, and institutional challenges that can undermine tax administration effectiveness. Resource-rich countries often generate significant revenue from natural resources, reducing their reliance on traditional tax administration efforts. Small island countries depend heavily on external financial inflows—such as aid, remittances, or tourism revenue—making their domestic tax bases highly vulnerable to external and domestic shocks. (iii) Third, we exclude countries that are among the top or bottom 10 percent in terms of OSI changes between 2017 and 2022 to ensure that our results are not driven by extreme reformers, non-reformers, back-sliding countries or outliers—as some countries may overestimate or underestimate their progress in tax administration. Countries that have undertaken rapid and substantial tax administration reforms may experience revenue changes that reflect broader institutional overhauls rather than the gradual improvements captured by OSI. Conversely, countries with no or minimal reforms or reform reversals may have stagnant tax systems that do not fully reflect the potential impact of stronger tax administration.

The results of these robustness checks are presented in Appendix Tables AIII.6 to AIII.9 for (i), Appendix Tables AIII.10 to AIII.12 for (ii), and Appendix Tables AIII.13 and AIII.14 for (iii). Overall, they show that our baseline results are consistent and robust when using alternative samples, with the magnitude of the effect varying depending on the sample exclusions. Specifically, first, we find that the coefficients associated with OSI are statistically significant at the 1 percent significance level in all specifications and are generally of a higher magnitude. Second, when excluding countries with highest OSI scores (top 10 percent of OSI), lower tax-to-GDP ratios (bottom 10 percent), FCS, resource-rich countries, and countries that are top or least reformers (top or bottom 10 percent in OSI change), the relationship between OSI and tax revenue becomes stronger, as characterized by higher magnitude coefficients associated with OSI. These findings suggest that extreme cases or outliers, as well as countries facing unique tax revenue features and challenges, could have diluted the positive effects of tax administration strength on tax revenue in our baseline. Third, when excluding countries with the highest tax-to-GDP ratios (top 10 percent), the lowest OSI (bottom 10 percent of OSI), and small island states, the coefficients of OSI are slightly smaller or comparable to the baseline IV estimates.

## 5. Alternative Control Variables

We further test the robustness of our baseline results by refining the set of control variables in two ways: (i) retaining only one variable from groups of strongly correlated controls, and (ii) incorporating additional controls such as informality, urbanization, age dependency ratio, education and health spending, and financial development. This approach helps to mitigate potential biases, including omitted variable bias and multicollinearity, which can distort coefficient estimates, inflate standard errors, and lead to model overfitting or redundancy.

The results are shown in Appendix Tables AIII.15 to AIII.24. They closely align with our baseline findings in terms of both significance and magnitude for the OSI for most specifications, confirming that strengthening tax administration is positively associated with higher tax revenue. The interpretation of control variables remains largely unchanged. Among the additional control variables, we find that (i) informality—proxied by self-employment as a share of total employment (Elgin et al., 2021)—and education and health spending have generally no effect on tax revenue, as their coefficients are small and insignificant; (ii) tax revenue decreases

with urbanization and the age dependency ratio; and (iii) unexpectedly, financial development is negatively associated with tax revenue.

## VII. Sensitivity

In this section, we conduct several sensitivity analyses to assess how the impact of OSI on tax revenue varies based on a country's level of development (LICs vs. EMs), informality, financial development, and institutions and governance quality. To capture these conditional effects, we compute the average of each variable over the period of study (2017–22) and interact it with OSI, instrumenting both OSI and the interaction term using the intensity of FAD CD in tax administration and its interaction with the average variable to avoid a forbidden regression issue. Since these averages remain constant over time, their direct effects are absorbed by country fixed effects, preventing us from including them separately. This approach allows us to isolate and analyze how these factors condition the revenue gain of OSI.

In addition, we also analyze how OSI impacts different components of tax revenue, given that stronger tax administration may yield varying effects across tax types. These analyses are motivated by the fact that understanding these interactions is critical for identifying the conditions under which stronger tax administration yields the highest revenue gains.

### 1. LICs vs. EMs

LICs and EMs differ in their performance of tax administration and challenges faced in modernizing tax administration and collecting tax revenue. LICs generally lag behind EMs in several practices and structural foundations of tax administration and struggle with high informality, significant exposure to domestic and external shocks, volatile tax revenue, and less resilient and stable tax systems, which may limit the revenue gains from stronger tax administrations in line with the “15 percent tax-to-GDP tipping point” evidence in Gaspar et al. (2016) and Bellon and Warwick (2025). In contrast, EMs typically have more developed administrative structures, allowing them to translate efficiency improvements into higher tax revenue more effectively.

The results, reported in Appendix Table AIII.25, indicate that the revenue gains from strengthening tax administration are more than twice as large in EMs compared to LICs, confirming that tax administration improvements yield higher revenue gains in EMs. However, we observe that the intensity of FAD CD missions is less correlated with OSI in EMs, whereas in LICs, the correlation is even stronger, as indicated by the Kleibergen-Paap rk Wald F statistic. In addition, we find some differentiated effects of the control variables across income groups. Specifically, in EMs, tax revenue is negatively associated with inflation and oil exports, and positively associated with terms of trade and tax policy yield. In LICs, by contrast, tax revenue is negatively related to the share of agriculture in GDP and positively associated with better control of corruption.

### 2. Informality

Informality poses a significant challenge to tax collection, especially in LICs where large portions of economic activity remain outside the formal tax net. Strengthening tax administration in highly informal countries may have limited revenue effects unless accompanied by broader efforts to formalize businesses, expand the tax base, and enhance tax enforcement and financial inclusion. In contrast, in countries with lower informality, improved administration is more likely to yield direct revenue gains through better compliance and enforcement (Ghura, 1998; Gupta, 2007; Mitra, 2017; Yohou, 2017; Gwaindepi, 2022).

Our results, presented in Appendix Table AIII.26, show that OSI remains positive and significant at the 1 percent level. The interaction term between OSI and informality—proxied by self-employment as a share of total employment—is negative and significant at the 5 percent level in columns 5 and 6, although the coefficient is relatively smaller in size. This suggests that the impact of OSI on tax revenue will still be positive regardless of the level of informality. However, the gains from improved tax administration will be lower as informality increases. Specifically, when self-employment exceeds 48 and 75 percent of total employment (corresponding to the top 30 and 14 percent of countries with the highest self-employment), countries will experience lower revenue gains compared to the baseline estimates for the full and EMDE samples, respectively.

### 3. Financial Development

The extensive use of financial institutions can be an important source of information for tax authorities. Financial information leaves paper trails and, when exchanged with tax authorities, is a critical resource to address tax evasion—including cross-border one—and strengthen compliance and tax enforcement (IMF, 2015). Thus, financial development can enhance tax administration effectiveness by increasing transaction transparency, improving access to third-party data, and reducing opportunities for unreported economic activity.

Our results, reported in Appendix Table AIII.27, show that the coefficients associated with OSI are statistically significant only in the EMDE sample. However, the interaction term between OSI and financial development is significant and large in magnitude across all specifications. It implies that the impact of OSI could be mediated by the level of financial development in a country, highlighting the importance of financial development in enabling tax administration to effectively translate into higher revenue gains. Specifically, we find that 60 and 40 percent of countries (with a financial development index below 0.32 in the full sample and 0.17 in the EMDE sample) experience lower revenue gains than estimated in the baseline for the full and EMDE samples, respectively.

### 4. Institutions and Governance Quality

Stronger institutions and governance quality can amplify the revenue gain of improved tax administration by ensuring that reforms are well-implemented and widely enforced.<sup>25</sup> In contrast, in environments with weak governance, even well-designed administrative reforms may fail to translate into higher revenues due to corruption, inefficiencies, or political resistance (IMF, 2015; IMF, 2018; IMF, 2019; Morrow et al., 2022; Benitez et al., 2023; Bellon and Warwick, 2025; IMF, 2025). We measure institutions and governance quality by using several indicators, including control of corruption, rule of law, government effectiveness, regulatory quality, political stability and absence of violence or terrorism, and voice and accountability.

The results are presented in Appendix Tables AIII.28 to AIII.33. They reveal that the coefficients associated with OSI remain significant at the 1 percent level across all specifications, and the interaction terms between OSI and these governance indicators are all positive and significant at least at the 5 percent level. This suggests that the strength of tax administration, as captured by OSI, has a positive impact on tax revenue, with the effect being enhanced when institutions and governance quality are stronger. Specifically, depending on the governance indicator used, a significant proportion of countries across all indicators—ranging from 0 to 17 percent—experience negative revenue impacts despite improvements in tax administration strength due to

<sup>25</sup> For instance, Benitez et al. (2023) show that Improvements in government quality could raise tax potential in LIDCs by 2.3 ppts of GDP.



weaker institutions and governance. Also, a notable proportion—ranging from 21 to 58 percent—of countries experience less than the baseline estimates due to weaker institutions and governance.

## 5. Differentiated Effects on Tax Types

We further examine how strengthening tax administration affects different types of taxes, recognizing that the effects may vary for the following reasons. While greater reliance on direct taxes is often associated with improved revenue performance, many developing countries face competing policy objectives (e.g., increasing revenue while promoting investment), tax avoidance by multinationals, and structural constraints in raising direct tax revenue, such as widespread poverty, inequality, informality, governance issues—including vested interest groups—and the lack of property registers. Meanwhile, indirect taxes, particularly VAT, can enhance compliance and broaden the tax base, yet they are often subject to exemptions and reduced rates.

Specifically, we assess the impact of OSI on the GDP ratios of income and profit taxes, property taxes, taxes on sales and production, and taxes not elsewhere classified. Although our primary focus is on tax revenue, we also explore the impact for non-tax revenue. Strengthening tax administration may have a limited effect on non-tax revenue for similar reasons as those affecting trade taxes and social contributions (Chang et al., 2020; Adan et al., 2023). Non-tax revenue is inherently more volatile, influenced by commodity prices, contractual agreements, and external factors such as donor commitments. Moreover, its collection mechanisms often differ, sometimes falling under agencies other than tax authorities.

Our results, presented in Appendix Tables AIII.34 to AIII.38, show that the impact of tax administration reforms varies across different tax types. First, the largest revenue gains are observed for taxes on sales and production, including VAT. This suggests that improvements in tax administration are particularly effective in enhancing indirect tax collection. This aligns with the broader tax base and higher enforceability of indirect taxes, especially VAT, compared to direct taxes. Second, property taxes also benefit from stronger tax administration, though the revenue gains are generally smaller than for taxes on sales and production.<sup>26</sup> This indicates that while better tax administration can enhance property tax collection, structural constraints such as weak property registers may still limit the extent of these gains. Third, income and profit taxes also increase, but to a smaller extent. This suggests that challenges beyond tax administration, such as informality and tax avoidance, continue to constrain this tax type revenue collection. Fourth, taxes not elsewhere classified and non-tax revenue are not affected by tax administration strength. The coefficients are statistically insignificant in all specifications at a 10 percent significance level.

Overall, these findings highlight that the effectiveness of tax administration reforms depends on tax types. The largest gains are seen in indirect taxation, while direct taxes exhibit more muted responses.

## VIII. Conclusion

This paper highlights the critical role of strengthening tax administration capacity in improving tax revenue mobilization, particularly in EMDEs. Building tax administration capacity has long been considered one of the critical determinants of a wide cross-country disparity in tax-to-GDP ratio (Besley and Persson, 2014). However, estimating the revenue gains from tax administration reforms has proven difficult due to data and

<sup>26</sup> It is worth noting that the lower coefficients for property taxes may also reflect the fact that, in many countries, property taxes are not administered by the national tax authority but are instead collected directly by local governments.

methodological challenges. Only a few papers (Chang et al., 2020; Adan et al., 2023) have attempted to quantify these revenue gains in a cross-country setting, while most analyses have been conducted at the micro-level. Still, these papers made strong assumptions about the variation in tax administration and employed empirical methodologies that either mixed the effects of tax administration with those of unobserved factors—such as tax morale, geographical characteristics (e.g., resource endowment), historical legacies—or assumed that tax administration is uncorrelated with these unobserved factors. In addition, they failed to account for the potential simultaneity bias, which arises from the possibility that tax administration reforms can also be influenced by the level of tax revenue.

By addressing these data and empirical challenges, this paper provides more robust evidence that tax administration reform significantly increases tax revenue. The revenue gains are lower than those found in previous studies—reflecting the advantages of improved measurement and empirical strategies. Nonetheless, our results still point to a sizable and economically meaningful effect—demonstrating that strengthening tax administration can play a direct and powerful role in boosting tax revenue. Specifically, we employed an IV strategy by using the intensity of past IMF's FAD CD in tax administration as an instrument for the strength of tax administration. We also developed novel measures of tax administration strength based on a Delphi method and a weighting survey, which consisted of gathering expert feedback to refine the measures of tax administration strength, improving the indices' practicality, granularity, and consistency across ISORA vintages, and incorporating the relative importance of each practice or structural foundation of tax administration in raising tax revenue.

Moreover, the sensitivity analyses reveal that the revenue gains from tax administration reforms are more than twice as large in EMs compared to LICs, suggesting that structural impediments to revenue mobilization and institutional weaknesses in LICs may constrain the countries from reaping the full benefits of the tax administration reforms. The estimated revenue gains are relatively smaller in AEs, where tax systems are mature, institutions are well functioning, and tax compliance is high. Our findings suggest that revenue gains are smaller in countries with higher levels of informality, weaker institutions, lower financial development, and a higher share of indirect taxes.

These findings carry important policy implications for governments and development partners seeking to enhance tax administration capacity and strengthen public finances, consistent with [Benitez et al. \(2023\)](#) and [IMF \(2025\)](#). First, our results highlights the critical importance of adopting a holistic and institutional strategy that integrates tax administration, tax policy, and financial, institutional, or legal reforms to support revenue mobilization ([Benitez et al., 2023](#) ; [IMF, 2025](#)). Building fiscal and state capacities will be particularly important for sustaining the benefits of tax administration reforms in low-income developing countries. Targeted reforms should be based on a country's level of development and structural constraints, taking into account the starting point and local context. Second, sustained investment in CD programs is essential for building effective tax administration ([IMF, 2025](#)). We provide evidence of a positive relationship between the IMF's past CD and improvements in the recipient country's tax administration strength. From a development perspective, this emphasizes the importance of the authorities' long-term political commitment to reform and the need for continued CD interventions from development partners. Third, continuous monitoring and evaluation of tax administration reforms are essential to sustaining progress ([IMF, 2025](#)). Regular evaluations of tax administration performance, including the ISORA and Tax Administration Diagnostic Assessment Tool (TADAT), could allow governments to adjust reform strategies and strengthen implementation.

# Appendix I. Data Descriptions and Sources

Appendix Table AI.1. Description of Tax Administration Indices

| Index                                                               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operational Strength Index (OSI)                                    | Measuring the overall strength of tax administration practices, institutional frameworks, and structural foundations based on the indices outlined below.                                                                                                                                                                                                                                                                                                                            |
| Compliance Risk Management (CRM)                                    | Measuring sound compliance practices and institutional features, including risk approach, monitoring and tracking, to effectively identify, assess, and mitigate the risks associated with non-compliance to tax laws                                                                                                                                                                                                                                                                |
| Use of Third-Party Data (UTD)                                       | Measuring the availability of third-party data to the tax administration, including data from employers, financial institutions, other government agencies, international exchanges, and electronic invoice mechanisms, as well as the systems in place to import, store, manage, and pre-fill tax returns with this data.                                                                                                                                                           |
| Degree of Digitalization (DIG)                                      | Measuring the practices and systems that support the use of digital technologies in business processes, such as the availability of e-filing and e-payment options, e-services (including tools and calculators, comprehensive taxpayer views, online services, and mobile applications), and advanced digital technologies (such as AI, digital authentication, blockchain, and chatbots).                                                                                          |
| Service Orientation (SOR)                                           | Measuring taxpayer services designed to support voluntary compliance, including service delivery standards, satisfaction surveys, provisions for individuals with disabilities, availability of services and information in multiple languages, taxpayer rights, and the channels used for registration, as well as assessing taxpayer compliance burdens.                                                                                                                           |
| Public Accountability (PAC)                                         | Measuring the extent of information made available to the public, such as plans and progress against those plans, internal and external controls (including audits), and the ability to challenge tax assessments, as part of a visible commitment to accountability and transparency.                                                                                                                                                                                               |
| Autonomy (AUT)                                                      | Measuring the extent to which laws, regulations, and policies grant the administration autonomy in managing its operations, including the ability to determine its internal structure, performance standards, work requirements, discretion over operating and capital budgets, as well as staff employment, salary, promotions, and dismissals.                                                                                                                                     |
| Large Taxpayer Office and High-Net-Worth Individuals (LTO and HNWI) | Measuring whether an LTO (Large Taxpayer Office) and/or HNWI (High-Net-Worth Individual) is operational, and the various functions carried out by the LTO or HNWI, including registration, return and payment processing, services, audit, collection enforcement, management of arrears, and dispute resolution.                                                                                                                                                                    |
| Tax Enforcement (ENF)                                               | Measuring the powers in legislation or regulation to assist in tax arrears collection, such as granting payment extensions, collecting through third parties, imposing restrictions (e.g., travel bans, business closures), enforcing garnishments or liens, offering reduced penalties or interest, and collecting disputed taxes. It also includes powers for publicizing debtor names and collaborating with other tax authorities.                                               |
| Human Resource Management and Development (HRM)                     | Measuring the extent to which modern human resources practices and policies are in place to support tax administration, such as an HR strategy or multi-year workforce plan, training strategy, staffing plan, recruitment plan, flexible work arrangements, leadership development and succession planning, time reporting systems, diversity and equal opportunities policies, assessing current and future capability needs, and a formal plan to address gaps in staff capacity. |

Source: Authors' calculations

Appendix Table AI.2. Summary of Sub-Indices

| Nine Sub-Indices (Layer 1)                                              | Sub-categories<br>Indices (Layer 2) | Sub-subcategories<br>Indices (Layer 3) | Total ISORA<br>questions used |                        |
|-------------------------------------------------------------------------|-------------------------------------|----------------------------------------|-------------------------------|------------------------|
|                                                                         |                                     |                                        | New                           | Chang et al.<br>(2020) |
| Compliance Risk Management (CRM)                                        | 10                                  | 26                                     | 36                            | 3                      |
| Use of Third-Party Data (UTD)                                           | 3                                   | 22                                     | 25                            | 12                     |
| Degree of Digitalization (DIG)                                          | 4                                   | 18                                     | 22                            | 10                     |
| Service Orientation (SOR)                                               | 9                                   | 14                                     | 23                            | 14                     |
| Public Accountability (PAC)                                             | 7                                   | 19                                     | 26                            | 12                     |
| Autonomy (AUT)                                                          | 2                                   | 12                                     | 14                            | 14                     |
| Large Taxpayer Office and High-Net-<br>Worth Individuals (LTO and HNWI) | 2                                   | 6                                      | 8                             | 1                      |
| Tax Enforcement (ENF)                                                   | 1                                   | 20                                     | 21                            |                        |
| Human Resource Management and<br>Development (HRM)                      | 3                                   | 15                                     | 18                            |                        |
| <b>Total</b>                                                            | <b>41</b>                           | <b>152</b>                             | <b>193</b>                    | <b>66</b>              |

Source: Authors' calculations

Appendix Table AI.3. Data Descriptions and Sources

|                                 | Variables                                                                                                            | Descriptions                                                                                                                                                        | Sources                                                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| ISORA                           | Operational Strength Index and sub-Indices of tax administration strength                                            | Measures of the overall strength of the tax administration and strength across practices and structural foundations (see tables on definition of each index)        | Authors' calculations based on International Survey on Revenue Administration (ISORA) database                                             |
|                                 | Tax staff over the labor force (percent)                                                                             | The number of tax staff as percentage of the labor force                                                                                                            | Authors' calculations based on International Survey on Revenue Administration (ISORA) and International Labor Organization (ILO) databases |
|                                 | Active taxpayers over the labor force (percent)                                                                      | The number of active taxpayers as percentage of the labor force                                                                                                     | Authors' calculations based on International Survey on Revenue Administration (ISORA) and International Labor Organization (ILO) databases |
| Dependent and Control Variables | Tax revenues excluding trade taxes and social security contributions (% of GDP)                                      | Total tax revenues excluding trade taxes and social security contributions as a percent of GDP.                                                                     | Authors' calculations based on the IMF's WEO and WoRLD databases.                                                                          |
|                                 | Real GDP growth (percent), lagged                                                                                    | One-year lagged value of real GDP growth (percent)                                                                                                                  | Authors' calculations based on the IMF's WEO database                                                                                      |
|                                 | Log (GDP per capita), lagged                                                                                         | One-year lagged value of the log of GDP per capita (in USD)                                                                                                         | Authors' calculations based on the IMF's WEO database                                                                                      |
|                                 | Square log (GDP per capita), lagged                                                                                  | One-year lagged value of the squared of the log of GDP per capita (in USD)                                                                                          | Authors' calculations based on the IMF's WEO database                                                                                      |
|                                 | Trade openness (% of GDP), lagged                                                                                    | One-year lagged value of trade openness (sum of exports and imports over GDP)                                                                                       | Authors' calculations based on the IMF's WEO database                                                                                      |
|                                 | External debt (% of GDP), lagged                                                                                     | External debt over GDP                                                                                                                                              | Authors' calculations based on the IMF's WEO and World Bank's WDI databases                                                                |
|                                 | CPI (percent), lagged                                                                                                | One-year lagged value of inflation, percent change of consumer price index, period average                                                                          | Authors' calculations based on the IMF's WEO and World Bank's WDI databases                                                                |
|                                 | Terms of trade (2000=1), lagged                                                                                      | One-year lagged value of terms of trade (2000=1)                                                                                                                    | Authors' calculations based on the IMF's WEO and World Bank's WDI databases                                                                |
|                                 | Oil exports (% of GDP), lagged                                                                                       | One-year lagged value of oil exports as percent of GDP                                                                                                              | Authors' calculations based on the IMF's WEO database                                                                                      |
|                                 | Log (Agriculture, % of GDP), lagged                                                                                  | One-year lagged value of the log of the share of agriculture in GDP (percent)                                                                                       | Authors' calculations based on the World Bank's WDI database                                                                               |
|                                 | Governance indicators (e.g, control corruption, lagged; government effectiveness, lagged, rule of law, lagged, etc.) | One-year lagged value of the governance indicators (control of corruption index, government effectiveness index, rule of law index, etc.)                           | Authors' calculations based on the World Bank WGI database                                                                                 |
|                                 | Measures of informality (self-employment as percentage of total employment), lagged                                  | One-year lagged value of self-employment as percentage of total employment                                                                                          | Elgin et al. (2021). World Bank.                                                                                                           |
|                                 | Urban population (% of total population), lagged                                                                     | One-year lagged value of urban population refers to people living in urban areas as defined by national statistical offices                                         | Authors' calculations based on the World Bank's WDI database                                                                               |
|                                 | Age dependency ratio (% of working-age population), lagged                                                           | One-year lagged value of age dependency ratio is the ratio of dependents--people younger than 15 or older than 64--to the working-age population--those ages 15-64. | Authors' calculations based on the World Bank's WDI database                                                                               |

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|                                                                                                                         |                                                                                                                                                         |                                                                               |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Education spending (% of GDP), lagged                                                                                   | One-year lagged value of public spending in education as percentage of GDP                                                                              | Authors' calculations based on the World Bank's WDI database                  |
| Health spending (% of GDP), lagged                                                                                      | One-year lagged value of public spending in health sector as percentage of GDP                                                                          | Authors' calculations based on the World Bank's WDI database                  |
| Financial development index, lagged                                                                                     | One-year lagged value of a measure of financial development, based on depth, access and efficiency of the financial institutions and financial markets. | Authors' calculations based on the IMF's Financial Development Index database |
| Tax policy yield                                                                                                        | A narrative measure of tax policy yield built using a narrative approach and large language models (AI).                                                | Atsebi et al. (forthcoming)                                                   |
| The intensity of the IMF's FAD CD programs in tax administration, aggregated across the past four or five to two years. | Measures of the FTE used in IMF CD in tax administration (in years), used as instrumental variable.                                                     | IMF FAD internal CD database                                                  |

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## Appendix II. Descriptive Statistics and Stylized Facts

Appendix Table AII.1. Summary Statistics

|                                                                              | (1)<br>Obs. | (2)<br>Mean | (3)<br>Median | (5)<br>Std.Dev. | (6)<br>Min | (7)<br>Max |
|------------------------------------------------------------------------------|-------------|-------------|---------------|-----------------|------------|------------|
| Non-Trade Tax Revenue (Percent of GDP), consolidated WoRLD and WEO           | 901         | 0.152       | 0.142         | 0.079           | 0.002      | 0.496      |
| Operational Strength Index (OSI), Expert Weights                             | 741         | 0.609       | 0.627         | 0.150           | 0.075      | 0.879      |
| Compliance Risk Management (CRM)                                             | 747         | 0.627       | 0.649         | 0.191           | 0.000      | 0.967      |
| Use of Third-Party Data (UTD)                                                | 747         | 0.409       | 0.385         | 0.266           | 0.000      | 1.000      |
| Digitalization (DIG)                                                         | 747         | 0.659       | 0.781         | 0.294           | 0.000      | 1.000      |
| Service Orientation (SOR)                                                    | 747         | 0.693       | 0.733         | 0.217           | 0.000      | 1.000      |
| Public Accountability (PAC)                                                  | 747         | 0.564       | 0.561         | 0.179           | 0.000      | 1.000      |
| Autonomy (AUT)                                                               | 747         | 0.718       | 0.772         | 0.247           | 0.000      | 1.000      |
| LTO and HNWI (LTO)                                                           | 747         | 0.584       | 0.622         | 0.243           | 0.000      | 1.000      |
| Tax Enforcement (ENF)                                                        | 747         | 0.575       | 0.571         | 0.160           | 0.000      | 0.914      |
| Human Resource Management (HRM)                                              | 747         | 0.665       | 0.696         | 0.296           | 0.000      | 1.000      |
| Tax Policy Yield, exc. Trade Tax and SSC                                     | 960         | 0.001       | 0.000         | 0.006           | -0.028     | 0.095      |
| FTE used in IMF tax administration CD (in years)                             | 960         | 0.199       | 0.004         | 0.403           | 0.000      | 4.476      |
| Cumulative FTE used in IMF tax admin CD over 5 to 2 years earlier (in years) | 960         | 0.644       | 0.311         | 1.065           | 0.000      | 10.660     |
| #Tax Staff/LaborForce                                                        | 669         | 0.108       | 0.083         | 0.086           | 0.005      | 0.440      |
| Active Taxpayer/Labor Force                                                  | 670         | 56.614      | 22.835        | 66.214          | 0.000      | 275.864    |
| #Tax Staff/LaborForce                                                        | 669         | 0.108       | 0.083         | 0.086           | 0.005      | 0.440      |
| Sq(#Tax Staff/Labor Force)                                                   | 669         | 0.019       | 0.007         | 0.027           | 0.000      | 0.194      |
| Active Taxpayer/Labor Force                                                  | 670         | 56.614      | 22.835        | 66.214          | 0.000      | 275.864    |
| Real GDP growth, lagged                                                      | 954         | 3.564       | 3.546         | 4.741           | -36.392    | 37.687     |
| Log (GDP per capita, USD), lagged                                            | 949         | 8.421       | 8.479         | 1.992           | -20.142    | 11.761     |
| Sq(Log (GDP per capita, USD)), lagged                                        | 949         | 74.887      | 71.905        | 30.012          | 0.010      | 405.718    |
| Trade openness (% of GDP), lagged                                            | 945         | 0.907       | 0.785         | 0.578           | 0.209      | 4.427      |
| External debt (% of GDP), lagged                                             | 874         | 0.822       | 0.455         | 1.363           | 0.005      | 12.798     |
| Inflation, lagged                                                            | 951         | 0.071       | 0.025         | 0.552           | -0.056     | 15.885     |
| Terms of Trade (2000=1), lagged                                              | 935         | 1.039       | 1.000         | 0.166           | 0.598      | 1.948      |
| Oil exports (% of GDP), lagged                                               | 975         | 0.047       | 0.002         | 0.107           | 0.000      | 0.699      |
| Log (Agri, % of GDP), lagged                                                 | 917         | 1.738       | 1.955         | 1.388           | -4.380     | 4.073      |
| Control Corruption, lagged                                                   | 958         | -0.068      | -0.306        | 0.994           | -1.837     | 2.399      |
| Informality: Self-Employment, lagged                                         | 714         | 35.242      | 30.197        | 24.540          | 0.000      | 92.060     |
| Urban Population (% of Total), lagged                                        | 940         | 57.676      | 57.613        | 23.026          | 11.482     | 100.000    |
| Age dependency ratio (% of Working-Age Pop.), lagged                         | 945         | 59.515      | 54.270        | 17.871          | 17.283     | 106.571    |
| Education Spending (% of GDP), lagged                                        | 763         | 4.493       | 4.350         | 1.809           | 1.025      | 14.195     |
| Current Health Spending (% of GDP), lagged                                   | 905         | 6.578       | 6.151         | 2.916           | 1.642      | 21.828     |
| Financial Development Index, lagged                                          | 905         | 0.320       | 0.248         | 0.226           | 0.033      | 0.980      |

Source: Authors' calculations using ISORA and WEO

Appendix Table AII.2. Correlations of the Operational Strength Index over Time

|         | OSI2014 | OSI2015 | OSI2016 | OSI2017 | OSI2022 |
|---------|---------|---------|---------|---------|---------|
| OSI2014 | 1       |         |         |         |         |
| OSI2015 | 0.997   | 1       |         |         |         |
| OSI2016 | 0.961   | 0.961   | 1       |         |         |
| OSI2017 | 0.956   | 0.956   | 0.997   | 1       |         |
| OSI2022 | 0.893   | 0.893   | 0.916   | 0.915   | 1       |

Source: Authors' calculations

## Correlation between Tax Revenue and Tax Administration Strength

Appendix Table AII.4 shows the coefficients of correlation (unconditional) between the ISORA index and tax-to-GDP ratio. In addition to the correlation estimate for the full sample (column 1), columns 2–10 of the table demonstrate how the correlation coefficients vary depending on a country's level of informality, financial development, and institutions and governance quality; which we explore in sensitivity analysis in section VII. To derive a basic stylized fact, we divide the sample into high vs. low levels of informality, financial development, or institutional development based on the median value of each variable over the study period (2014–22).

The overall tax administration strength (OSI) significantly correlates with tax revenue in the full sample (the correlation coefficient is large at 0.449 and significant at 1 percent level). The correlation generally gets stronger in countries with strong institutions and governance (related to higher control of corruption, rule of law, political stability, and voice and accountability), highlighting the importance of institutional capacity building (Benitez et al., 2023). In countries with a high level of informality, the correlation tends to become weaker (partly due to their higher volatility in tax-to-GDP ratio) due to low tax collection capacity (Besley and Persson, 2013). A lower correlation is also found in countries with higher financial development.

Among the nine ISORA sub-indices, the degree of digitalization, use of third-party data, and compliance risk management show the strongest correlation with the tax-to-GDP ratio; these practices are also strongly correlated with each other (Appendix Table AII.3) and were rated by the experts as the most important practices for raising tax revenue. Even under high informality or financial development, digitalization has the strongest correlation with tax revenue among the nine sub-indices. In contrast, the correlation between the LTO/HNWI and tax-to-GDP ratio appears insignificant, while autonomy, tax enforcement, and human resource management and development show weaker correlations with tax revenue—consistent with expert opinions collected from the weighting survey.



Appendix Table AII.3. Correlations across Practices and Structural Foundations

|                                                                     | OSI   | CRM   | UTD   | DIG   | SOR   | PAC   | AUT   | LTO    | ENF   | HRM   | STA   | ind |
|---------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-----|
| Operational Strength Index (OSI)                                    | 1     |       |       |       |       |       |       |        |       |       |       |     |
| Compliance Risk Management (CRM)                                    | 0.722 | 1     |       |       |       |       |       |        |       |       |       |     |
| Use of Third-Party Data (UTD)                                       | 0.730 | 0.463 | 1     |       |       |       |       |        |       |       |       |     |
| Degree of Digitalization (DIG)                                      | 0.768 | 0.520 | 0.575 | 1     |       |       |       |        |       |       |       |     |
| Service Orientation (SOR)                                           | 0.779 | 0.543 | 0.478 | 0.557 | 1     |       |       |        |       |       |       |     |
| Public Accountability (PAC)                                         | 0.671 | 0.495 | 0.395 | 0.472 | 0.624 | 1     |       |        |       |       |       |     |
| Autonomy (AUT)                                                      | 0.617 | 0.392 | 0.300 | 0.419 | 0.544 | 0.494 | 1     |        |       |       |       |     |
| Large Taxpayer Office and High-Net-Worth Individuals (LTO and HNWI) | 0.340 | 0.261 | 0.183 | 0.072 | 0.280 | 0.233 | 0.153 | 1      |       |       |       |     |
| Tax Enforcement (ENF)                                               | 0.511 | 0.455 | 0.311 | 0.359 | 0.398 | 0.331 | 0.319 | 0.155  | 1     |       |       |     |
| Human Resource Management and Development (HRM)                     | 0.644 | 0.373 | 0.339 | 0.397 | 0.541 | 0.496 | 0.503 | 0.121  | 0.345 | 1     |       |     |
| Tax Staff over Labor Force                                          | 0.193 | 0.097 | 0.100 | 0.254 | 0.085 | 0.140 | 0.134 | -0.058 | 0.206 | 0.097 | 1     |     |
| Active Taxpayers over Labor Force                                   | 0.447 | 0.378 | 0.319 | 0.429 | 0.311 | 0.288 | 0.269 | -0.093 | 0.221 | 0.240 | 0.552 | 1   |

Source: Authors' calculations

Appendix Table AII.4. Correlation between ISORA Indices and Tax-to-GDP Ratio

|                                             | (1) Full sample | (2) High informality | (3) High financial development | Governance indicators          |                      |                                   |                             |                              |                                   |
|---------------------------------------------|-----------------|----------------------|--------------------------------|--------------------------------|----------------------|-----------------------------------|-----------------------------|------------------------------|-----------------------------------|
|                                             |                 |                      |                                | (4) High control of corruption | (5) High rule of law | (6) High government effectiveness | (7) High regulatory quality | (8) High political stability | (9) High voice and accountability |
| <b>Operational Strength Index (OSI)</b>     | <b>0.449***</b> | <b>0.360***</b>      | <b>0.341***</b>                | <b>0.526***</b>                | <b>0.513***</b>      | <b>0.399***</b>                   | <b>0.343***</b>             | <b>0.490***</b>              | <b>0.508***</b>                   |
| <b>ISORA sub-indices</b>                    |                 |                      |                                |                                |                      |                                   |                             |                              |                                   |
| 1. Compliance Risk Management (CRM)         | 0.355***        | 0.286***             | 0.354***                       | 0.450***                       | 0.440***             | 0.398***                          | 0.356***                    | 0.396***                     | 0.412***                          |
| 2. Use of Third-Party Data (UTD)            | 0.353***        | 0.270***             | 0.165***                       | 0.399***                       | 0.397***             | 0.251***                          | 0.177***                    | 0.409***                     | 0.351***                          |
| 3. Degree of Digitalization (DIG)           | 0.493***        | 0.346***             | 0.312***                       | 0.503***                       | 0.474***             | 0.350***                          | 0.318***                    | 0.451***                     | 0.481***                          |
| 4. Service Orientation (SOR)                | 0.362***        | 0.236***             | 0.276***                       | 0.367***                       | 0.350***             | 0.257***                          | 0.233***                    | 0.344***                     | 0.406***                          |
| 5. Public Accountability (PAC)              | 0.344***        | 0.173***             | 0.295***                       | 0.364***                       | 0.372***             | 0.316***                          | 0.266***                    | 0.383***                     | 0.411***                          |
| 6. Autonomy (AUT)                           | 0.275***        | 0.059                | 0.324***                       | 0.338***                       | 0.354***             | 0.300***                          | 0.246***                    | 0.317***                     | 0.374***                          |
| 7. LTO and HNWI                             | -0.058          | 0.087                | 0.052                          | 0.111**                        | 0.064                | 0.062                             | 0.028                       | 0.055                        | 0.038                             |
| 8. Tax Enforcement (ENF)                    | 0.281***        | 0.184***             | 0.215***                       | 0.318***                       | 0.284***             | 0.223***                          | 0.221***                    | 0.262***                     | 0.258***                          |
| 9. Human Resource Manag. and Develop. (HRM) | 0.308***        | 0.169***             | 0.245***                       | 0.317***                       | 0.325***             | 0.253***                          | 0.243***                    | 0.311***                     | 0.334***                          |

Source: Authors' calculations using ISORA and WEO. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: Yellow shaded cells indicate the strongest correlation among nine ISORA sub-indices.

## Appendix III. Results

Appendix Table AIII.1. Robustness: Cumulative FTE used over the past five or four years (-5/-4 to -1)

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -1] | (4)<br>IV EMDEs<br>[-4 to -1] | (5)<br>IV All<br>[-5 to -1] | (6)<br>IV EMDEs<br>[-5 to -1] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0059<br>(0.0028)     | 0.0098<br>(0.0049)     | 0.1066***<br>(0.0197)       | 0.1677***<br>(0.0310)         | 0.0883***<br>(0.0116)       | 0.1416***<br>(0.0156)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3020***<br>(0.0408)  | 0.2936***<br>(0.0415)  | 0.3336***<br>(0.0099)       | 0.3317***<br>(0.0253)         | 0.3278***<br>(0.0136)       | 0.3254***<br>(0.0172)         |
| #Tax Staff/LaborForce                    | 0.4465**<br>(0.1043)   | 0.5019**<br>(0.1309)   | 0.5386***<br>(0.0686)       | 0.6116***<br>(0.0809)         | 0.5218***<br>(0.0745)       | 0.5934***<br>(0.0919)         |
| Sq(#Tax Staff/Labor Force)               | -2.0220***<br>(0.3939) | -2.4303***<br>(0.5067) | -2.2734***<br>(0.3064)      | -2.6286***<br>(0.4285)        | -2.2276***<br>(0.3269)      | -2.5958***<br>(0.4550)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0000)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0176<br>(0.0147)     | 0.0232<br>(0.0125)     | 0.0186<br>(0.0173)          | 0.0315**<br>(0.0122)          | 0.0184<br>(0.0175)          | 0.0301**<br>(0.0129)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017<br>(0.0010)    | -0.0023*<br>(0.0008)   | -0.0018<br>(0.0012)         | -0.0029***<br>(0.0008)        | -0.0018<br>(0.0012)         | -0.0028***<br>(0.0009)        |
| Trade openness (% of GDP), lagged        | 0.0191***<br>(0.0032)  | 0.0224***<br>(0.0047)  | 0.0167***<br>(0.0040)       | 0.0173***<br>(0.0065)         | 0.0172***<br>(0.0038)       | 0.0181***<br>(0.0061)         |
| External debt (% of GDP), lagged         | -0.0000<br>(0.0004)    | -0.0165***<br>(0.0026) | -0.0008<br>(0.0008)         | -0.0152***<br>(0.0020)        | -0.0007<br>(0.0007)         | -0.0154***<br>(0.0018)        |
| Inflation, lagged                        | -0.0249***<br>(0.0034) | -0.0255***<br>(0.0040) | -0.0272***<br>(0.0019)      | -0.0341***<br>(0.0034)        | -0.0267***<br>(0.0020)      | -0.0327***<br>(0.0041)        |
| Terms of Trade (2000=1), lagged          | 0.0185*<br>(0.0074)    | 0.0201**<br>(0.0070)   | 0.0141<br>(0.0094)          | 0.0150<br>(0.0084)            | 0.0149<br>(0.0096)          | 0.0158<br>(0.0088)            |
| Oil exports (% of GDP), lagged           | -0.1132***<br>(0.0112) | -0.1415***<br>(0.0154) | -0.0938***<br>(0.0172)      | -0.1113***<br>(0.0291)        | -0.0974***<br>(0.0148)      | -0.1163***<br>(0.0248)        |
| Log (Agri, % of GDP), lagged             | -0.0076<br>(0.0048)    | -0.0106*<br>(0.0038)   | -0.0133***<br>(0.0043)      | -0.0179***<br>(0.0034)        | -0.0122***<br>(0.0047)      | -0.0167***<br>(0.0040)        |
| Control Corruption, lagged               | 0.0024<br>(0.0014)     | 0.0034<br>(0.0039)     | 0.0006<br>(0.0018)          | 0.0015<br>(0.0048)            | 0.0009<br>(0.0017)          | 0.0019<br>(0.0046)            |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.216                  | 0.273                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3467.6                     | -2742.3                       | -3485.5                     | -2774.3                       |
| BIC                                      | —                      | —                      | -3450.5                     | -2726.1                       | -3468.4                     | -2758.1                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 35.209                      | 26.161                        | 43.603                      | 31.288                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 13.332                      | 23.502                        | 16.218                      | 26.527                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.2. Robustness: Cumulative FTE used over the past five or four to three years (-5/-4 to -3)

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -3] | (4)<br>IV EMDEs<br>[-4 to -3] | (5)<br>IV All<br>[-5 to -3] | (6)<br>IV EMDEs<br>[-5 to -3] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0059<br>(0.0028)     | 0.0098<br>(0.0049)     | 0.0784***<br>(0.0096)       | 0.1137***<br>(0.0241)         | 0.0625***<br>(0.0092)       | 0.0934***<br>(0.0293)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3020***<br>(0.0408)  | 0.2936***<br>(0.0415)  | 0.3247***<br>(0.0143)       | 0.3187***<br>(0.0112)         | 0.3198***<br>(0.0207)       | 0.3138***<br>(0.0107)         |
| #Tax Staff/LaborForce                    | 0.4465**<br>(0.1043)   | 0.5019**<br>(0.1309)   | 0.5127***<br>(0.0825)       | 0.5740***<br>(0.1116)         | 0.4982***<br>(0.0851)       | 0.5600***<br>(0.1176)         |
| Sq(#Tax Staff/Labor Force)               | -2.0220***<br>(0.3939) | -2.4303***<br>(0.5067) | -2.2029***<br>(0.3527)      | -2.5607***<br>(0.4979)        | -2.1633***<br>(0.3625)      | -2.5352***<br>(0.5127)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0176<br>(0.0147)     | 0.0232<br>(0.0125)     | 0.0183<br>(0.0177)          | 0.0286**<br>(0.0142)          | 0.0182<br>(0.0178)          | 0.0276<br>(0.0144)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017<br>(0.0010)    | -0.0023<br>(0.0008)    | -0.0018<br>(0.0012)         | -0.0027***<br>(0.0010)        | -0.0018<br>(0.0012)         | -0.0026***<br>(0.0010)        |
| Trade openness (% of GDP), lagged        | 0.0191***<br>(0.0032)  | 0.0224***<br>(0.0047)  | 0.0174***<br>(0.0036)       | 0.0191***<br>(0.0052)         | 0.0178***<br>(0.0035)       | 0.0197***<br>(0.0050)         |
| External debt (% of GDP), lagged         | -0.0000<br>(0.0004)    | -0.0165***<br>(0.0026) | -0.0006<br>(0.0006)         | -0.0156***<br>(0.0017)        | -0.0005<br>(0.0005)         | -0.0158***<br>(0.0017)        |
| Inflation, lagged                        | -0.0249***<br>(0.0034) | -0.0255***<br>(0.0040) | -0.0265***<br>(0.0021)      | -0.0312***<br>(0.0055)        | -0.0262***<br>(0.0022)      | -0.0301***<br>(0.0058)        |
| Terms of Trade (2000=1), lagged          | 0.0185*<br>(0.0074)    | 0.0201**<br>(0.0070)   | 0.0153<br>(0.0101)          | 0.0167*<br>(0.0097)           | 0.0160<br>(0.0101)          | 0.0174*<br>(0.0098)           |
| Oil exports (% of GDP), lagged           | -0.1132***<br>(0.0112) | -0.1415***<br>(0.0154) | -0.0993***<br>(0.0126)      | -0.1217***<br>(0.0184)        | -0.1023***<br>(0.0113)      | -0.1255***<br>(0.0161)        |
| Log (Agri, % of GDP), lagged             | -0.0076<br>(0.0048)    | -0.0106*<br>(0.0038)   | -0.0117**<br>(0.0053)       | -0.0154***<br>(0.0052)        | -0.0108**<br>(0.0054)       | -0.0145***<br>(0.0054)        |
| Control Corruption, lagged               | 0.0024<br>(0.0014)     | 0.0034<br>(0.0039)     | 0.0011<br>(0.0015)          | 0.0022<br>(0.0043)            | 0.0014<br>(0.0015)          | 0.0024<br>(0.0043)            |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.216                  | 0.273                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3493.8                     | -2804.2                       | -3505.1                     | -2822.5                       |
| BIC                                      | —                      | —                      | -3476.7                     | -2788.0                       | -3488.0                     | -2806.3                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 37.413                      | 23.917                        | 42.223                      | 27.472                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 10.701                      | 9.8255                        | 13.493                      | 12.031                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to three years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.3. Robustness: Lagged Values of OSI

|                                                  | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|--------------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1], lagged         | -0.0086<br>(0.0079)    | -0.0074<br>(0.0109)    | 0.2089***<br>(0.0200)       | 0.3378***<br>(0.0616)         | 0.1673***<br>(0.0172)       | 0.2439***<br>(0.0312)         |
| Tax Policy Yield, exc. Trade Tax and SSC, lagged | 0.0046<br>(0.0872)     | 0.1051<br>(0.1074)     | 0.0103<br>(0.0624)          | 0.0697<br>(0.0868)            | 0.0092<br>(0.0606)          | 0.0794<br>(0.0962)            |
| #Tax Staff/LaborForce, lagged                    | 0.0285<br>(0.1755)     | 0.1164<br>(0.0994)     | 0.2532<br>(0.1834)          | 0.4606***<br>(0.1651)         | 0.2103<br>(0.1826)          | 0.3670***<br>(0.1267)         |
| Sq(#Tax Staff/Labor Force), lagged               | 0.1536<br>(0.5764)     | -0.1168<br>(0.3817)    | -0.3997<br>(0.6568)         | -0.7835<br>(0.5995)           | -0.2941<br>(0.6405)         | -0.6023<br>(0.4835)           |
| Active Taxpayer/Labor Force, lagged              | -0.0000<br>(0.0000)    | 0.0000<br>(0.0000)     | -0.0001**<br>(0.0000)       | -0.0001***<br>(0.0000)        | -0.0001**<br>(0.0000)       | -0.0001***<br>(0.0000)        |
| Real GDP growth, lagged                          | -0.0001<br>(0.0004)    | -0.0000<br>(0.0003)    | -0.0001<br>(0.0004)         | 0.0002<br>(0.0003)            | -0.0001<br>(0.0004)         | 0.0001<br>(0.0003)            |
| Log (GDP per capita, USD), lagged                | 0.0081<br>(0.0140)     | -0.0462**<br>(0.0160)  | 0.0028<br>(0.0112)          | -0.0610***<br>(0.0181)        | 0.0038<br>(0.0105)          | -0.0570***<br>(0.0166)        |
| Sq(Log (GDP per capita, USD)), lagged            | -0.0013<br>(0.0008)    | 0.0026*<br>(0.0010)    | -0.0008<br>(0.0006)         | 0.0039***<br>(0.0010)         | -0.0009<br>(0.0006)         | 0.0035***<br>(0.0010)         |
| Trade openness (% of GDP), lagged                | 0.0116*<br>(0.0050)    | 0.0183*<br>(0.0069)    | 0.0144***<br>(0.0030)       | 0.0231***<br>(0.0042)         | 0.0139***<br>(0.0029)       | 0.0218***<br>(0.0035)         |
| External debt (% of GDP), lagged                 | -0.0021<br>(0.0013)    | -0.0043<br>(0.0063)    | -0.0045***<br>(0.0008)      | -0.0091<br>(0.0058)           | -0.0040***<br>(0.0008)      | -0.0078<br>(0.0054)           |
| Inflation, lagged                                | -0.0377***<br>(0.0073) | -0.0272***<br>(0.0056) | -0.0301***<br>(0.0086)      | -0.0149<br>(0.0092)           | -0.0315***<br>(0.0085)      | -0.0183***<br>(0.0075)        |
| Terms of Trade (2000=1), lagged                  | 0.0074<br>(0.0038)     | 0.0043<br>(0.0041)     | 0.0025<br>(0.0054)          | -0.0032<br>(0.0059)           | 0.0035<br>(0.0051)          | -0.0011<br>(0.0058)           |
| Oil exports (% of GDP), lagged                   | -0.0424*<br>(0.0175)   | -0.1068***<br>(0.0221) | -0.0412***<br>(0.0140)      | -0.1355***<br>(0.0223)        | -0.0415***<br>(0.0144)      | -0.1277***<br>(0.0193)        |
| Log (Agri, % of GDP), lagged                     | -0.0060<br>(0.0054)    | -0.0139***<br>(0.0027) | -0.0142***<br>(0.0059)      | -0.0276***<br>(0.0039)        | -0.0127***<br>(0.0057)      | -0.0239***<br>(0.0035)        |
| Control Corruption, lagged                       | -0.0005<br>(0.0013)    | -0.0010<br>(0.0029)    | -0.0038***<br>(0.0009)      | -0.0086***<br>(0.0014)        | -0.0032***<br>(0.0009)      | -0.0065***<br>(0.0014)        |
| Observations                                     | 511                    | 413                    | 511                         | 413                           | 511                         | 413                           |
| Number of countries                              | 120                    | 98                     | 120                         | 98                            | 120                         | 98                            |
| within R-squared                                 | 0.123                  | 0.215                  | —                           | —                             | —                           | —                             |
| Country FE                                       | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                          | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                              | —                      | —                      | -3116.3                     | -2442.9                       | -3165.8                     | -2578.6                       |
| BIC                                              | —                      | —                      | -3099.4                     | -2426.8                       | -3148.8                     | -2562.5                       |
| Ho: OSI is exogenous                             | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic                    | —                      | —                      | 15.484                      | 6.5955                        | 18.519                      | 8.2162                        |
| Kleibergen-Paap rk Wald F statistic              | —                      | —                      | 38.691                      | 11.300                        | 47.656                      | 17.875                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.4. Robustness: Equal Weighted OSI

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0037<br>(0.0025)     | 0.0049<br>(0.0056)     | 0.1113***<br>(0.0071)       | 0.1721***<br>(0.0137)         | 0.0910***<br>(0.0094)       | 0.1432***<br>(0.0251)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3011***<br>(0.0417)  | 0.2921***<br>(0.0439)  | 0.3281***<br>(0.0087)       | 0.3225***<br>(0.0247)         | 0.3230***<br>(0.0133)       | 0.3172***<br>(0.0155)         |
| #Tax Staff/LaborForce                    | 0.4441**<br>(0.1047)   | 0.4988**<br>(0.1314)   | 0.5342***<br>(0.0813)       | 0.6240***<br>(0.0959)         | 0.5172***<br>(0.0842)       | 0.6023***<br>(0.1075)         |
| Sq(#Tax Staff/Labor Force)               | -2.0146***<br>(0.3950) | -2.4251***<br>(0.5074) | -2.2300***<br>(0.3388)      | -2.6693***<br>(0.4471)        | -2.1893***<br>(0.3502)      | -2.6271***<br>(0.4779)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0176<br>(0.0147)     | 0.0230<br>(0.0125)     | 0.0203<br>(0.0179)          | 0.0334**<br>(0.0136)          | 0.0198<br>(0.0181)          | 0.0316*<br>(0.0143)           |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017<br>(0.0010)    | -0.0023<br>(0.0008)    | -0.0019<br>(0.0012)         | -0.0031***<br>(0.0010)        | -0.0019<br>(0.0012)         | -0.0029***<br>(0.0010)        |
| Trade openness (% of GDP), lagged        | 0.0191***<br>(0.0032)  | 0.0226***<br>(0.0047)  | 0.0169***<br>(0.0035)       | 0.0177***<br>(0.0055)         | 0.0173***<br>(0.0035)       | 0.0186***<br>(0.0052)         |
| External debt (% of GDP), lagged         | 0.0000<br>(0.0004)     | -0.0165***<br>(0.0026) | -0.0009<br>(0.0006)         | -0.0154***<br>(0.0019)        | -0.0008<br>(0.0006)         | -0.0156***<br>(0.0019)        |
| Inflation, lagged                        | -0.0248***<br>(0.0034) | -0.0252***<br>(0.0040) | -0.0268***<br>(0.0019)      | -0.0332***<br>(0.0052)        | -0.0264***<br>(0.0020)      | -0.0318***<br>(0.0057)        |
| Terms of Trade (2000=1), lagged          | 0.0186*<br>(0.0074)    | 0.0203**<br>(0.0070)   | 0.0142<br>(0.0100)          | 0.0152*<br>(0.0090)           | 0.0151<br>(0.0101)          | 0.0161*<br>(0.0094)           |
| Oil exports (% of GDP), lagged           | -0.1137***<br>(0.0110) | -0.1425***<br>(0.0152) | -0.0950***<br>(0.0137)      | -0.1141***<br>(0.0229)        | -0.0985***<br>(0.0122)      | -0.1190***<br>(0.0194)        |
| Log (Agri, % of GDP), lagged             | -0.0075<br>(0.0048)    | -0.0104*<br>(0.0038)   | -0.0133**<br>(0.0056)       | -0.0175***<br>(0.0051)        | -0.0122**<br>(0.0057)       | -0.0163***<br>(0.0055)        |
| Control Corruption, lagged               | 0.0024<br>(0.0014)     | 0.0035<br>(0.0039)     | 0.0009<br>(0.0015)          | 0.0022<br>(0.0045)            | 0.0012<br>(0.0014)          | 0.0025<br>(0.0044)            |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.216                  | 0.272                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3464.1                     | -2739.0                       | -3483.6                     | -2773.1                       |
| BIC                                      | —                      | —                      | -3447.1                     | -2722.8                       | -3466.5                     | -2756.9                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 32.025                      | 17.781                        | 37.211                      | 20.866                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 18.712                      | 13.930                        | 23.885                      | 18.101                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.5. Robustness: Alternative Fixed Effects: Income Group X Year Fixed

|                                          | (1)<br>OLS All        | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|-----------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0064<br>(0.0156)    | 0.0118<br>(0.0173)     | 0.0859***<br>(0.0059)       | 0.1236***<br>(0.0127)         | 0.0692***<br>(0.0050)       | 0.1026***<br>(0.0209)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3105***<br>(0.1169) | 0.3044**<br>(0.1255)   | 0.3454***<br>(0.0135)       | 0.3453***<br>(0.0218)         | 0.3380***<br>(0.0184)       | 0.3376***<br>(0.0152)         |
| #Tax Staff/LaborForce                    | 0.4681**<br>(0.2114)  | 0.5155**<br>(0.2035)   | 0.5471***<br>(0.0740)       | 0.6119***<br>(0.1090)         | 0.5305***<br>(0.0783)       | 0.5938***<br>(0.1181)         |
| Sq(#Tax Staff/Labor Force)               | -2.0507**<br>(0.8336) | -2.4301***<br>(0.9090) | -2.2629***<br>(0.3249)      | -2.6071***<br>(0.5296)        | -2.2182***<br>(0.3392)      | -2.5739***<br>(0.5488)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)    | 0.0000<br>(0.0001)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0001) | 0.0007***<br>(0.0002)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0185<br>(0.0203)    | 0.0270<br>(0.0207)     | 0.0186<br>(0.0155)          | 0.0320**<br>(0.0137)          | 0.0186<br>(0.0157)          | 0.0310**<br>(0.0139)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0018<br>(0.0014)   | -0.0025*<br>(0.0015)   | -0.0018<br>(0.0010)         | -0.0029***<br>(0.0009)        | -0.0018*<br>(0.0010)        | -0.0028***<br>(0.0009)        |
| Trade openness (% of GDP), lagged        | 0.0178**<br>(0.0076)  | 0.0208**<br>(0.0088)   | 0.0161***<br>(0.0036)       | 0.0172***<br>(0.0055)         | 0.0164***<br>(0.0035)       | 0.0179***<br>(0.0052)         |
| External debt (% of GDP), lagged         | -0.0002<br>(0.0014)   | -0.0159**<br>(0.0074)  | -0.0007<br>(0.0006)         | -0.0146***<br>(0.0019)        | -0.0006<br>(0.0006)         | -0.0148***<br>(0.0019)        |
| Inflation, lagged                        | -0.0230<br>(0.0159)   | -0.0240<br>(0.0151)    | -0.0246***<br>(0.0032)      | -0.0299***<br>(0.0028)        | -0.0243***<br>(0.0032)      | -0.0288***<br>(0.0032)        |
| Terms of Trade (2000=1), lagged          | 0.0177*<br>(0.0092)   | 0.0199**<br>(0.0089)   | 0.0139<br>(0.0098)          | 0.0157*<br>(0.0093)           | 0.0147<br>(0.0099)          | 0.0165*<br>(0.0096)           |
| Oil exports (% of GDP), lagged           | -0.1072*<br>(0.0579)  | -0.1375***<br>(0.0462) | -0.0915***<br>(0.0133)      | -0.1140***<br>(0.0220)        | -0.0948***<br>(0.0115)      | -0.1184***<br>(0.0187)        |
| Log (Agri, % of GDP), lagged             | -0.0050<br>(0.0072)   | -0.0075<br>(0.0079)    | -0.0098**<br>(0.0045)       | -0.0126***<br>(0.0039)        | -0.0088*<br>(0.0047)        | -0.0117***<br>(0.0042)        |
| Control Corruption, lagged               | 0.0028<br>(0.0048)    | 0.0042<br>(0.0054)     | 0.0010<br>(0.0020)          | 0.0022<br>(0.0049)            | 0.0014<br>(0.0020)          | 0.0026<br>(0.0048)            |
| Observations                             | 523                   | 419                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                   | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.9833                | 0.9757                 | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                   | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Income Group X Year FE                   | Yes                   | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                     | —                      | -3498.3                     | -2806.3                       | -3511.0                     | -2825.8                       |
| BIC                                      | —                     | —                      | -3481.2                     | -2790.1                       | -3493.9                     | -2809.6                       |
| Ho: OSI is exogenous                     | —                     | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                     | —                      | 36.497                      | 25.743                        | 42.939                      | 30.275                        |
| Kleibergen-Paap rk Wald F statistic      | —                     | —                      | 10.829                      | 12.848                        | 12.702                      | 15.176                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.6. Robustness: Dropping Top 10% OSI

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0169***<br>(0.0022)  | 0.0199**<br>(0.0061)   | 0.1296***<br>(0.0082)       | 0.1767***<br>(0.0133)         | 0.0962***<br>(0.0104)       | 0.1299***<br>(0.0342)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3944***<br>(0.0358)  | 0.3457***<br>(0.0463)  | 0.3782***<br>(0.0185)       | 0.3087***<br>(0.0250)         | 0.3830***<br>(0.0193)       | 0.3198***<br>(0.0325)         |
| #Tax Staff/LaborForce                    | 0.4647**<br>(0.1015)   | 0.5673***<br>(0.1168)  | 0.5629***<br>(0.0647)       | 0.6652***<br>(0.0809)         | 0.5337***<br>(0.0734)       | 0.6359***<br>(0.1002)         |
| Sq(#Tax Staff/Labor Force)               | -2.1813***<br>(0.4043) | -2.6993***<br>(0.4869) | -2.4946***<br>(0.3166)      | -2.9262***<br>(0.4479)        | -2.4016***<br>(0.3550)      | -2.8583***<br>(0.5034)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0000)         | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0231<br>(0.0193)     | 0.0230<br>(0.0194)     | 0.0253<br>(0.0250)          | 0.0341<br>(0.0258)            | 0.0246<br>(0.0249)          | 0.0308<br>(0.0256)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0021<br>(0.0013)    | -0.0022<br>(0.0013)    | -0.0021<br>(0.0017)         | -0.0029<br>(0.0017)           | -0.0021<br>(0.0017)         | -0.0027<br>(0.0017)           |
| Trade openness (% of GDP), lagged        | 0.0179***<br>(0.0037)  | 0.0211**<br>(0.0052)   | 0.0138***<br>(0.0041)       | 0.0140**<br>(0.0058)          | 0.0150***<br>(0.0038)       | 0.0161***<br>(0.0049)         |
| External debt (% of GDP), lagged         | 0.0000<br>(0.0003)     | -0.0133***<br>(0.0018) | -0.0010***<br>(0.0003)      | -0.0126***<br>(0.0024)        | -0.0007***<br>(0.0002)      | -0.0128***<br>(0.0020)        |
| Inflation, lagged                        | -0.0249***<br>(0.0034) | -0.0244***<br>(0.0031) | -0.0233***<br>(0.0021)      | -0.0256***<br>(0.0017)        | -0.0238***<br>(0.0022)      | -0.0252***<br>(0.0021)        |
| Terms of Trade (2000=1), lagged          | 0.0173*<br>(0.0076)    | 0.0188*<br>(0.0075)    | 0.0125<br>(0.0110)          | 0.0136<br>(0.0109)            | 0.0139<br>(0.0112)          | 0.0152<br>(0.0113)            |
| Oil exports (% of GDP), lagged           | -0.1097***<br>(0.0098) | -0.1400***<br>(0.0111) | -0.0851***<br>(0.0106)      | -0.1053***<br>(0.0131)        | -0.0924***<br>(0.0080)      | -0.1156***<br>(0.0080)        |
| Log (Agri, % of GDP), lagged             | -0.0111**<br>(0.0029)  | -0.0136***<br>(0.0018) | -0.0183***<br>(0.0037)      | -0.0208***<br>(0.0024)        | -0.0161***<br>(0.0043)      | -0.0187***<br>(0.0032)        |
| Control Corruption, lagged               | 0.0051*<br>(0.0019)    | 0.0065<br>(0.0039)     | 0.0041<br>(0.0026)          | 0.0065<br>(0.0056)            | 0.0044*<br>(0.0025)         | 0.0065<br>(0.0055)            |
| Observations                             | 472                    | 387                    | 472                         | 387                           | 472                         | 387                           |
| Number of countries                      | 109                    | 91                     | 109                         | 91                            | 109                         | 91                            |
| within R-squared                         | 0.213                  | 0.264                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3071.8                     | -2501.2                       | -3100.5                     | -2548.4                       |
| BIC                                      | —                      | —                      | -3055.2                     | -2485.4                       | -3083.9                     | -2532.6                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 33.126                      | 23.062                        | 42.166                      | 30.721                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 11.410                      | 16.873                        | 15.779                      | 36.272                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.7. Robustness: Dropping Bottom 10% OSI

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | -0.0014<br>(0.0034)    | 0.0029<br>(0.0046)     | 0.0830***<br>(0.0088)       | 0.1259***<br>(0.0104)         | 0.0704***<br>(0.0090)       | 0.1087***<br>(0.0107)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2310**<br>(0.0621)   | 0.2093**<br>(0.0557)   | 0.2745***<br>(0.0350)       | 0.2681***<br>(0.0233)         | 0.2680***<br>(0.0404)       | 0.2598***<br>(0.0252)         |
| #Tax Staff/LaborForce                    | 0.4353***<br>(0.0443)  | 0.5016***<br>(0.0357)  | 0.5057***<br>(0.0336)       | 0.5885***<br>(0.0409)         | 0.4952***<br>(0.0326)       | 0.5763***<br>(0.0372)         |
| Sq(#Tax Staff/Labor Force)               | -1.8789***<br>(0.1453) | -2.2625***<br>(0.1252) | -2.0621***<br>(0.1348)      | -2.4480***<br>(0.0949)        | -2.0347***<br>(0.1346)      | -2.4220***<br>(0.0874)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0001)    | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0005***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0216<br>(0.0117)     | 0.0218<br>(0.0090)     | 0.0246<br>(0.0155)          | 0.0345***<br>(0.0106)         | 0.0241<br>(0.0153)          | 0.0327***<br>(0.0105)         |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0018*<br>(0.0008)   | -0.0020**<br>(0.0006)  | -0.0020*<br>(0.0010)        | -0.0029***<br>(0.0008)        | -0.0019*<br>(0.0010)        | -0.0028**<br>(0.0008)         |
| Trade openness (% of GDP), lagged        | 0.0112***<br>(0.0010)  | 0.0140***<br>(0.0012)  | 0.0107***<br>(0.0006)       | 0.0135***<br>(0.0012)         | 0.0108***<br>(0.0006)       | 0.0135***<br>(0.0012)         |
| External debt (% of GDP), lagged         | 0.0004<br>(0.0004)     | -0.0144***<br>(0.0022) | -0.0003<br>(0.0006)         | -0.0130***<br>(0.0041)        | -0.0002<br>(0.0006)         | -0.0132***<br>(0.0039)        |
| Inflation, lagged                        | -0.0085**<br>(0.0028)  | -0.0152**<br>(0.0038)  | -0.0081***<br>(0.0029)      | -0.0172***<br>(0.0054)        | -0.0082***<br>(0.0027)      | -0.0169***<br>(0.0052)        |
| Terms of Trade (2000=1), lagged          | 0.0268**<br>(0.0058)   | 0.0273***<br>(0.0054)  | 0.0242***<br>(0.0076)       | 0.0253***<br>(0.0070)         | 0.0246***<br>(0.0075)       | 0.0255***<br>(0.0070)         |
| Oil exports (% of GDP), lagged           | -0.1261***<br>(0.0061) | -0.1606***<br>(0.0090) | -0.1174***<br>(0.0068)      | -0.1501***<br>(0.0116)        | -0.1187***<br>(0.0068)      | -0.1516***<br>(0.0108)        |
| Log (Agri, % of GDP), lagged             | 0.0008<br>(0.0071)     | -0.0024<br>(0.0080)    | -0.0053<br>(0.0069)         | -0.0106<br>(0.0091)           | -0.0044<br>(0.0067)         | -0.0094<br>(0.0091)           |
| Control Corruption, lagged               | 0.0013<br>(0.0014)     | 0.0019<br>(0.0044)     | 0.0001<br>(0.0015)          | 0.0015<br>(0.0048)            | 0.0002<br>(0.0015)          | 0.0015<br>(0.0047)            |
| Observations                             | 473                    | 368                    | 473                         | 368                           | 473                         | 368                           |
| Number of countries                      | 107                    | 85                     | 107                         | 85                            | 107                         | 85                            |
| within R-squared                         | 0.238                  | 0.306                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3170.9                     | -2467.2                       | -3182.4                     | -2486.9                       |
| BIC                                      | —                      | —                      | -3154.3                     | -2451.5                       | -3165.8                     | -2471.3                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 38.611                      | 29.697                        | 46.131                      | 34.852                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 10.675                      | 15.803                        | 14.205                      | 22.283                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.



Appendix Table AIII.8. Robustness: Dropping Top 10% Tax-to-GDP Ratio

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0035<br>(0.0021)     | 0.0106<br>(0.0051)     | 0.1078***<br>(0.0128)       | 0.1475***<br>(0.0082)         | 0.0804***<br>(0.0218)       | 0.1206***<br>(0.0168)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2752***<br>(0.0458)  | 0.2970***<br>(0.0411)  | 0.3049***<br>(0.0119)       | 0.3309***<br>(0.0213)         | 0.2971***<br>(0.0190)       | 0.3242***<br>(0.0129)         |
| #Tax Staff/LaborForce                    | 0.5482***<br>(0.1143)  | 0.5060**<br>(0.1274)   | 0.6581***<br>(0.1007)       | 0.6019***<br>(0.0967)         | 0.6292***<br>(0.1094)       | 0.5831***<br>(0.1054)         |
| Sq(#Tax Staff/Labor Force)               | -2.5669***<br>(0.3901) | -2.4480***<br>(0.4916) | -2.8733***<br>(0.3963)      | -2.6239***<br>(0.4519)        | -2.7926***<br>(0.4223)      | -2.5895***<br>(0.4742)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0001)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0001)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0007***<br>(0.0001)  | 0.0007***<br>(0.0001)  | 0.0007***<br>(0.0001)       | 0.0008***<br>(0.0001)         | 0.0007***<br>(0.0001)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0168<br>(0.0119)     | 0.0233<br>(0.0122)     | 0.0184<br>(0.0139)          | 0.0305**<br>(0.0131)          | 0.0180<br>(0.0140)          | 0.0291**<br>(0.0135)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0018*<br>(0.0008)   | -0.0024**<br>(0.0008)  | -0.0019**<br>(0.0009)       | -0.0030***<br>(0.0009)        | -0.0019**<br>(0.0009)       | -0.0028***<br>(0.0009)        |
| Trade openness (% of GDP), lagged        | 0.0187***<br>(0.0061)  | 0.0226***<br>(0.0048)  | 0.0163**<br>(0.0065)        | 0.0181***<br>(0.0058)         | 0.0169***<br>(0.0064)       | 0.0190***<br>(0.0055)         |
| External debt (% of GDP), lagged         | -0.0018<br>(0.0010)    | -0.0168***<br>(0.0023) | -0.0025***<br>(0.0009)      | -0.0157***<br>(0.0018)        | -0.0023**<br>(0.0009)       | -0.0159***<br>(0.0017)        |
| Inflation, lagged                        | -0.0305***<br>(0.0034) | -0.0318***<br>(0.0034) | -0.0344***<br>(0.0021)      | -0.0408***<br>(0.0029)        | -0.0334***<br>(0.0020)      | -0.0391***<br>(0.0036)        |
| Terms of Trade (2000=1), lagged          | 0.0205*<br>(0.0075)    | 0.0199**<br>(0.0070)   | 0.0162<br>(0.0101)          | 0.0155*<br>(0.0092)           | 0.0173*<br>(0.0103)         | 0.0164*<br>(0.0095)           |
| Oil exports (% of GDP), lagged           | -0.1388***<br>(0.0175) | -0.1424***<br>(0.0158) | -0.1190***<br>(0.0217)      | -0.1166***<br>(0.0228)        | -0.1242***<br>(0.0187)      | -0.1216***<br>(0.0194)        |
| Log (Agri, % of GDP), lagged             | -0.0087*<br>(0.0038)   | -0.0110**<br>(0.0039)  | -0.0143***<br>(0.0055)      | -0.0175***<br>(0.0048)        | -0.0129**<br>(0.0058)       | -0.0162***<br>(0.0052)        |
| Control Corruption, lagged               | 0.0041<br>(0.0029)     | 0.0037<br>(0.0038)     | 0.0024<br>(0.0034)          | 0.0021<br>(0.0043)            | 0.0028<br>(0.0033)          | 0.0024<br>(0.0043)            |
| Observations                             | 479                    | 422                    | 479                         | 422                           | 479                         | 422                           |
| Number of countries                      | 110                    | 98                     | 110                         | 98                            | 110                         | 98                            |
| within R-squared                         | 0.279                  | 0.277                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3183.3                     | -2755.3                       | -3210.6                     | -2784.9                       |
| BIC                                      | —                      | —                      | -3166.6                     | -2739.1                       | -3193.9                     | -2768.7                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 26.478                      | 23.856                        | 32.568                      | 28.773                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 8.6843                      | 11.494                        | 11.756                      | 14.338                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.9. Robustness: Dropping Bottom 10% Tax-to-GDP Ratio

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0056<br>(0.0068)     | 0.0095**<br>(0.0021)   | 0.1368***<br>(0.0106)       | 0.2364***<br>(0.0232)         | 0.1152***<br>(0.0106)       | 0.1965***<br>(0.0264)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3161***<br>(0.0395)  | 0.2853***<br>(0.0404)  | 0.3478***<br>(0.0171)       | 0.3023***<br>(0.0543)         | 0.3426***<br>(0.0124)       | 0.2993***<br>(0.0369)         |
| #Tax Staff/LaborForce                    | 0.4862**<br>(0.1057)   | 0.5658***<br>(0.1213)  | 0.6332***<br>(0.0936)       | 0.8048***<br>(0.0968)         | 0.6090***<br>(0.0872)       | 0.7628***<br>(0.1031)         |
| Sq(#Tax Staff/Labor Force)               | -2.0846***<br>(0.4011) | -2.5145***<br>(0.4623) | -2.4240***<br>(0.3837)      | -2.9563***<br>(0.4398)        | -2.3681***<br>(0.3700)      | -2.8787***<br>(0.4528)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0001)  | 0.0008***<br>(0.0001)  | 0.0007***<br>(0.0001)       | 0.0010***<br>(0.0001)         | 0.0006***<br>(0.0001)       | 0.0010***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0105<br>(0.0162)     | 0.0171<br>(0.0151)     | 0.0103<br>(0.0206)          | 0.0268<br>(0.0196)            | 0.0103<br>(0.0205)          | 0.0251<br>(0.0192)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0012<br>(0.0011)    | -0.0018<br>(0.0011)    | -0.0012<br>(0.0014)         | -0.0026<br>(0.0014)           | -0.0012<br>(0.0014)         | -0.0025<br>(0.0014)           |
| Trade openness (% of GDP), lagged        | 0.0199***<br>(0.0036)  | 0.0243***<br>(0.0050)  | 0.0156***<br>(0.0035)       | 0.0151***<br>(0.0055)         | 0.0163***<br>(0.0037)       | 0.0167***<br>(0.0054)         |
| External debt (% of GDP), lagged         | 0.0003<br>(0.0005)     | -0.0171***<br>(0.0019) | -0.0006<br>(0.0008)         | -0.0135***<br>(0.0017)        | -0.0005<br>(0.0007)         | -0.0142***<br>(0.0016)        |
| Inflation, lagged                        | -0.0226***<br>(0.0040) | -0.0215***<br>(0.0057) | -0.0239***<br>(0.0025)      | -0.0323***<br>(0.0093)        | -0.0237***<br>(0.0026)      | -0.0304***<br>(0.0093)        |
| Terms of Trade (2000=1), lagged          | 0.0142<br>(0.0075)     | 0.0158*<br>(0.0072)    | 0.0062<br>(0.0099)          | 0.0045<br>(0.0075)            | 0.0075<br>(0.0097)          | 0.0065<br>(0.0082)            |
| Oil exports (% of GDP), lagged           | -0.1157***<br>(0.0169) | -0.1525***<br>(0.0205) | -0.0977***<br>(0.0225)      | -0.1210***<br>(0.0302)        | -0.1006***<br>(0.0219)      | -0.1265***<br>(0.0277)        |
| Log (Agri, % of GDP), lagged             | -0.0072<br>(0.0049)    | -0.0103*<br>(0.0041)   | -0.0146***<br>(0.0055)      | -0.0204***<br>(0.0046)        | -0.0133**<br>(0.0052)       | -0.0186***<br>(0.0048)        |
| Control Corruption, lagged               | -0.0010<br>(0.0010)    | -0.0021<br>(0.0032)    | -0.0033***<br>(0.0006)      | -0.0046<br>(0.0034)           | -0.0029***<br>(0.0007)      | -0.0042<br>(0.0035)           |
| Observations                             | 473                    | 368                    | 473                         | 368                           | 473                         | 368                           |
| Number of countries                      | 108                    | 86                     | 108                         | 86                            | 108                         | 86                            |
| within R-squared                         | 0.2060                 | 0.2768                 | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3059.8                     | -2304.3                       | -3080.3                     | -2349.7                       |
| BIC                                      | —                      | —                      | -3043.2                     | -2288.7                       | -3063.7                     | -2334.1                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 19.327                      | 8.8448                        | 22.180                      | 10.371                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 22.806                      | 14.594                        | 24.364                      | 15.411                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.10. Robustness: Dropping Fragile States and Conflict-affected States (FCS)

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0151**<br>(0.0042)   | 0.0251***<br>(0.0051)  | 0.1182***<br>(0.0156)       | 0.2041***<br>(0.0304)         | 0.0969***<br>(0.0131)       | 0.1648***<br>(0.0344)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3068***<br>(0.0213)  | 0.2864***<br>(0.0252)  | 0.3383***<br>(0.0261)       | 0.3280***<br>(0.0538)         | 0.3318***<br>(0.0168)       | 0.3189***<br>(0.0378)         |
| #Tax Staff/LaborForce                    | 0.5407***<br>(0.1010)  | 0.6393***<br>(0.1303)  | 0.6497***<br>(0.1027)       | 0.8072***<br>(0.1180)         | 0.6272***<br>(0.1010)       | 0.7704***<br>(0.1283)         |
| Sq(#Tax Staff/Labor Force)               | -2.2971***<br>(0.3967) | -2.8150***<br>(0.5182) | -2.5560***<br>(0.4074)      | -3.1268***<br>(0.4825)        | -2.5025***<br>(0.4081)      | -3.0583***<br>(0.5155)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0004***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0005***<br>(0.0000)       | 0.0010***<br>(0.0001)         | 0.0005***<br>(0.0000)       | 0.0009***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0092<br>(0.0147)     | 0.0151<br>(0.0116)     | 0.0108<br>(0.0179)          | 0.0277<br>(0.0159)            | 0.0105<br>(0.0178)          | 0.0249<br>(0.0156)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0012<br>(0.0010)    | -0.0019<br>(0.0008)    | -0.0014<br>(0.0012)         | -0.0029**<br>(0.0011)         | -0.0013<br>(0.0012)         | -0.0027**<br>(0.0011)         |
| Trade openness (% of GDP), lagged        | 0.0153**<br>(0.0035)   | 0.0178*<br>(0.0068)    | 0.0130***<br>(0.0031)       | 0.0134**<br>(0.0063)          | 0.0134***<br>(0.0032)       | 0.0143**<br>(0.0064)          |
| External debt (% of GDP), lagged         | 0.0002<br>(0.0005)     | -0.0177***<br>(0.0024) | -0.0006<br>(0.0006)         | -0.0179***<br>(0.0027)        | -0.0004<br>(0.0006)         | -0.0178***<br>(0.0023)        |
| Inflation, lagged                        | -0.0398***<br>(0.0043) | -0.0352***<br>(0.0040) | -0.0421***<br>(0.0029)      | -0.0462***<br>(0.0056)        | -0.0416***<br>(0.0030)      | -0.0438***<br>(0.0055)        |
| Terms of Trade (2000=1), lagged          | 0.0127<br>(0.0073)     | 0.0138<br>(0.0070)     | 0.0051<br>(0.0114)          | 0.0025<br>(0.0104)            | 0.0067<br>(0.0112)          | 0.0050<br>(0.0107)            |
| Oil exports (% of GDP), lagged           | -0.0895***<br>(0.0137) | -0.1240***<br>(0.0267) | -0.0763***<br>(0.0140)      | -0.1053***<br>(0.0332)        | -0.0791***<br>(0.0129)      | -0.1094***<br>(0.0305)        |
| Log (Agri, % of GDP), lagged             | -0.0013<br>(0.0041)    | -0.0046<br>(0.0038)    | -0.0089<br>(0.0056)         | -0.0166**<br>(0.0066)         | -0.0074<br>(0.0052)         | -0.0140**<br>(0.0065)         |
| Control Corruption, lagged               | -0.0004<br>(0.0009)    | 0.0002<br>(0.0034)     | -0.0019***<br>(0.0006)      | -0.0015<br>(0.0039)           | -0.0016***<br>(0.0006)      | -0.0011<br>(0.0038)           |
| Observations                             | 456                    | 351                    | 456                         | 351                           | 456                         | 351                           |
| Number of countries                      | 103                    | 81                     | 103                         | 81                            | 103                         | 81                            |
| within R-squared                         | 0.2013                 | 0.2613                 | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -2977.7                     | -2244.2                       | -2994.4                     | -2283.9                       |
| BIC                                      | —                      | —                      | -2961.2                     | -2228.8                       | -2977.9                     | -2268.5                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 28.209                      | 15.935                        | 34.581                      | 20.140                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 15.207                      | 14.704                        | 17.020                      | 16.881                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.11. Robustness: Dropping Small Islands

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0064<br>(0.0037)     | 0.0094<br>(0.0065)     | 0.1136***<br>(0.0048)       | 0.1445***<br>(0.0090)         | 0.0950***<br>(0.0043)       | 0.1219***<br>(0.0116)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.1615***<br>(0.0262)  | 0.2054***<br>(0.0402)  | 0.2751***<br>(0.0458)       | 0.3381***<br>(0.0542)         | 0.2555***<br>(0.0322)       | 0.3159***<br>(0.0432)         |
| #Tax Staff/LaborForce                    | 0.3417***<br>(0.0631)  | 0.3786***<br>(0.0796)  | 0.4491***<br>(0.0492)       | 0.4692***<br>(0.0687)         | 0.4305***<br>(0.0475)       | 0.4541***<br>(0.0668)         |
| Sq(#Tax Staff/Labor Force)               | -1.6554***<br>(0.1537) | -1.9885***<br>(0.2425) | -1.9210***<br>(0.1324)      | -2.0946***<br>(0.2185)        | -1.8750***<br>(0.1256)      | -2.0769***<br>(0.2154)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0001)    | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0001)  | 0.0006***<br>(0.0001)  | 0.0006***<br>(0.0001)       | 0.0007***<br>(0.0001)         | 0.0006***<br>(0.0001)       | 0.0007***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0213<br>(0.0114)     | 0.0136<br>(0.0080)     | 0.0173<br>(0.0132)          | 0.0183***<br>(0.0067)         | 0.0180<br>(0.0134)          | 0.0175**<br>(0.0070)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017*<br>(0.0007)   | -0.0013<br>(0.0005)    | -0.0013<br>(0.0009)         | -0.0017***<br>(0.0005)        | -0.0014<br>(0.0009)         | -0.0016***<br>(0.0005)        |
| Trade openness (% of GDP), lagged        | 0.0171***<br>(0.0019)  | 0.0232***<br>(0.0029)  | 0.0158***<br>(0.0035)       | 0.0204***<br>(0.0053)         | 0.0160***<br>(0.0033)       | 0.0209***<br>(0.0050)         |
| External debt (% of GDP), lagged         | 0.0002<br>(0.0010)     | -0.0126***<br>(0.0018) | 0.0002<br>(0.0007)          | -0.0129***<br>(0.0036)        | 0.0002<br>(0.0007)          | -0.0129***<br>(0.0033)        |
| Inflation, lagged                        | -0.0011<br>(0.0016)    | -0.0083*<br>(0.0033)   | -0.0001<br>(0.0018)         | -0.0118**<br>(0.0055)         | -0.0003<br>(0.0016)         | -0.0112**<br>(0.0054)         |
| Terms of Trade (2000=1), lagged          | 0.0180**<br>(0.0046)   | 0.0198***<br>(0.0041)  | 0.0122*<br>(0.0065)         | 0.0150**<br>(0.0061)          | 0.0132**<br>(0.0062)        | 0.0158***<br>(0.0060)         |
| Oil exports (% of GDP), lagged           | -0.0296<br>(0.0219)    | -0.0722***<br>(0.0156) | 0.0082<br>(0.0209)          | -0.0340***<br>(0.0107)        | 0.0017<br>(0.0204)          | -0.0404***<br>(0.0107)        |
| Log (Agri, % of GDP), lagged             | -0.0081<br>(0.0075)    | -0.0121<br>(0.0074)    | -0.0135<br>(0.0087)         | -0.0184*<br>(0.0095)          | -0.0125<br>(0.0085)         | -0.0174*<br>(0.0094)          |
| Control Corruption, lagged               | 0.0071**<br>(0.0017)   | 0.0104**<br>(0.0035)   | 0.0050**<br>(0.0020)        | 0.0076**<br>(0.0038)          | 0.0054***<br>(0.0020)       | 0.0080**<br>(0.0038)          |
| Observations                             | 440                    | 349                    | 440                         | 349                           | 440                         | 349                           |
| Number of countries                      | 100                    | 81                     | 100                         | 81                            | 100                         | 81                            |
| within R-squared                         | 0.237                  | 0.290                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -2945.4                     | -2344.9                       | -2963.4                     | -2369.5                       |
| BIC                                      | —                      | —                      | -2929.1                     | -2329.5                       | -2947.1                     | -2354.1                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 33.057                      | 20.527                        | 39.671                      | 25.468                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 21.708                      | 19.136                        | 21.105                      | 20.964                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.12. Robustness: Dropping Rich-Resource Countries

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0092<br>(0.0043)     | 0.0144***<br>(0.0030)  | 0.1385***<br>(0.0136)       | 0.1754***<br>(0.0207)         | 0.1137***<br>(0.0135)       | 0.1429***<br>(0.0271)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2666**<br>(0.0696)   | 0.2641***<br>(0.0563)  | 0.3571***<br>(0.0130)       | 0.3754***<br>(0.0158)         | 0.3398***<br>(0.0225)       | 0.3529***<br>(0.0145)         |
| #Tax Staff/LaborForce                    | 0.1036<br>(0.0861)     | 0.3064**<br>(0.1104)   | 0.2560***<br>(0.0626)       | 0.4764***<br>(0.0727)         | 0.2268***<br>(0.0635)       | 0.4421***<br>(0.0794)         |
| Sq(#Tax Staff/Labor Force)               | -0.9661**<br>(0.2514)  | -1.8511***<br>(0.3814) | -1.3375***<br>(0.1898)      | -2.1828***<br>(0.3372)        | -1.2664***<br>(0.1867)      | -2.1159***<br>(0.3548)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0000)  | 0.0006***<br>(0.0000)  | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0000)         | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0000)         |
| Log (GDP per capita, USD), lagged        | 0.0083<br>(0.0137)     | 0.0251<br>(0.0143)     | 0.0058<br>(0.0124)          | 0.0283<br>(0.0137)            | 0.0063<br>(0.0127)          | 0.0277<br>(0.0139)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0010<br>(0.0009)    | -0.0023<br>(0.0010)    | -0.0008<br>(0.0008)         | -0.0027***<br>(0.0010)        | -0.0009<br>(0.0008)         | -0.0026***<br>(0.0010)        |
| Trade openness (% of GDP), lagged        | 0.0200***<br>(0.0039)  | 0.0225**<br>(0.0051)   | 0.0174***<br>(0.0047)       | 0.0183***<br>(0.0065)         | 0.0179***<br>(0.0047)       | 0.0192***<br>(0.0063)         |
| External debt (% of GDP), lagged         | 0.0009<br>(0.0007)     | -0.0143**<br>(0.0032)  | -0.0002<br>(0.0011)         | -0.0142***<br>(0.0031)        | 0.0000<br>(0.0010)          | -0.0142***<br>(0.0030)        |
| Inflation, lagged                        | -0.0173**<br>(0.0045)  | -0.0224***<br>(0.0036) | -0.0195***<br>(0.0039)      | -0.0310***<br>(0.0058)        | -0.0191***<br>(0.0039)      | -0.0292***<br>(0.0059)        |
| Terms of Trade (2000=1), lagged          | 0.0080<br>(0.0092)     | 0.0086<br>(0.0088)     | -0.0009<br>(0.0137)         | -0.0001<br>(0.0125)           | 0.0008<br>(0.0135)          | 0.0017<br>(0.0128)            |
| Oil exports (% of GDP), lagged           | -0.1755***<br>(0.0211) | -0.1721***<br>(0.0153) | -0.1540***<br>(0.0308)      | -0.1436***<br>(0.0210)        | -0.1581***<br>(0.0297)      | -0.1494***<br>(0.0188)        |
| Log (Agri, % of GDP), lagged             | -0.0098<br>(0.0042)    | -0.0115**<br>(0.0037)  | -0.0165***<br>(0.0064)      | -0.0181***<br>(0.0056)        | -0.0153**<br>(0.0063)       | -0.0168***<br>(0.0057)        |
| Control Corruption, lagged               | 0.0022<br>(0.0010)     | 0.0023<br>(0.0032)     | -0.0002<br>(0.0005)         | 0.0006<br>(0.0034)            | 0.0002<br>(0.0006)          | 0.0009<br>(0.0035)            |
| Observations                             | 488                    | 388                    | 488                         | 388                           | 488                         | 388                           |
| Number of countries                      | 111                    | 90                     | 111                         | 90                            | 111                         | 90                            |
| within R-squared                         | 0.257                  | 0.288                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3239.2                     | -2526.2                       | -3268.1                     | -2561.0                       |
| BIC                                      | —                      | —                      | -3222.4                     | -2510.4                       | -3251.3                     | -2545.1                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 29.529                      | 17.166                        | 36.359                      | 21.426                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 13.427                      | 11.760                        | 14.995                      | 13.043                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.13. Robustness: Dropping Top Reformers (Top 10% Change in OSI between 2017 and 2022)

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | -0.0072<br>(0.0117)    | -0.0041<br>(0.0033)    | 0.1109***<br>(0.0205)       | 0.2290***<br>(0.0597)         | 0.0989***<br>(0.0203)       | 0.1994***<br>(0.0552)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3224***<br>(0.0484)  | 0.3101***<br>(0.0534)  | 0.3134***<br>(0.0295)       | 0.2590***<br>(0.0316)         | 0.3143***<br>(0.0317)       | 0.2655***<br>(0.0280)         |
| #Tax Staff/LaborForce                    | 0.4755***<br>(0.1022)  | 0.5086***<br>(0.1211)  | 0.5234***<br>(0.0772)       | 0.6023***<br>(0.0916)         | 0.5185***<br>(0.0762)       | 0.5904***<br>(0.0948)         |
| Sq(#Tax Staff/Labor Force)               | -1.9441***<br>(0.3939) | -2.2510***<br>(0.4936) | -2.0950***<br>(0.3532)      | -2.5343***<br>(0.5091)        | -2.0796***<br>(0.3499)      | -2.4983***<br>(0.5135)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0001)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0008***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0009***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0134<br>(0.0159)     | 0.0203<br>(0.0138)     | 0.0103<br>(0.0170)          | 0.0199<br>(0.0106)            | 0.0106<br>(0.0174)          | 0.0199<br>(0.0110)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0014<br>(0.0011)    | -0.0020<br>(0.0010)    | -0.0012<br>(0.0012)         | -0.0022***<br>(0.0008)        | -0.0012<br>(0.0012)         | -0.0022***<br>(0.0008)        |
| Trade openness (% of GDP), lagged        | 0.0207***<br>(0.0040)  | 0.0281***<br>(0.0067)  | 0.0218***<br>(0.0047)       | 0.0294***<br>(0.0087)         | 0.0217***<br>(0.0047)       | 0.0293***<br>(0.0087)         |
| External debt (% of GDP), lagged         | -0.0001<br>(0.0005)    | -0.0206***<br>(0.0027) | -0.0009<br>(0.0007)         | -0.0204***<br>(0.0009)        | -0.0009<br>(0.0007)         | -0.0204***<br>(0.0011)        |
| Inflation, lagged                        | -0.0203***<br>(0.0045) | -0.0192***<br>(0.0065) | -0.0263***<br>(0.0035)      | -0.0371***<br>(0.0133)        | -0.0257***<br>(0.0034)      | -0.0349***<br>(0.0128)        |
| Terms of Trade (2000=1), lagged          | 0.0170<br>(0.0083)     | 0.0191***<br>(0.0075)  | 0.0154<br>(0.0094)          | 0.0181***<br>(0.0063)         | 0.0155<br>(0.0095)          | 0.0182***<br>(0.0067)         |
| Oil exports (% of GDP), lagged           | -0.1120***<br>(0.0113) | -0.1468***<br>(0.0164) | -0.1042***<br>(0.0170)      | -0.1360***<br>(0.0328)        | -0.1050***<br>(0.0165)      | -0.1374***<br>(0.0306)        |
| Log (Agri, % of GDP), lagged             | -0.0049<br>(0.0052)    | -0.0071<br>(0.0039)    | -0.0097***<br>(0.0043)      | -0.0139***<br>(0.0029)        | -0.0092***<br>(0.0042)      | -0.0130***<br>(0.0029)        |
| Control Corruption, lagged               | 0.0019<br>(0.0014)     | 0.0022<br>(0.0040)     | 0.0008<br>(0.0015)          | 0.0020<br>(0.0051)            | 0.0009<br>(0.0015)          | 0.0020<br>(0.0050)            |
| Observations                             | 481                    | 376                    | 481                         | 376                           | 481                         | 376                           |
| Number of countries                      | 110                    | 88                     | 110                         | 88                            | 110                         | 88                            |
| within R-squared                         | 0.196                  | 0.264                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3136.7                     | -2368.3                       | -3146.8                     | -2400.9                       |
| BIC                                      | —                      | —                      | -3120.0                     | -2352.6                       | -3130.1                     | -2385.2                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 14.265                      | 4.8360                        | 18.245                      | 6.9370                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 67.215                      | 22.486                        | 64.266                      | 25.824                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.14. Robustness: Dropping Least Reformers (Bottom 10% Change in OSI between 2017 and 2022)

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0178***<br>(0.0035)  | 0.0243**<br>(0.0069)   | 0.1111***<br>(0.0205)       | 0.1635***<br>(0.0201)         | 0.0911***<br>(0.0115)       | 0.1388***<br>(0.0054)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3232***<br>(0.0594)  | 0.3145***<br>(0.0507)  | 0.3839***<br>(0.0276)       | 0.4093***<br>(0.0136)         | 0.3709***<br>(0.0325)       | 0.3925***<br>(0.0145)         |
| #Tax Staff/LaborForce                    | 0.4738***<br>(0.1011)  | 0.5196***<br>(0.1232)  | 0.5702***<br>(0.0742)       | 0.6416***<br>(0.0944)         | 0.5496***<br>(0.0777)       | 0.6200***<br>(0.1044)         |
| Sq(#Tax Staff/Labor Force)               | -2.1394***<br>(0.3893) | -2.5181***<br>(0.4793) | -2.3988***<br>(0.3232)      | -2.7595***<br>(0.4490)        | -2.3433***<br>(0.3386)      | -2.7167***<br>(0.4777)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0187<br>(0.0155)     | 0.0269<br>(0.0142)     | 0.0166<br>(0.0171)          | 0.0313<br>(0.0119)            | 0.0171<br>(0.0173)          | 0.0305**<br>(0.0127)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0020<br>(0.0011)    | -0.0027**<br>(0.0010)  | -0.0018<br>(0.0011)         | -0.0030***<br>(0.0008)        | -0.0018<br>(0.0012)         | -0.0030***<br>(0.0009)        |
| Trade openness (% of GDP), lagged        | 0.0208***<br>(0.0034)  | 0.0255***<br>(0.0053)  | 0.0191***<br>(0.0047)       | 0.0222***<br>(0.0079)         | 0.0194***<br>(0.0045)       | 0.0228***<br>(0.0074)         |
| External debt (% of GDP), lagged         | -0.0002<br>(0.0004)    | -0.0166***<br>(0.0018) | -0.0011<br>(0.0008)         | -0.0175***<br>(0.0033)        | -0.0009<br>(0.0006)         | -0.0174***<br>(0.0032)        |
| Inflation, lagged                        | -0.0337***<br>(0.0028) | -0.0356***<br>(0.0031) | -0.0339***<br>(0.0021)      | -0.0397***<br>(0.0015)        | -0.0339***<br>(0.0021)      | -0.0390***<br>(0.0020)        |
| Terms of Trade (2000=1), lagged          | 0.0163*<br>(0.0072)    | 0.0180*<br>(0.0071)    | 0.0133<br>(0.0090)          | 0.0147*<br>(0.0087)           | 0.0139<br>(0.0092)          | 0.0153<br>(0.0091)            |
| Oil exports (% of GDP), lagged           | -0.1109***<br>(0.0143) | -0.1403***<br>(0.0195) | -0.0908***<br>(0.0228)      | -0.1100***<br>(0.0337)        | -0.0951***<br>(0.0199)      | -0.1154***<br>(0.0282)        |
| Log (Agri, % of GDP), lagged             | -0.0115**<br>(0.0039)  | -0.0141**<br>(0.0031)  | -0.0140***<br>(0.0033)      | -0.0161***<br>(0.0030)        | -0.0135***<br>(0.0036)      | -0.0157***<br>(0.0032)        |
| Control Corruption, lagged               | 0.0009<br>(0.0010)     | 0.0021<br>(0.0032)     | -0.0017<br>(0.0012)         | -0.0011<br>(0.0035)           | -0.0011<br>(0.0010)         | -0.0005<br>(0.0032)           |
| Observations                             | 476                    | 386                    | 476                         | 386                           | 476                         | 386                           |
| Number of countries                      | 109                    | 90                     | 109                         | 90                            | 109                         | 90                            |
| within R-squared                         | 0.219                  | 0.286                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3112.1                     | -2521.6                       | -3126.4                     | -2544.9                       |
| BIC                                      | —                      | —                      | -3095.5                     | -2505.8                       | -3109.7                     | -2529.0                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 38.669                      | 25.666                        | 43.849                      | 28.495                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 9.2702                      | 10.062                        | 11.439                      | 12.160                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.15. Robustness: Dropping Strongly Correlated Variables: Trade Openness, Agriculture, and Corruption

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0045<br>(0.0038)     | 0.0095<br>(0.0050)     | 0.0884***<br>(0.0139)       | 0.1340***<br>(0.0127)         | 0.0722***<br>(0.0081)       | 0.1078***<br>(0.0159)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2629***<br>(0.0533)  | 0.2579***<br>(0.0521)  | 0.2846***<br>(0.0288)       | 0.2847***<br>(0.0212)         | 0.2804***<br>(0.0341)       | 0.2791***<br>(0.0234)         |
| #Tax Staff/LaborForce                    | 0.4870**<br>(0.1147)   | 0.5367**<br>(0.1413)   | 0.5737***<br>(0.0945)       | 0.6537***<br>(0.1292)         | 0.5570***<br>(0.1016)       | 0.6291***<br>(0.1411)         |
| Sq(#Tax Staff/Labor Force)               | -2.2317***<br>(0.4405) | -2.6038***<br>(0.5114) | -2.4921***<br>(0.4061)      | -2.8988***<br>(0.5562)        | -2.4419***<br>(0.4321)      | -2.8367***<br>(0.5870)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0007***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0007***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0176<br>(0.0129)     | 0.0215<br>(0.0103)     | 0.0171<br>(0.0157)          | 0.0257**<br>(0.0104)          | 0.0172<br>(0.0158)          | 0.0248**<br>(0.0108)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017<br>(0.0008)    | -0.0021**<br>(0.0007)  | -0.0016<br>(0.0010)         | -0.0024***<br>(0.0007)        | -0.0016<br>(0.0010)         | -0.0024***<br>(0.0007)        |
| External debt (% of GDP), lagged         | 0.0005<br>(0.0006)     | -0.0150**<br>(0.0029)  | -0.0004<br>(0.0009)         | -0.0139**<br>(0.0020)         | -0.0002<br>(0.0008)         | -0.0141***<br>(0.0020)        |
| Inflation, lagged                        | -0.0206**<br>(0.0051)  | -0.0212**<br>(0.0037)  | -0.0212**<br>(0.0060)       | -0.0270**<br>(0.0028)         | -0.0211***<br>(0.0059)      | -0.0258**<br>(0.0025)         |
| Terms of Trade (2000=1), lagged          | 0.0179*<br>(0.0066)    | 0.0203**<br>(0.0066)   | 0.0153*<br>(0.0091)         | 0.0172**<br>(0.0087)          | 0.0158*<br>(0.0093)         | 0.0179*<br>(0.0089)           |
| Oil exports (% of GDP), lagged           | -0.0847***<br>(0.0077) | -0.1080***<br>(0.0102) | -0.0675***<br>(0.0104)      | -0.0844***<br>(0.0168)        | -0.0708***<br>(0.0084)      | -0.0893***<br>(0.0130)        |
| Observations                             | 535                    | 430                    | 535                         | 430                           | 535                         | 430                           |
| Number of countries                      | 122                    | 100                    | 122                         | 100                           | 122                         | 100                           |
| within R-squared                         | 0.188                  | 0.232                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3509.1                     | -2804.8                       | -3522.6                     | -2831.3                       |
| BIC                                      | —                      | —                      | -3492.0                     | -2788.5                       | -3505.5                     | -2815.1                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 35.933                      | 21.626                        | 42.384                      | 26.136                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 12.072                      | 10.255                        | 14.132                      | 13.422                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.



Appendix Table AIII.16. Robustness: Dropping Strongly Correlated Variables: GDP per Capita and its Square Term, Agriculture, and Corruption

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0045<br>(0.0037)     | 0.0044<br>(0.0032)     | 0.1103***<br>(0.0057)       | 0.1577***<br>(0.0068)         | 0.0878***<br>(0.0041)       | 0.1210***<br>(0.0165)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3081***<br>(0.0416)  | 0.2797***<br>(0.0426)  | 0.3311***<br>(0.0126)       | 0.3076***<br>(0.0275)         | 0.3262***<br>(0.0140)       | 0.3009***<br>(0.0165)         |
| #Tax Staff/LaborForce                    | 0.4540**<br>(0.1121)   | 0.5618**<br>(0.1673)   | 0.5667***<br>(0.0949)       | 0.7021***<br>(0.1536)         | 0.5427***<br>(0.1003)       | 0.6685***<br>(0.1650)         |
| Sq(#Tax Staff/Labor Force)               | -1.9534***<br>(0.4054) | -2.5596**<br>(0.6021)  | -2.3042***<br>(0.3683)      | -2.9116***<br>(0.6113)        | -2.2295***<br>(0.3887)      | -2.8273***<br>(0.6400)        |
| Active Taxpayer/Labor Force              | 0.0000*<br>(0.0000)    | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | 0.0000<br>(0.0001)            |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Trade openness (% of GDP), lagged        | 0.0190***<br>(0.0027)  | 0.0227***<br>(0.0039)  | 0.0171***<br>(0.0028)       | 0.0184***<br>(0.0043)         | 0.0175***<br>(0.0027)       | 0.0194***<br>(0.0041)         |
| External debt (% of GDP), lagged         | 0.0011<br>(0.0008)     | -0.0112*<br>(0.0042)   | 0.0000<br>(0.0012)          | -0.0090**<br>(0.0034)         | 0.0003<br>(0.0011)          | -0.0095***<br>(0.0037)        |
| Inflation, lagged                        | 0.0030<br>(0.0038)     | 0.0087*<br>(0.0024)    | 0.0006<br>(0.0045)          | 0.0044<br>(0.0028)            | 0.0011<br>(0.0045)          | 0.0054**<br>(0.0025)          |
| Terms of Trade (2000=1), lagged          | 0.0195**<br>(0.0062)   | 0.0205**<br>(0.0066)   | 0.0161*<br>(0.0087)         | 0.0168*<br>(0.0087)           | 0.0169*<br>(0.0088)         | 0.0177*<br>(0.0089)           |
| Oil exports (% of GDP), lagged           | -0.1114***<br>(0.0122) | -0.1381***<br>(0.0169) | -0.0875***<br>(0.0173)      | -0.1068***<br>(0.0263)        | -0.0926***<br>(0.0146)      | -0.1143***<br>(0.0214)        |
| Observations                             | 533                    | 428                    | 533                         | 428                           | 533                         | 428                           |
| Number of countries                      | 122                    | 100                    | 122                         | 100                           | 122                         | 100                           |
| within R-squared                         | 0.192                  | 0.231                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3475.7                     | -2757.1                       | -3498.4                     | -2799.3                       |
| BIC                                      | —                      | —                      | -3458.6                     | -2740.9                       | -3481.3                     | -2783.0                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 38.163                      | 23.859                        | 44.487                      | 28.970                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 10.099                      | 9.9383                        | 12.303                      | 12.796                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.17. Robustness: Dropping Strongly Correlated Variables: GDP per Capita and its Square Term, Trade Openness, and Corruption

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0082***<br>(0.0017)  | 0.0094<br>(0.0052)     | 0.1028***<br>(0.0118)       | 0.1365***<br>(0.0069)         | 0.0812***<br>(0.0055)       | 0.1006***<br>(0.0157)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2852***<br>(0.0412)  | 0.2682***<br>(0.0415)  | 0.3164***<br>(0.0134)       | 0.3031***<br>(0.0252)         | 0.3093***<br>(0.0159)       | 0.2932***<br>(0.0165)         |
| #Tax Staff/LaborForce                    | 0.4471***<br>(0.1057)  | 0.5134**<br>(0.1552)   | 0.5265***<br>(0.0854)       | 0.6103***<br>(0.1437)         | 0.5083***<br>(0.0910)       | 0.5829***<br>(0.1532)         |
| Sq(#Tax Staff/Labor Force)               | -1.9940***<br>(0.3775) | -2.4442**<br>(0.5456)  | -2.2146***<br>(0.3449)      | -2.6478***<br>(0.5819)        | -2.1642***<br>(0.3654)      | -2.5902***<br>(0.6055)        |
| Active Taxpayer/Labor Force              | 0.0000*<br>(0.0000)    | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0000)           | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0000)         | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0001)         |
| External debt (% of GDP), lagged         | 0.0016<br>(0.0008)     | -0.0100*<br>(0.0039)   | 0.0007<br>(0.0012)          | -0.0084***<br>(0.0031)        | 0.0009<br>(0.0012)          | -0.0088***<br>(0.0033)        |
| Inflation, lagged                        | 0.0054<br>(0.0039)     | 0.0116**<br>(0.0029)   | 0.0034<br>(0.0047)          | 0.0080**<br>(0.0032)          | 0.0039<br>(0.0046)          | 0.0090***<br>(0.0030)         |
| Terms of Trade (2000=1), lagged          | 0.0169<br>(0.0065)     | 0.0185**<br>(0.0064)   | 0.0131<br>(0.0091)          | 0.0145<br>(0.0089)            | 0.0140<br>(0.0093)          | 0.0157<br>(0.0091)            |
| Oil exports (% of GDP), lagged           | -0.0945***<br>(0.0103) | -0.1200***<br>(0.0120) | -0.0797***<br>(0.0124)      | -0.1014***<br>(0.0155)        | -0.0831***<br>(0.0105)      | -0.1067***<br>(0.0123)        |
| Log (Agri, % of GDP), lagged             | -0.0046<br>(0.0034)    | -0.0064*<br>(0.0025)   | -0.0098***<br>(0.0026)      | -0.0115***<br>(0.0016)        | -0.0086***<br>(0.0028)      | -0.0101***<br>(0.0019)        |
| Observations                             | 531                    | 426                    | 531                         | 426                           | 531                         | 426                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.168                  | 0.200                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3458.7                     | -2758.2                       | -3477.3                     | -2792.2                       |
| BIC                                      | —                      | —                      | -3441.6                     | -2742.0                       | -3460.2                     | -2776.0                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 35.792                      | 22.313                        | 42.618                      | 27.373                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 12.487                      | 12.946                        | 14.270                      | 16.530                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.18. Robustness: Dropping Strongly Correlated Variables: GDP per Capita and its Square Term, Trade Openness, and Agriculture

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs      | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|-----------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0056<br>(0.0033)     | 0.0067<br>(0.0040)    | 0.0994***<br>(0.0154)       | 0.1373***<br>(0.0164)         | 0.0789***<br>(0.0074)       | 0.1014***<br>(0.0103)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2745***<br>(0.0500)  | 0.2573***<br>(0.0487) | 0.3005***<br>(0.0211)       | 0.2862***<br>(0.0239)         | 0.2948***<br>(0.0261)       | 0.2782***<br>(0.0223)         |
| #Tax Staff/LaborForce                    | 0.4568**<br>(0.1086)   | 0.5358**<br>(0.1508)  | 0.5604***<br>(0.0860)       | 0.6631***<br>(0.1300)         | 0.5377***<br>(0.0946)       | 0.6281***<br>(0.1462)         |
| Sq(#Tax Staff/Labor Force)               | -2.0569***<br>(0.4081) | -2.5916**<br>(0.6054) | -2.3625***<br>(0.3696)      | -2.8943***<br>(0.6333)        | -2.2957***<br>(0.3999)      | -2.8112***<br>(0.6750)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)    | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001) | 0.0007***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0007***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| External debt (% of GDP), lagged         | 0.0014<br>(0.0007)     | -0.0102<br>(0.0037)   | 0.0005<br>(0.0012)          | -0.0085***<br>(0.0026)        | 0.0007<br>(0.0011)          | -0.0089**<br>(0.0029)         |
| Inflation, lagged                        | 0.0054<br>(0.0041)     | 0.0115**<br>(0.0030)  | 0.0029<br>(0.0053)          | 0.0073<br>(0.0043)            | 0.0035<br>(0.0052)          | 0.0084**<br>(0.0039)          |
| Terms of Trade (2000=1), lagged          | 0.0179**<br>(0.0059)   | 0.0199**<br>(0.0055)  | 0.0148*<br>(0.0085)         | 0.0164*<br>(0.0075)           | 0.0155<br>(0.0086)          | 0.0174**<br>(0.0078)          |
| Oil exports (% of GDP), lagged           | -0.0915***<br>(0.0102) | -0.1169**<br>(0.0157) | -0.0711***<br>(0.0150)      | -0.0922***<br>(0.0252)        | -0.0756***<br>(0.0121)      | -0.0990**<br>(0.0198)         |
| Control Corruption, lagged               | 0.0016<br>(0.0014)     | 0.0030<br>(0.0040)    | 0.0001<br>(0.0014)          | 0.0017<br>(0.0045)            | 0.0004<br>(0.0013)          | 0.0020<br>(0.0044)            |
| Observations                             | 535                    | 430                   | 535                         | 430                           | 535                         | 430                           |
| Number of countries                      | 122                    | 100                   | 122                         | 100                           | 122                         | 100                           |
| within R-squared                         | 0.168                  | 0.198                 | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                   | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                   | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                     | -3487.8                     | -2782.7                       | -3505.9                     | -2818.0                       |
| BIC                                      | —                      | —                     | -3470.6                     | -2766.4                       | -3488.7                     | -2801.7                       |
| Ho: OSI is exogenous                     | —                      | —                     | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                     | 35.372                      | 21.085                        | 41.987                      | 25.944                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                     | 11.971                      | 9.9659                        | 14.286                      | 13.366                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.19. Robustness: Dropping Strongly Correlated Variables: Terms of Trade

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0144**<br>(0.0051)   | 0.0174***<br>(0.0031)  | 0.1057***<br>(0.0058)       | 0.1431***<br>(0.0114)         | 0.0855***<br>(0.0060)       | 0.1170***<br>(0.0250)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2734***<br>(0.0319)  | 0.2539***<br>(0.0311)  | 0.3088***<br>(0.0146)       | 0.2927***<br>(0.0324)         | 0.3010***<br>(0.0069)       | 0.2846***<br>(0.0231)         |
| #Tax Staff/LaborForce                    | 0.4385**<br>(0.1018)   | 0.4934**<br>(0.1265)   | 0.5255***<br>(0.0800)       | 0.5835***<br>(0.1006)         | 0.5062***<br>(0.0836)       | 0.5648***<br>(0.1102)         |
| Sq(#Tax Staff/Labor Force)               | -1.9223***<br>(0.3779) | -2.2915***<br>(0.4776) | -2.1767***<br>(0.3472)      | -2.4797***<br>(0.4636)        | -2.1203***<br>(0.3600)      | -2.4405***<br>(0.4857)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0000)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0000)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0206<br>(0.0146)     | 0.0263<br>(0.0129)     | 0.0209<br>(0.0171)          | 0.0323*<br>(0.0146)           | 0.0209<br>(0.0173)          | 0.0310*<br>(0.0152)           |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0020<br>(0.0010)    | -0.0025*<br>(0.0009)   | -0.0020*<br>(0.0012)        | -0.0030***<br>(0.0011)        | -0.0020*<br>(0.0012)        | -0.0029***<br>(0.0011)        |
| Trade openness (% of GDP), lagged        | 0.0175**<br>(0.0045)   | 0.0219**<br>(0.0058)   | 0.0157***<br>(0.0051)       | 0.0178***<br>(0.0065)         | 0.0161***<br>(0.0050)       | 0.0187***<br>(0.0061)         |
| External debt (% of GDP), lagged         | 0.0002<br>(0.0004)     | -0.0160***<br>(0.0026) | -0.0006<br>(0.0006)         | -0.0151***<br>(0.0018)        | -0.0004<br>(0.0005)         | -0.0153***<br>(0.0018)        |
| Inflation, lagged                        | -0.0282***<br>(0.0033) | -0.0284***<br>(0.0040) | -0.0296***<br>(0.0023)      | -0.0348***<br>(0.0045)        | -0.0293***<br>(0.0023)      | -0.0335***<br>(0.0051)        |
| Oil exports (% of GDP), lagged           | -0.0791*<br>(0.0334)   | -0.1037*<br>(0.0401)   | -0.0685*<br>(0.0409)        | -0.0871*<br>(0.0484)          | -0.0709*<br>(0.0395)        | -0.0906**<br>(0.0458)         |
| Log (Agri, % of GDP), lagged             | -0.0120**<br>(0.0031)  | -0.0150***<br>(0.0024) | -0.0163***<br>(0.0031)      | -0.0201***<br>(0.0031)        | -0.0153***<br>(0.0033)      | -0.0190***<br>(0.0035)        |
| Control Corruption, lagged               | 0.0009<br>(0.0016)     | 0.0011<br>(0.0041)     | -0.0004<br>(0.0019)         | 0.0001<br>(0.0049)            | -0.0001<br>(0.0018)         | 0.0003<br>(0.0048)            |
| Observations                             | 530                    | 425                    | 530                         | 425                           | 530                         | 425                           |
| Number of countries                      | 122                    | 100                    | 122                         | 100                           | 122                         | 100                           |
| within R-squared                         | 0.185                  | 0.230                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3464.8                     | -2767.3                       | -3482.3                     | -2793.5                       |
| BIC                                      | —                      | —                      | -3447.8                     | -2751.1                       | -3465.2                     | -2777.2                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 36.519                      | 23.973                        | 43.300                      | 28.679                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 10.036                      | 10.934                        | 11.587                      | 12.757                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.20. Robustness: Dropping Strongly Correlated Variables: Oil Exports

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0139***<br>(0.0030)  | 0.0203**<br>(0.0048)   | 0.0862***<br>(0.0074)       | 0.1199***<br>(0.0122)         | 0.0661***<br>(0.0076)       | 0.0913***<br>(0.0221)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2825***<br>(0.0465)  | 0.2664***<br>(0.0442)  | 0.3079***<br>(0.0201)       | 0.2945***<br>(0.0123)         | 0.3009***<br>(0.0283)       | 0.2864***<br>(0.0175)         |
| #Tax Staff/LaborForce                    | 0.4822**<br>(0.1054)   | 0.5350**<br>(0.1417)   | 0.5448***<br>(0.0856)       | 0.6007***<br>(0.1149)         | 0.5274***<br>(0.0887)       | 0.5818***<br>(0.1241)         |
| Sq(#Tax Staff/Labor Force)               | -2.2468***<br>(0.4145) | -2.5945***<br>(0.5730) | -2.4017***<br>(0.3779)      | -2.6990***<br>(0.5390)        | -2.3587***<br>(0.3882)      | -2.6690***<br>(0.5596)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0001)    | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0001)  | 0.0005***<br>(0.0000)  | 0.0005***<br>(0.0001)       | 0.0006***<br>(0.0000)         | 0.0005***<br>(0.0000)       | 0.0006***<br>(0.0000)         |
| Log (GDP per capita, USD), lagged        | 0.0247<br>(0.0172)     | 0.0361<br>(0.0180)     | 0.0246<br>(0.0197)          | 0.0396**<br>(0.0190)          | 0.0246<br>(0.0198)          | 0.0386**<br>(0.0193)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0022<br>(0.0012)    | -0.0032*<br>(0.0012)   | -0.0022*<br>(0.0013)        | -0.0035***<br>(0.0013)        | -0.0022<br>(0.0013)         | -0.0034**<br>(0.0013)         |
| Trade openness (% of GDP), lagged        | 0.0127***<br>(0.0018)  | 0.0139***<br>(0.0023)  | 0.0118***<br>(0.0020)       | 0.0118***<br>(0.0027)         | 0.0120***<br>(0.0020)       | 0.0124***<br>(0.0025)         |
| External debt (% of GDP), lagged         | 0.0002<br>(0.0004)     | -0.0143***<br>(0.0024) | -0.0004<br>(0.0006)         | -0.0137***<br>(0.0021)        | -0.0002<br>(0.0005)         | -0.0139***<br>(0.0020)        |
| Inflation, lagged                        | -0.0247***<br>(0.0027) | -0.0268***<br>(0.0028) | -0.0264***<br>(0.0018)      | -0.0322***<br>(0.0031)        | -0.0259***<br>(0.0019)      | -0.0306***<br>(0.0036)        |
| Terms of Trade (2000=1), lagged          | 0.0113<br>(0.0065)     | 0.0113<br>(0.0062)     | 0.0090<br>(0.0092)          | 0.0092<br>(0.0087)            | 0.0096<br>(0.0091)          | 0.0098<br>(0.0087)            |
| Log (Agri, % of GDP), lagged             | -0.0042<br>(0.0057)    | -0.0062<br>(0.0057)    | -0.0088<br>(0.0061)         | -0.0115*<br>(0.0065)          | -0.0075<br>(0.0064)         | -0.0100<br>(0.0071)           |
| Control Corruption, lagged               | 0.0001<br>(0.0012)     | -0.0004<br>(0.0027)    | -0.0009<br>(0.0008)         | -0.0011<br>(0.0030)           | -0.0006<br>(0.0008)         | -0.0009<br>(0.0030)           |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.176                  | 0.202                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3468.5                     | -2772.2                       | -3481.9                     | -2794.4                       |
| BIC                                      | —                      | —                      | -3451.4                     | -2756.0                       | -3464.8                     | -2778.2                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 33.263                      | 21.906                        | 39.586                      | 25.986                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 9.6723                      | 10.215                        | 11.336                      | 12.068                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.21. Robustness: Adding Informality

|                                          | (1)<br>OLS All        | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|-----------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0193***<br>(0.0030) | 0.0154***<br>(0.0008)  | 0.1362***<br>(0.0224)       | 0.1796***<br>(0.0259)         | 0.1225***<br>(0.0217)       | 0.1550***<br>(0.0286)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3263***<br>(0.0117) | 0.2915***<br>(0.0219)  | 0.3579***<br>(0.0485)       | 0.3196***<br>(0.0590)         | 0.3542***<br>(0.0421)       | 0.3154***<br>(0.0483)         |
| #Tax Staff/LaborForce                    | 0.4592***<br>(0.0906) | 0.4989**<br>(0.1290)   | 0.5711***<br>(0.1138)       | 0.6075***<br>(0.1328)         | 0.5579***<br>(0.1130)       | 0.5912***<br>(0.1363)         |
| Sq(#Tax Staff/Labor Force)               | -1.8295**<br>(0.4076) | -2.0650**<br>(0.5218)  | -2.1419***<br>(0.4730)      | -2.1838***<br>(0.4882)        | -2.1052***<br>(0.4735)      | -2.1660***<br>(0.4981)        |
| Active Taxpayer/Labor Force              | 0.0000**<br>(0.0000)  | 0.0001<br>(0.0000)     | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            | 0.0000<br>(0.0000)          | 0.0000<br>(0.0000)            |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0001) | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0001)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0001)       | 0.0008***<br>(0.0001)         |
| Trade openness (% of GDP), lagged        | 0.0180***<br>(0.0033) | 0.0231***<br>(0.0043)  | 0.0147***<br>(0.0016)       | 0.0170***<br>(0.0016)         | 0.0151***<br>(0.0016)       | 0.0180***<br>(0.0015)         |
| External debt (% of GDP), lagged         | 0.0014<br>(0.0009)    | -0.0133***<br>(0.0025) | 0.0003<br>(0.0011)          | -0.0112***<br>(0.0025)        | 0.0005<br>(0.0011)          | -0.0115***<br>(0.0026)        |
| Inflation, lagged                        | 0.0004<br>(0.0036)    | 0.0079**<br>(0.0020)   | -0.0023<br>(0.0036)         | 0.0037<br>(0.0024)            | -0.0020<br>(0.0036)         | 0.0044*<br>(0.0023)           |
| Terms of Trade (2000=1), lagged          | 0.0033<br>(0.0071)    | 0.0037<br>(0.0065)     | -0.0031<br>(0.0103)         | -0.0038<br>(0.0086)           | -0.0024<br>(0.0103)         | -0.0026<br>(0.0089)           |
| Oil exports (% of GDP), lagged           | 0.0713<br>(0.0798)    | 0.0436<br>(0.0632)     | 0.1238<br>(0.0915)          | 0.1064<br>(0.0717)            | 0.1176<br>(0.0917)          | 0.0969<br>(0.0737)            |
| Informality: Self-Employment, lagged     | 0.0000<br>(0.0002)    | 0.0001<br>(0.0002)     | -0.0001<br>(0.0003)         | -0.0001<br>(0.0003)           | -0.0001<br>(0.0003)         | -0.0001<br>(0.0003)           |
| Observations                             | 453                   | 348                    | 453                         | 348                           | 453                         | 348                           |
| Number of countries                      | 105                   | 83                     | 105                         | 83                            | 105                         | 83                            |
| within R-squared                         | 0.203                 | 0.230                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                   | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                   | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                     | —                      | -2979.9                     | -2252.9                       | -2995.0                     | -2281.7                       |
| BIC                                      | —                     | —                      | -2963.4                     | -2237.5                       | -2978.5                     | -2266.2                       |
| Ho: OSI is exogenous                     | —                     | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                     | —                      | 31.463                      | 17.690                        | 35.799                      | 21.299                        |
| Kleibergen-Paap rk Wald F statistic      | —                     | —                      | 12.297                      | 10.558                        | 13.366                      | 11.903                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.22. Robustness: Adding Urbanization and Age Dependency

|                                                      | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]                     | 0.0073**<br>(0.0020)   | 0.0046<br>(0.0053)     | 0.1271***<br>(0.0052)       | 0.1724***<br>(0.0076)         | 0.1013***<br>(0.0068)       | 0.1295***<br>(0.0156)         |
| Tax Policy Yield, exc. Trade Tax and SSC             | 0.3070***<br>(0.0410)  | 0.2701***<br>(0.0422)  | 0.3404***<br>(0.0158)       | 0.3008***<br>(0.0339)         | 0.3332***<br>(0.0115)       | 0.2929***<br>(0.0185)         |
| #Tax Staff/LaborForce                                | 0.4510**<br>(0.1014)   | 0.6082**<br>(0.1506)   | 0.5153***<br>(0.0767)       | 0.7123***<br>(0.1315)         | 0.5014***<br>(0.0818)       | 0.6857***<br>(0.1421)         |
| Sq(#Tax Staff/Labor Force)                           | -1.9157***<br>(0.3642) | -2.7183***<br>(0.5392) | -2.0592***<br>(0.2737)      | -2.9083***<br>(0.5126)        | -2.0282***<br>(0.2949)      | -2.8597***<br>(0.5381)        |
| Active Taxpayer/Labor Force                          | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | 0.0000<br>(0.0001)            |
| Real GDP growth, lagged                              | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Trade openness (% of GDP), lagged                    | 0.0187***<br>(0.0023)  | 0.0236***<br>(0.0031)  | 0.0147***<br>(0.0020)       | 0.0171***<br>(0.0035)         | 0.0156***<br>(0.0019)       | 0.0187***<br>(0.0031)         |
| External debt (% of GDP), lagged                     | 0.0013<br>(0.0008)     | -0.0155**<br>(0.0043)  | 0.0004<br>(0.0013)          | -0.0121***<br>(0.0026)        | 0.0006<br>(0.0012)          | -0.0129***<br>(0.0029)        |
| Inflation, lagged                                    | 0.0008<br>(0.0038)     | 0.0072**<br>(0.0025)   | -0.0029<br>(0.0036)         | 0.0010<br>(0.0026)            | -0.0021<br>(0.0037)         | 0.0026<br>(0.0023)            |
| Terms of Trade (2000=1), lagged                      | 0.0190**<br>(0.0063)   | 0.0200**<br>(0.0067)   | 0.0151<br>(0.0092)          | 0.0156*<br>(0.0090)           | 0.0159*<br>(0.0092)         | 0.0168*<br>(0.0092)           |
| Oil exports (% of GDP), lagged                       | -0.1131***<br>(0.0114) | -0.1471***<br>(0.0147) | -0.0853***<br>(0.0173)      | -0.1107***<br>(0.0276)        | -0.0913***<br>(0.0142)      | -0.1200***<br>(0.0213)        |
| Urban Population (% of Total), lagged                | -0.0010***<br>(0.0001) | -0.0016***<br>(0.0001) | -0.0019***<br>(0.0002)      | -0.0023***<br>(0.0004)        | -0.0017***<br>(0.0002)      | -0.0021***<br>(0.0004)        |
| Age dependency ratio (% of Working-Age Pop.), lagged | -0.0002<br>(0.0001)    | -0.0007***<br>(0.0001) | 0.0000<br>(0.0001)          | -0.0005***<br>(0.0001)        | -0.0000<br>(0.0001)         | -0.0005***<br>(0.0001)        |
| Observations                                         | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                                  | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                                     | 0.196                  | 0.250                  | —                           | —                             | —                           | —                             |
| Country FE                                           | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                              | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                                  | —                      | —                      | -3435.3                     | -2719.2                       | -3462.7                     | -2770.9                       |
| BIC                                                  | —                      | —                      | -3418.2                     | -2703.0                       | -3445.7                     | -2754.7                       |
| Ho: OSI is exogenous                                 | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic                        | —                      | —                      | 32.683                      | 21.513                        | 37.943                      | 26.116                        |
| Kleibergen-Paap rk Wald F statistic                  | —                      | —                      | 12.588                      | 10.753                        | 15.426                      | 13.564                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.23. Robustness: Adding Education and Health Spending

|                                            | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|--------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]           | 0.0118*<br>(0.0049)    | 0.0104**<br>(0.0027)   | 0.1493***<br>(0.0269)       | 0.2178***<br>(0.0333)         | 0.1186***<br>(0.0285)       | 0.1614***<br>(0.0428)         |
| Tax Policy Yield, exc. Trade Tax and SSC   | 0.3222***<br>(0.0682)  | 0.2724**<br>(0.0715)   | 0.3554***<br>(0.0313)       | 0.3150***<br>(0.0374)         | 0.3480***<br>(0.0368)       | 0.3034***<br>(0.0378)         |
| #Tax Staff/LaborForce                      | 0.4893***<br>(0.0743)  | 0.5923***<br>(0.1151)  | 0.6366***<br>(0.0967)       | 0.8299***<br>(0.1390)         | 0.6037***<br>(0.0979)       | 0.7653***<br>(0.1466)         |
| Sq(#Tax Staff/Labor Force)                 | -1.9179***<br>(0.2131) | -2.4300***<br>(0.3081) | -2.3786***<br>(0.2983)      | -3.1090***<br>(0.4277)        | -2.2757***<br>(0.3070)      | -2.9243***<br>(0.4455)        |
| Active Taxpayer/Labor Force                | 0.0000<br>(0.0000)     | -0.0000<br>(0.0001)    | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                    | 0.0004***<br>(0.0000)  | 0.0005***<br>(0.0001)  | 0.0005***<br>(0.0001)       | 0.0007***<br>(0.0001)         | 0.0005***<br>(0.0001)       | 0.0007***<br>(0.0001)         |
| Trade openness (% of GDP), lagged          | 0.0196**<br>(0.0029)   | 0.0251***<br>(0.0040)  | 0.0179**<br>(0.0023)        | 0.0203***<br>(0.0031)         | 0.0183**<br>(0.0022)        | 0.0216***<br>(0.0026)         |
| External debt (% of GDP), lagged           | 0.0018*<br>(0.0007)    | -0.0039<br>(0.0045)    | 0.0006<br>(0.0008)          | -0.0013<br>(0.0031)           | 0.0008<br>(0.0008)          | -0.0020<br>(0.0034)           |
| Inflation, lagged                          | 0.0133*<br>(0.0053)    | 0.0172*<br>(0.0080)    | 0.0110***<br>(0.0041)       | 0.0112*<br>(0.0063)           | 0.0115***<br>(0.0040)       | 0.0129**<br>(0.0062)          |
| Terms of Trade (2000=1), lagged            | 0.0220**<br>(0.0054)   | 0.0234**<br>(0.0053)   | 0.0142*<br>(0.0086)         | 0.0142**<br>(0.0067)          | 0.0160*<br>(0.0086)         | 0.0167**<br>(0.0075)          |
| Oil exports (% of GDP), lagged             | -0.0147<br>(0.0462)    | -0.0469<br>(0.0323)    | 0.0361<br>(0.0488)          | 0.0132<br>(0.0204)            | 0.0248<br>(0.0520)          | -0.0031<br>(0.0285)           |
| Education Spending (% of GDP), lagged      | -0.0015<br>(0.0008)    | -0.0007<br>(0.0006)    | -0.0019*<br>(0.0010)        | -0.0015<br>(0.0012)           | -0.0019*<br>(0.0010)        | -0.0013<br>(0.0011)           |
| Current Health Spending (% of GDP), lagged | 0.0002<br>(0.0003)     | 0.0001<br>(0.0003)     | -0.0001<br>(0.0003)         | -0.0006<br>(0.0005)           | -0.0000<br>(0.0003)         | -0.0004<br>(0.0005)           |
| Observations                               | 481                    | 376                    | 481                         | 376                           | 481                         | 376                           |
| Number of countries                        | 115                    | 93                     | 115                         | 93                            | 115                         | 93                            |
| within R-squared                           | 0.244                  | 0.266                  | —                           | —                             | —                           | —                             |
| Country FE                                 | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                    | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                        | —                      | —                      | -3165.1                     | -2397.6                       | -3203.4                     | -2472.5                       |
| BIC                                        | —                      | —                      | -3148.4                     | -2381.9                       | -3186.7                     | -2456.8                       |
| Ho: OSI is exogenous                       | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic              | —                      | —                      | 28.379                      | 16.689                        | 32.853                      | 20.084                        |
| Kleibergen-Paap rk Wald F statistic        | —                      | —                      | 11.780                      | 11.103                        | 13.937                      | 13.386                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.



Appendix Table AIII.24. Robustness: Adding Financial Development

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0025<br>(0.0041)     | 0.0032<br>(0.0029)     | 0.1023***<br>(0.0061)       | 0.1521***<br>(0.0107)         | 0.0824***<br>(0.0081)       | 0.1165***<br>(0.0202)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3369***<br>(0.0373)  | 0.2932***<br>(0.0374)  | 0.3527***<br>(0.0130)       | 0.3158***<br>(0.0275)         | 0.3496***<br>(0.0127)       | 0.3104***<br>(0.0157)         |
| #Tax Staff/LaborForce                    | 0.4618**<br>(0.1081)   | 0.5961**<br>(0.1731)   | 0.5718***<br>(0.0950)       | 0.7366***<br>(0.1583)         | 0.5499***<br>(0.1005)       | 0.7031***<br>(0.1696)         |
| Sq(#Tax Staff/Labor Force)               | -1.9575***<br>(0.3909) | -2.6749**<br>(0.6285)  | -2.3093***<br>(0.3695)      | -3.0525***<br>(0.6388)        | -2.2392***<br>(0.3908)      | -2.9623***<br>(0.6689)        |
| Active Taxpayer/Labor Force              | 0.0000*<br>(0.0000)    | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | 0.0000<br>(0.0001)            |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0000)  | 0.0006***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0007***<br>(0.0001)         |
| Trade openness (% of GDP), lagged        | 0.0209**<br>(0.0030)   | 0.0244***<br>(0.0044)  | 0.0190**<br>(0.0029)        | 0.0203**<br>(0.0046)          | 0.0194**<br>(0.0028)        | 0.0213***<br>(0.0044)         |
| External debt (% of GDP), lagged         | 0.0013<br>(0.0008)     | -0.0093<br>(0.0046)    | 0.0003<br>(0.0011)          | -0.0076*<br>(0.0034)          | 0.0005<br>(0.0010)          | -0.0080**<br>(0.0037)         |
| Inflation, lagged                        | -0.0100*<br>(0.0039)   | -0.0027<br>(0.0046)    | -0.0117**<br>(0.0045)       | -0.0066*<br>(0.0038)          | -0.0113*<br>(0.0045)        | -0.0057<br>(0.0036)           |
| Terms of Trade (2000=1), lagged          | 0.0199**<br>(0.0061)   | 0.0206**<br>(0.0066)   | 0.0167*<br>(0.0087)         | 0.0168*<br>(0.0088)           | 0.0173**<br>(0.0088)        | 0.0177*<br>(0.0091)           |
| Oil exports (% of GDP), lagged           | -0.1152***<br>(0.0126) | -0.1390***<br>(0.0168) | -0.0921***<br>(0.0163)      | -0.1075***<br>(0.0241)        | -0.0967***<br>(0.0138)      | -0.1150***<br>(0.0197)        |
| Financial Development Index, lagged      | -0.0342***<br>(0.0057) | -0.0148*<br>(0.0054)   | -0.0253***<br>(0.0039)      | 0.0094<br>(0.0160)            | -0.0270***<br>(0.0041)      | 0.0036<br>(0.0150)            |
| Observations                             | 527                    | 422                    | 527                         | 422                           | 527                         | 422                           |
| Number of countries                      | 120                    | 98                     | 120                         | 98                            | 120                         | 98                            |
| within R-squared                         | 0.197                  | 0.231                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3443.0                     | -2721.3                       | -3462.0                     | -2760.6                       |
| BIC                                      | —                      | —                      | -3425.9                     | -2705.1                       | -3444.9                     | -2744.4                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 37.281                      | 23.350                        | 43.561                      | 28.509                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 9.5356                      | 10.883                        | 11.549                      | 13.650                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.25. Sensitivity: By Level of Development

|                                          | (1)<br>OLS EMs         | (2)<br>OLS LICs        | (3)<br>IV EMs<br>[-4 to -2] | (4)<br>IV LICs<br>[-4 to -2] | (5)<br>IV EMs<br>[-5 to -2] | (6)<br>IV LICs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|
| Operational Strength Index [0,1]         | 0.0214**<br>(0.0054)   | 0.0026<br>(0.0165)     | 0.2361***<br>(0.0675)       | 0.1033**<br>(0.0521)         | 0.2125***<br>(0.0437)       | 0.0609<br>(0.0530)           |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3274***<br>(0.0656)  | -0.0056<br>(0.0898)    | 0.2573***<br>(0.0470)       | 0.0569<br>(0.0404)           | 0.2650***<br>(0.0414)       | 0.0306<br>(0.0505)           |
| #Tax Staff/LaborForce                    | 0.6182***<br>(0.1285)  | 0.5520***<br>(0.1061)  | 0.7990***<br>(0.1061)       | 0.6087***<br>(0.1347)        | 0.7791***<br>(0.1288)       | 0.5848***<br>(0.1124)        |
| Sq(#Tax Staff/Labor Force)               | -2.7166***<br>(0.5509) | -3.9958***<br>(0.5487) | -2.9552***<br>(0.5804)      | -5.1096***<br>(0.3268)       | -2.9289***<br>(0.6121)      | -4.6404***<br>(0.3590)       |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)          | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)          |
| Real GDP growth, lagged                  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0001)  | 0.0008***<br>(0.0000)       | 0.0007***<br>(0.0001)        | 0.0008***<br>(0.0001)       | 0.0006***<br>(0.0001)        |
| Log (GDP per capita, USD), lagged        | -0.0075<br>(0.0084)    | 0.0101<br>(0.0118)     | 0.0002<br>(0.0109)          | -0.0224<br>(0.0256)          | -0.0006<br>(0.0118)         | -0.0087<br>(0.0235)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0004<br>(0.0006)    | -0.0007<br>(0.0011)    | -0.0011<br>(0.0007)         | 0.0018<br>(0.0021)           | -0.0010<br>(0.0007)         | 0.0007<br>(0.0020)           |
| Trade openness (% of GDP), lagged        | 0.0348**<br>(0.0107)   | 0.0198***<br>(0.0035)  | 0.0295***<br>(0.0086)       | 0.0156***<br>(0.0019)        | 0.0301***<br>(0.0082)       | 0.0174***<br>(0.0021)        |
| External debt (% of GDP), lagged         | -0.0113**<br>(0.0025)  | -0.0179*<br>(0.0065)   | -0.0069***<br>(0.0016)      | -0.0168***<br>(0.0042)       | -0.0074***<br>(0.0018)      | -0.0173***<br>(0.0047)       |
| Inflation, lagged                        | -0.0383***<br>(0.0056) | 0.0157<br>(0.0182)     | -0.0550***<br>(0.0087)      | 0.0279<br>(0.0219)           | -0.0531***<br>(0.0096)      | 0.0228<br>(0.0211)           |
| Terms of Trade (2000=1), lagged          | 0.0238**<br>(0.0057)   | 0.0117<br>(0.0109)     | 0.0140***<br>(0.0053)       | 0.0096<br>(0.0153)           | 0.0150**<br>(0.0063)        | 0.0105<br>(0.0139)           |
| Oil exports (% of GDP), lagged           | -0.1662***<br>(0.0283) | -0.0720*<br>(0.0291)   | -0.1413***<br>(0.0375)      | -0.0239<br>(0.0520)          | -0.1440***<br>(0.0332)      | -0.0442<br>(0.0493)          |
| Log (Agri, % of GDP), lagged             | -0.0010<br>(0.0025)    | -0.0232*<br>(0.0090)   | -0.0074<br>(0.0057)         | -0.0303**<br>(0.0146)        | -0.0067<br>(0.0047)         | -0.0273**<br>(0.0136)        |
| Control Corruption, lagged               | -0.0062<br>(0.0052)    | 0.0181***<br>(0.0024)  | -0.0060<br>(0.0053)         | 0.0182***<br>(0.0031)        | -0.0060<br>(0.0054)         | 0.0182***<br>(0.0030)        |
| Observations                             | 239                    | 185                    | 239                         | 185                          | 239                         | 185                          |
| Number of countries                      | 55                     | 44                     | 55                          | 44                           | 55                          | 44                           |
| within R-squared                         | 0.324                  | 0.342                  | —                           | —                            | —                           | —                            |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                          | Yes                         | Yes                          |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                          | Yes                         | Yes                          |
| AIC                                      | —                      | —                      | -1493.5                     | -1291.9                      | -1508.4                     | -1313.8                      |
| BIC                                      | —                      | —                      | -1479.6                     | -1279.0                      | -1494.5                     | -1300.9                      |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                            | 0                           | 0                            |
| Cragg-Donald Wald F statistic            | —                      | —                      | 6.0870                      | 9.1043                       | 5.8919                      | 13.856                       |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 5.0135                      | 32.987                       | 6.3579                      | 59.245                       |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on EMs, while columns 2, 4 and 6 are regressions based on LICs. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.26. Sensitivity: By Informality: Self-employment (% of total employment), Avg. 2014-22

|                                                             | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|-------------------------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]                            | -0.0225<br>(0.0121)    | -0.0250<br>(0.0122)    | 0.1291***<br>(0.0239)       | 0.1852***<br>(0.0253)         | 0.1247***<br>(0.0144)       | 0.1773***<br>(0.0406)         |
| OSI X Informality: Self-emp. (% of tot. emp.), Avg. 2014-22 | 0.0006**<br>(0.0002)   | 0.0007**<br>(0.0002)   | -0.0006<br>(0.0005)         | -0.0007**<br>(0.0003)         | -0.0008**<br>(0.0003)       | -0.0008**<br>(0.0003)         |
| Tax Policy Yield, exc. Trade Tax and SSC                    | 0.2863***<br>(0.0269)  | 0.2892***<br>(0.0285)  | 0.2927***<br>(0.0215)       | 0.2780***<br>(0.0384)         | 0.2862***<br>(0.0156)       | 0.2699***<br>(0.0258)         |
| #Tax Staff/LaborForce                                       | 0.5073***<br>(0.0984)  | 0.5672***<br>(0.1179)  | 0.5614***<br>(0.0998)       | 0.6156***<br>(0.0908)         | 0.5469***<br>(0.0994)       | 0.6034***<br>(0.0948)         |
| Sq(#Tax Staff/Labor Force)                                  | -2.1540***<br>(0.4279) | -2.5787***<br>(0.5271) | -2.1996***<br>(0.4291)      | -2.4246***<br>(0.4311)        | -2.1584***<br>(0.4221)      | -2.4063***<br>(0.4094)        |
| Active Taxpayer/Labor Force                                 | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                                     | 0.0004***<br>(0.0000)  | 0.0006***<br>(0.0001)  | 0.0005***<br>(0.0000)       | 0.0007***<br>(0.0001)         | 0.0005***<br>(0.0000)       | 0.0007***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged                           | 0.0091<br>(0.0159)     | 0.0136<br>(0.0131)     | 0.0075<br>(0.0219)          | 0.0222<br>(0.0193)            | 0.0064<br>(0.0215)          | 0.0201<br>(0.0192)            |
| Sq(Log (GDP per capita, USD)), lagged                       | -0.0011<br>(0.0011)    | -0.0016<br>(0.0009)    | -0.0010<br>(0.0015)         | -0.0023*<br>(0.0013)          | -0.0009<br>(0.0014)         | -0.0021<br>(0.0013)           |
| Trade openness (% of GDP), lagged                           | 0.0132**<br>(0.0035)   | 0.0167**<br>(0.0067)   | 0.0122**<br>(0.0026)        | 0.0145***<br>(0.0052)         | 0.0126**<br>(0.0027)        | 0.0151***<br>(0.0053)         |
| External debt (% of GDP), lagged                            | 0.0004<br>(0.0004)     | -0.0169***<br>(0.0013) | -0.0006<br>(0.0007)         | -0.0162***<br>(0.0021)        | -0.0005<br>(0.0007)         | -0.0161***<br>(0.0017)        |
| Inflation, lagged                                           | -0.0261***<br>(0.0039) | -0.0256***<br>(0.0044) | -0.0273***<br>(0.0034)      | -0.0327***<br>(0.0033)        | -0.0272***<br>(0.0035)      | -0.0322***<br>(0.0040)        |
| Terms of Trade (2000=1), lagged                             | 0.0138<br>(0.0073)     | 0.0155*<br>(0.0064)    | 0.0097<br>(0.0102)          | 0.0110<br>(0.0086)            | 0.0105<br>(0.0101)          | 0.0118<br>(0.0088)            |
| Oil exports (% of GDP), lagged                              | -0.0899***<br>(0.0125) | -0.1235***<br>(0.0257) | -0.0777***<br>(0.0141)      | -0.1099***<br>(0.0310)        | -0.0794***<br>(0.0133)      | -0.1120***<br>(0.0294)        |
| Log (Agri, % of GDP), lagged                                | 0.0001<br>(0.0056)     | -0.0031<br>(0.0052)    | -0.0051<br>(0.0061)         | -0.0103<br>(0.0074)           | -0.0040<br>(0.0059)         | -0.0089<br>(0.0075)           |
| Control Corruption, lagged                                  | -0.0001<br>(0.0009)    | -0.0003<br>(0.0037)    | -0.0008<br>(0.0010)         | -0.0001<br>(0.0049)           | -0.0004<br>(0.0011)         | 0.0002<br>(0.0052)            |
| Observations                                                | 457                    | 352                    | 457                         | 352                           | 457                         | 352                           |
| Number of countries                                         | 104                    | 82                     | 104                         | 82                            | 104                         | 82                            |
| within R-squared                                            | 0.183                  | 0.230                  | —                           | —                             | —                           | —                             |
| Country FE                                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                                     | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                                         | —                      | —                      | -2986.0                     | -2276.8                       | -2994.7                     | -2292.0                       |
| BIC                                                         | —                      | —                      | -2969.5                     | -2261.3                       | -2978.2                     | -2276.5                       |
| Ho: OSI is exogenous                                        | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic                               | —                      | —                      | 8.2626                      | 4.2552                        | 9.8767                      | 5.0383                        |
| Kleibergen-Paap rk Wald F statistic                         | —                      | —                      | 38.799                      | 22.929                        | 56.486                      | 45.881                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 3, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.27. Sensitivity: By Financial Development Index, Avg. 2014-22

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0267<br>(0.0161)     | 0.0266**<br>(0.0095)   | 0.0427***<br>(0.0091)       | 0.0890***<br>(0.0156)         | 0.0068<br>(0.0129)          | 0.0398***<br>(0.0140)         |
| OSI X FD: Fin.dev. index, Avg. 2014-22   | -0.0861<br>(0.0706)    | -0.0793*<br>(0.0321)   | 0.1891***<br>(0.0554)       | 0.2801***<br>(0.1164)         | 0.2660***<br>(0.0328)       | 0.4511***<br>(0.0794)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3182***<br>(0.0386)  | 0.3041***<br>(0.0439)  | 0.3364***<br>(0.0106)       | 0.3060***<br>(0.0234)         | 0.3311***<br>(0.0109)       | 0.2940***<br>(0.0262)         |
| #Tax Staff/LaborForce                    | 0.4679**<br>(0.1079)   | 0.4905**<br>(0.1345)   | 0.5121***<br>(0.0868)       | 0.5885***<br>(0.1082)         | 0.4881***<br>(0.0962)       | 0.5843***<br>(0.1158)         |
| Sq(#Tax Staff/Labor Force)               | -2.1257***<br>(0.4396) | -2.4090***<br>(0.5193) | -2.1299***<br>(0.3398)      | -2.5137***<br>(0.4752)        | -2.0329***<br>(0.3696)      | -2.4826***<br>(0.4977)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0005***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0199<br>(0.0166)     | 0.0233<br>(0.0125)     | 0.0125<br>(0.0189)          | 0.0273<br>(0.0165)            | 0.0094<br>(0.0207)          | 0.0232<br>(0.0191)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0019<br>(0.0012)    | -0.0023**<br>(0.0008)  | -0.0013<br>(0.0013)         | -0.0026**<br>(0.0011)         | -0.0011<br>(0.0014)         | -0.0023*<br>(0.0013)          |
| Trade openness (% of GDP), lagged        | 0.0197***<br>(0.0031)  | 0.0219***<br>(0.0047)  | 0.0185***<br>(0.0036)       | 0.0184***<br>(0.0058)         | 0.0191***<br>(0.0033)       | 0.0195***<br>(0.0052)         |
| External debt (% of GDP), lagged         | 0.0001<br>(0.0004)     | -0.0176***<br>(0.0028) | -0.0007<br>(0.0006)         | -0.0143***<br>(0.0019)        | -0.0006<br>(0.0005)         | -0.0131***<br>(0.0020)        |
| Inflation, lagged                        | -0.0298***<br>(0.0043) | -0.0237***<br>(0.0041) | -0.0277***<br>(0.0029)      | -0.0300***<br>(0.0055)        | -0.0264***<br>(0.0031)      | -0.0290***<br>(0.0063)        |
| Terms of Trade (2000=1), lagged          | 0.0187*<br>(0.0074)    | 0.0202**<br>(0.0073)   | 0.0146<br>(0.0102)          | 0.0153*<br>(0.0090)           | 0.0153<br>(0.0104)          | 0.0156*<br>(0.0090)           |
| Oil exports (% of GDP), lagged           | -0.1106***<br>(0.0101) | -0.1405***<br>(0.0155) | -0.1018***<br>(0.0127)      | -0.1208***<br>(0.0230)        | -0.1069***<br>(0.0099)      | -0.1259***<br>(0.0197)        |
| Log (Agri, % of GDP), lagged             | -0.0071<br>(0.0051)    | -0.0109**<br>(0.0039)  | -0.0116**<br>(0.0058)       | -0.0169***<br>(0.0050)        | -0.0104<br>(0.0064)         | -0.0155***<br>(0.0059)        |
| Control Corruption, lagged               | 0.0023<br>(0.0014)     | 0.0032<br>(0.0037)     | 0.0012<br>(0.0014)          | 0.0030<br>(0.0050)            | 0.0017<br>(0.0011)          | 0.0040<br>(0.0050)            |
| Observations                             | 523                    | 418                    | 523                         | 418                           | 523                         | 418                           |
| Number of countries                      | 119                    | 97                     | 119                         | 97                            | 119                         | 97                            |
| within R-squared                         | 0.216                  | 0.271                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3427.2                     | -2711.9                       | -3432.2                     | -2713.6                       |
| BIC                                      | —                      | —                      | -3410.1                     | -2695.7                       | -3415.2                     | -2697.4                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 19.400                      | 11.263                        | 20.929                      | 11.040                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 9.0388                      | 5.5373                        | 21.889                      | 4.7332                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 2, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.28. Sensitivity: By Control Corruption, Avg. 2014-22

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0088<br>(0.0083)     | 0.0258***<br>(0.0054)  | 0.1073***<br>(0.0129)       | 0.2146***<br>(0.0211)         | 0.0891***<br>(0.0089)       | 0.1693***<br>(0.0309)         |
| OSI X Control Corruption, Avg. 2014-22   | 0.0103<br>(0.0206)     | 0.0381***<br>(0.0056)  | 0.0121<br>(0.0154)          | 0.1017***<br>(0.0144)         | 0.0146<br>(0.0114)          | 0.0735***<br>(0.0170)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3048***<br>(0.0459)  | 0.2960***<br>(0.0405)  | 0.3360***<br>(0.0101)       | 0.3392***<br>(0.0396)         | 0.3308***<br>(0.0147)       | 0.3293***<br>(0.0265)         |
| #Tax Staff/LaborForce                    | 0.4394**<br>(0.1193)   | 0.5138**<br>(0.1285)   | 0.5277***<br>(0.0877)       | 0.6463***<br>(0.0944)         | 0.5087***<br>(0.0912)       | 0.6143***<br>(0.1111)         |
| Sq(#Tax Staff/Labor Force)               | -1.9880**<br>(0.4637)  | -2.4748***<br>(0.4917) | -2.2266***<br>(0.3733)      | -2.7528***<br>(0.4258)        | -2.1709***<br>(0.3865)      | -2.6779***<br>(0.4783)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0001<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0154<br>(0.0192)     | 0.0170<br>(0.0143)     | 0.0160<br>(0.0192)          | 0.0150<br>(0.0177)            | 0.0153<br>(0.0202)          | 0.0179<br>(0.0154)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0016<br>(0.0013)    | -0.0018<br>(0.0010)    | -0.0016<br>(0.0013)         | -0.0018<br>(0.0012)           | -0.0016<br>(0.0014)         | -0.0020*<br>(0.0011)          |
| Trade openness (% of GDP), lagged        | 0.0196***<br>(0.0024)  | 0.0251***<br>(0.0044)  | 0.0174***<br>(0.0034)       | 0.0243***<br>(0.0050)         | 0.0180***<br>(0.0031)       | 0.0234***<br>(0.0056)         |
| External debt (% of GDP), lagged         | -0.0000<br>(0.0004)    | -0.0162***<br>(0.0026) | -0.0008<br>(0.0007)         | -0.0145***<br>(0.0018)        | -0.0007<br>(0.0006)         | -0.0149***<br>(0.0017)        |
| Inflation, lagged                        | -0.0243***<br>(0.0035) | -0.0241***<br>(0.0039) | -0.0264***<br>(0.0024)      | -0.0307***<br>(0.0046)        | -0.0258***<br>(0.0022)      | -0.0299***<br>(0.0049)        |
| Terms of Trade (2000=1), lagged          | 0.0182*<br>(0.0069)    | 0.0192**<br>(0.0067)   | 0.0140<br>(0.0099)          | 0.0126<br>(0.0085)            | 0.0147<br>(0.0098)          | 0.0143<br>(0.0094)            |
| Oil exports (% of GDP), lagged           | -0.1147***<br>(0.0088) | -0.1470***<br>(0.0138) | -0.0961***<br>(0.0130)      | -0.1254***<br>(0.0198)        | -0.1001***<br>(0.0111)      | -0.1276***<br>(0.0180)        |
| Log (Agri, % of GDP), lagged             | -0.0075<br>(0.0050)    | -0.0095*<br>(0.0041)   | -0.0130**<br>(0.0053)       | -0.0152***<br>(0.0048)        | -0.0119**<br>(0.0055)       | -0.0145***<br>(0.0050)        |
| Control Corruption, lagged               | 0.0023<br>(0.0015)     | 0.0034<br>(0.0037)     | 0.0005<br>(0.0016)          | 0.0016<br>(0.0040)            | 0.0009<br>(0.0015)          | 0.0019<br>(0.0040)            |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.217                  | 0.278                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3470.7                     | -2732.9                       | -3488.6                     | -2778.1                       |
| BIC                                      | —                      | —                      | -3453.6                     | -2716.7                       | -3471.5                     | -2761.9                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 4.4655                      | 7.9889                        | 9.0316                      | 11.954                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 4.5185                      | 3.3054                        | 25.324                      | 17.698                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 3, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.29. Sensitivity: By Rule of Law, Estimate, Avg. 2014-22

|                                           | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|-------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]          | 0.0048<br>(0.0070)     | 0.0121**<br>(0.0037)   | 0.1327***<br>(0.0154)       | 0.2422***<br>(0.0312)         | 0.1141***<br>(0.0103)       | 0.2063***<br>(0.0341)         |
| OSI X Rule of Law, Estimate, Avg. 2014-22 | -0.0049<br>(0.0197)    | 0.0060<br>(0.0044)     | 0.0796***<br>(0.0184)       | 0.1542***<br>(0.0256)         | 0.0764***<br>(0.0095)       | 0.1301***<br>(0.0157)         |
| Tax Policy Yield, exc. Trade Tax and SSC  | 0.3007***<br>(0.0453)  | 0.2939***<br>(0.0423)  | 0.3582***<br>(0.0126)       | 0.3445***<br>(0.0376)         | 0.3517***<br>(0.0154)       | 0.3366***<br>(0.0288)         |
| #Tax Staff/LaborForce                     | 0.4499**<br>(0.1170)   | 0.5028**<br>(0.1304)   | 0.4898***<br>(0.0920)       | 0.6454***<br>(0.1034)         | 0.4756***<br>(0.1006)       | 0.6233***<br>(0.1116)         |
| Sq(#Tax Staff/Labor Force)                | -2.0377**<br>(0.4563)  | -2.4334***<br>(0.5030) | -2.0354***<br>(0.3453)      | -2.7281***<br>(0.4015)        | -2.0010***<br>(0.3832)      | -2.6821***<br>(0.4312)        |
| Active Taxpayer/Labor Force               | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           |
| Real GDP growth, lagged                   | 0.0006**<br>(0.0000)   | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged         | 0.0184<br>(0.0175)     | 0.0226<br>(0.0130)     | 0.0061<br>(0.0200)          | 0.0160<br>(0.0180)            | 0.0064<br>(0.0227)          | 0.0172<br>(0.0179)            |
| Sq(Log (GDP per capita, USD)), lagged     | -0.0018<br>(0.0012)    | -0.0022*<br>(0.0009)   | -0.0009<br>(0.0013)         | -0.0018<br>(0.0012)           | -0.0009<br>(0.0015)         | -0.0019<br>(0.0012)           |
| Trade openness (% of GDP), lagged         | 0.0189***<br>(0.0026)  | 0.0227***<br>(0.0045)  | 0.0192***<br>(0.0037)       | 0.0237***<br>(0.0060)         | 0.0195***<br>(0.0032)       | 0.0235***<br>(0.0054)         |
| External debt (% of GDP), lagged          | -0.0000<br>(0.0004)    | -0.0164***<br>(0.0026) | -0.0010<br>(0.0007)         | -0.0137***<br>(0.0021)        | -0.0009<br>(0.0006)         | -0.0141***<br>(0.0021)        |
| Inflation, lagged                         | -0.0252***<br>(0.0035) | -0.0252***<br>(0.0040) | -0.0221***<br>(0.0031)      | -0.0289***<br>(0.0034)        | -0.0220***<br>(0.0024)      | -0.0283***<br>(0.0042)        |
| Terms of Trade (2000=1), lagged           | 0.0186*<br>(0.0070)    | 0.0200**<br>(0.0069)   | 0.0122<br>(0.0102)          | 0.0117<br>(0.0087)            | 0.0131<br>(0.0097)          | 0.0130<br>(0.0091)            |
| Oil exports (% of GDP), lagged            | -0.1127***<br>(0.0097) | -0.1422***<br>(0.0150) | -0.1006***<br>(0.0127)      | -0.1255***<br>(0.0204)        | -0.1037***<br>(0.0105)      | -0.1279***<br>(0.0174)        |
| Log (Agri, % of GDP), lagged              | -0.0076<br>(0.0049)    | -0.0105*<br>(0.0039)   | -0.0129**<br>(0.0057)       | -0.0152***<br>(0.0046)        | -0.0119**<br>(0.0059)       | -0.0145***<br>(0.0051)        |
| Control Corruption, lagged                | 0.0024<br>(0.0014)     | 0.0035<br>(0.0038)     | 0.0004<br>(0.0012)          | 0.0027<br>(0.0041)            | 0.0007<br>(0.0012)          | 0.0028<br>(0.0041)            |
| Observations                              | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                       | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                          | 0.216                  | 0.273                  | —                           | —                             | —                           | —                             |
| Country FE                                | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                   | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                       | —                      | —                      | -3439.5                     | -2693.0                       | -3459.0                     | -2734.3                       |
| BIC                                       | —                      | —                      | -3422.5                     | -2676.8                       | -3441.9                     | -2718.1                       |
| Ho: OSI is exogenous                      | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic             | —                      | —                      | 4.7488                      | 7.4824                        | 8.5109                      | 10.146                        |
| Kleibergen-Paap rk Wald F statistic       | —                      | —                      | 41.392                      | 13.645                        | 149.50                      | 28.797                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 3, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.30. Sensitivity: By Gov't Effectiveness, Avg. 2014-22

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0078<br>(0.0071)     | 0.0185***<br>(0.0034)  | 0.1453***<br>(0.0188)       | 0.2855***<br>(0.0398)         | 0.1294***<br>(0.0147)       | 0.2522***<br>(0.0398)         |
| OSI X Gov't Effectiveness, Avg. 2014-22  | 0.0074<br>(0.0176)     | 0.0207**<br>(0.0046)   | 0.0880***<br>(0.0139)       | 0.1715***<br>(0.0262)         | 0.0851***<br>(0.0100)       | 0.1492***<br>(0.0186)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.3029***<br>(0.0434)  | 0.2904***<br>(0.0423)  | 0.3491***<br>(0.0169)       | 0.3162***<br>(0.0539)         | 0.3440***<br>(0.0148)       | 0.3139***<br>(0.0454)         |
| #Tax Staff/LaborForce                    | 0.4426**<br>(0.1143)   | 0.5079**<br>(0.1293)   | 0.5076***<br>(0.1004)       | 0.6925***<br>(0.1047)         | 0.4952***<br>(0.1050)       | 0.6695***<br>(0.1074)         |
| Sq(#Tax Staff/Labor Force)               | -2.0011**<br>(0.4467)  | -2.4420***<br>(0.4993) | -2.0650***<br>(0.3809)      | -2.7829***<br>(0.4209)        | -2.0353***<br>(0.4078)      | -2.7402***<br>(0.4360)        |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           | -0.0000<br>(0.0000)         | -0.0001<br>(0.0001)           |
| Real GDP growth, lagged                  | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | 0.0164<br>(0.0176)     | 0.0213<br>(0.0135)     | 0.0052<br>(0.0213)          | 0.0180<br>(0.0200)            | 0.0055<br>(0.0233)          | 0.0188<br>(0.0200)            |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0017<br>(0.0012)    | -0.0022*<br>(0.0009)   | -0.0009<br>(0.0014)         | -0.0020<br>(0.0014)           | -0.0009<br>(0.0016)         | -0.0021<br>(0.0014)           |
| Trade openness (% of GDP), lagged        | 0.0193***<br>(0.0028)  | 0.0231***<br>(0.0044)  | 0.0186***<br>(0.0030)       | 0.0214***<br>(0.0042)         | 0.0189***<br>(0.0027)       | 0.0215***<br>(0.0039)         |
| External debt (% of GDP), lagged         | -0.0000<br>(0.0004)    | -0.0160***<br>(0.0026) | -0.0011*<br>(0.0006)        | -0.0113***<br>(0.0017)        | -0.0010<br>(0.0006)         | -0.0120***<br>(0.0017)        |
| Inflation, lagged                        | -0.0245***<br>(0.0034) | -0.0251***<br>(0.0040) | -0.0232***<br>(0.0024)      | -0.0334***<br>(0.0051)        | -0.0230***<br>(0.0022)      | -0.0325***<br>(0.0056)        |
| Terms of Trade (2000=1), lagged          | 0.0183*<br>(0.0069)    | 0.0197**<br>(0.0067)   | 0.0115<br>(0.0098)          | 0.0101<br>(0.0080)            | 0.0122<br>(0.0094)          | 0.0114<br>(0.0082)            |
| Oil exports (% of GDP), lagged           | -0.1140***<br>(0.0098) | -0.1437***<br>(0.0148) | -0.1001***<br>(0.0118)      | -0.1209***<br>(0.0199)        | -0.1027***<br>(0.0102)      | -0.1231***<br>(0.0177)        |
| Log (Agri, % of GDP), lagged             | -0.0075<br>(0.0049)    | -0.0102*<br>(0.0040)   | -0.0133**<br>(0.0058)       | -0.0165***<br>(0.0048)        | -0.0125**<br>(0.0059)       | -0.0158***<br>(0.0052)        |
| Control Corruption, lagged               | 0.0024<br>(0.0014)     | 0.0036<br>(0.0038)     | 0.0002<br>(0.0012)          | 0.0025<br>(0.0042)            | 0.0005<br>(0.0012)          | 0.0026<br>(0.0041)            |
| Observations                             | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                      | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                         | 0.216                  | 0.275                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3430.1                     | -2647.9                       | -3447.9                     | -2688.3                       |
| BIC                                      | —                      | —                      | -3413.0                     | -2631.7                       | -3430.8                     | -2672.1                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 7.0805                      | 6.0548                        | 9.4040                      | 7.1098                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 23.965                      | 6.5085                        | 33.452                      | 8.4416                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 3, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.31. Sensitivity: By Regulatory Quality, Estimate, Avg. 2014-22

|                                                  | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|--------------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]                 | 0.0075<br>(0.0066)     | 0.0183***<br>(0.0019)  | 0.1560***<br>(0.0249)       | 0.3893***<br>(0.0580)         | 0.1365***<br>(0.0207)       | 0.3167***<br>(0.0426)         |
| OSI X Regulatory Quality, Estimate, Avg. 2014-22 | 0.0085<br>(0.0215)     | 0.0243*<br>(0.0090)    | 0.1708***<br>(0.0200)       | 0.3876***<br>(0.0730)         | 0.1510***<br>(0.0085)       | 0.2941***<br>(0.0465)         |
| Tax Policy Yield, exc. Trade Tax and SSC         | 0.3038***<br>(0.0453)  | 0.2932***<br>(0.0419)  | 0.3759***<br>(0.0253)       | 0.3465***<br>(0.0909)         | 0.3667***<br>(0.0179)       | 0.3383***<br>(0.0702)         |
| #Tax Staff/LaborForce                            | 0.4423***<br>(0.1155)  | 0.5089***<br>(0.1275)  | 0.4720***<br>(0.1152)       | 0.7834***<br>(0.0881)         | 0.4671***<br>(0.1177)       | 0.7287***<br>(0.0989)         |
| Sq(#Tax Staff/Labor Force)                       | -1.9999***<br>(0.4533) | -2.4457***<br>(0.4970) | -1.8733***<br>(0.4213)      | -2.9839***<br>(0.4022)        | -1.8852***<br>(0.4418)      | -2.8742***<br>(0.4399)        |
| Active Taxpayer/Labor Force                      | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0002***<br>(0.0001)        | -0.0000<br>(0.0000)         | -0.0001*<br>(0.0001)          |
| Real GDP growth, lagged                          | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0005***<br>(0.0000)       | 0.0008***<br>(0.0000)         | 0.0005***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged                | 0.0163<br>(0.0181)     | 0.0212<br>(0.0140)     | -0.0066<br>(0.0254)         | 0.0036<br>(0.0326)            | -0.0038<br>(0.0267)         | 0.0093<br>(0.0277)            |
| Sq(Log (GDP per capita, USD)), lagged            | -0.0016<br>(0.0012)    | -0.0022*<br>(0.0009)   | -0.0000<br>(0.0017)         | -0.0011<br>(0.0023)           | -0.0002<br>(0.0018)         | -0.0014<br>(0.0019)           |
| Trade openness (% of GDP), lagged                | 0.0193***<br>(0.0027)  | 0.0232***<br>(0.0043)  | 0.0205***<br>(0.0025)       | 0.0264***<br>(0.0014)         | 0.0204***<br>(0.0023)       | 0.0248***<br>(0.0023)         |
| External debt (% of GDP), lagged                 | -0.0000<br>(0.0004)    | -0.0158***<br>(0.0024) | -0.0014***<br>(0.0006)      | -0.0037***<br>(0.0009)        | -0.0012***<br>(0.0006)      | -0.0067***<br>(0.0010)        |
| Inflation, lagged                                | -0.0245***<br>(0.0035) | -0.0250***<br>(0.0041) | -0.0184***<br>(0.0030)      | -0.0311***<br>(0.0055)        | -0.0191***<br>(0.0027)      | -0.0308***<br>(0.0058)        |
| Terms of Trade (2000=1), lagged                  | 0.0184*<br>(0.0070)    | 0.0199**<br>(0.0067)   | 0.0112<br>(0.0097)          | 0.0092*<br>(0.0053)           | 0.0122<br>(0.0095)          | 0.0112*<br>(0.0066)           |
| Oil exports (% of GDP), lagged                   | -0.1140***<br>(0.0097) | -0.1438***<br>(0.0142) | -0.1061***<br>(0.0095)      | -0.1322***<br>(0.0133)        | -0.1073***<br>(0.0088)      | -0.1308***<br>(0.0136)        |
| Log (Agri, % of GDP), lagged                     | -0.0075<br>(0.0051)    | -0.0099*<br>(0.0041)   | -0.0115*<br>(0.0064)        | -0.0113*<br>(0.0057)          | -0.0110*<br>(0.0066)        | -0.0120*<br>(0.0056)          |
| Control Corruption, lagged                       | 0.0024<br>(0.0014)     | 0.0038<br>(0.0038)     | 0.0009<br>(0.0013)          | 0.0066*<br>(0.0039)           | 0.0011<br>(0.0012)          | 0.0056<br>(0.0041)            |
| Observations                                     | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                              | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                                 | 0.216                  | 0.275                  | —                           | —                             | —                           | —                             |
| Country FE                                       | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                          | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                              | —                      | —                      | -3377.5                     | -2496.7                       | -3408.9                     | -2596.7                       |
| BIC                                              | —                      | —                      | -3360.4                     | -2480.5                       | -3391.8                     | -2580.5                       |
| Ho: OSI is exogenous                             | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic                    | —                      | —                      | 4.7796                      | 3.0170                        | 7.0098                      | 4.4445                        |
| Kleibergen-Paap rk Wald F statistic              | —                      | —                      | 19.830                      | 2.9022                        | 29.400                      | 4.4221                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 3, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.



Appendix Table AIII.32. Sensitivity: By Political Stability and Absence of Violence/Terrorism, Estimate, Avg. 2014-22

|                                                   | (1)<br>OLS All                     | (2)<br>OLS EMDEs                   | (3)<br>IV All<br>[-4 to -2]        | (4)<br>IV EMDEs<br>[-4 to -2]      | (5)<br>IV All<br>[-5 to -2]        | (6)<br>IV EMDEs<br>[-5 to -2]      |
|---------------------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Operational Strength Index [0,1]                  | 0.0099 <sup>*</sup><br>(0.0037)    | 0.0184 <sup>**</sup><br>(0.0047)   | 0.1128 <sup>***</sup><br>(0.0093)  | 0.1591 <sup>***</sup><br>(0.0198)  | 0.0924 <sup>***</sup><br>(0.0092)  | 0.1333 <sup>***</sup><br>(0.0266)  |
| OSI X Political Stability, Estimate, Avg. 2014-22 | 0.0239 <sup>***</sup><br>(0.0048)  | 0.0331 <sup>***</sup><br>(0.0041)  | 0.0405 <sup>***</sup><br>(0.0153)  | 0.0447 <sup>**</sup><br>(0.0189)   | 0.0392 <sup>***</sup><br>(0.0098)  | 0.0441 <sup>***</sup><br>(0.0150)  |
| Tax Policy Yield, exc. Trade Tax and SSC          | 0.2956 <sup>***</sup><br>(0.0433)  | 0.2785 <sup>***</sup><br>(0.0482)  | 0.3226 <sup>***</sup><br>(0.0147)  | 0.3065 <sup>***</sup><br>(0.0183)  | 0.3166 <sup>***</sup><br>(0.0200)  | 0.3006 <sup>***</sup><br>(0.0182)  |
| #Tax Staff/LaborForce                             | 0.4490 <sup>**</sup><br>(0.1043)   | 0.5194 <sup>**</sup><br>(0.1271)   | 0.5424 <sup>***</sup><br>(0.0864)  | 0.6212 <sup>***</sup><br>(0.1082)  | 0.5238 <sup>***</sup><br>(0.0885)  | 0.6030 <sup>***</sup><br>(0.1154)  |
| Sq(#Tax Staff/Labor Force)                        | -2.0010 <sup>***</sup><br>(0.3957) | -2.4548 <sup>***</sup><br>(0.4797) | -2.2366 <sup>***</sup><br>(0.3327) | -2.6363 <sup>***</sup><br>(0.4488) | -2.1874 <sup>***</sup><br>(0.3443) | -2.6036 <sup>***</sup><br>(0.4669) |
| Active Taxpayer/Labor Force                       | 0.0000<br>(0.0000)                 | 0.0000<br>(0.0000)                 | -0.0000<br>(0.0000)                | -0.0000<br>(0.0001)                | -0.0000<br>(0.0000)                | -0.0000<br>(0.0001)                |
| Real GDP growth, lagged                           | 0.0006 <sup>***</sup><br>(0.0000)  | 0.0007 <sup>***</sup><br>(0.0001)  | 0.0006 <sup>***</sup><br>(0.0000)  | 0.0008 <sup>***</sup><br>(0.0001)  | 0.0006 <sup>***</sup><br>(0.0000)  | 0.0008 <sup>***</sup><br>(0.0001)  |
| Log (GDP per capita, USD), lagged                 | 0.0147<br>(0.0158)                 | 0.0201<br>(0.0130)                 | 0.0137<br>(0.0171)                 | 0.0262 <sup>*</sup><br>(0.0135)    | 0.0136<br>(0.0177)                 | 0.0249 <sup>*</sup><br>(0.0140)    |
| Sq(Log (GDP per capita, USD)), lagged             | -0.0015<br>(0.0011)                | -0.0021 <sup>*</sup><br>(0.0009)   | -0.0015<br>(0.0012)                | -0.0026 <sup>**</sup><br>(0.0010)  | -0.0015<br>(0.0012)                | -0.0025 <sup>**</sup><br>(0.0010)  |
| Trade openness (% of GDP), lagged                 | 0.0195 <sup>***</sup><br>(0.0032)  | 0.0235 <sup>***</sup><br>(0.0047)  | 0.0174 <sup>***</sup><br>(0.0039)  | 0.0193 <sup>**</sup><br>(0.0060)   | 0.0179 <sup>***</sup><br>(0.0038)  | 0.0201 <sup>**</sup><br>(0.0057)   |
| External debt (% of GDP), lagged                  | -0.0001<br>(0.0004)                | -0.0164 <sup>***</sup><br>(0.0028) | -0.0010<br>(0.0006)                | -0.0153 <sup>**</sup><br>(0.0019)  | -0.0008<br>(0.0006)                | -0.0155 <sup>**</sup><br>(0.0019)  |
| Inflation, lagged                                 | -0.0240 <sup>***</sup><br>(0.0034) | -0.0246 <sup>***</sup><br>(0.0042) | -0.0256 <sup>***</sup><br>(0.0022) | -0.0319 <sup>***</sup><br>(0.0050) | -0.0252 <sup>***</sup><br>(0.0023) | -0.0305 <sup>***</sup><br>(0.0054) |
| Terms of Trade (2000=1), lagged                   | 0.0173 <sup>*</sup><br>(0.0069)    | 0.0183 <sup>*</sup><br>(0.0067)    | 0.0121<br>(0.0105)                 | 0.0132<br>(0.0099)                 | 0.0131<br>(0.0102)                 | 0.0141<br>(0.0099)                 |
| Oil exports (% of GDP), lagged                    | -0.1138 <sup>***</sup><br>(0.0115) | -0.1426 <sup>***</sup><br>(0.0159) | -0.0948 <sup>***</sup><br>(0.0149) | -0.1167 <sup>***</sup><br>(0.0226) | -0.0987 <sup>***</sup><br>(0.0133) | -0.1216 <sup>***</sup><br>(0.0196) |
| Log (Agri, % of GDP), lagged                      | -0.0080<br>(0.0046)                | -0.0110 <sup>**</sup><br>(0.0037)  | -0.0139 <sup>**</sup><br>(0.0056)  | -0.0176 <sup>***</sup><br>(0.0050) | -0.0127 <sup>**</sup><br>(0.0056)  | -0.0164 <sup>***</sup><br>(0.0053) |
| Control Corruption, lagged                        | 0.0024<br>(0.0013)                 | 0.0036<br>(0.0036)                 | 0.0006<br>(0.0013)                 | 0.0020<br>(0.0041)                 | 0.0010<br>(0.0013)                 | 0.0023<br>(0.0040)                 |
| Observations                                      | 529                                | 424                                | 529                                | 424                                | 529                                | 424                                |
| Number of countries                               | 121                                | 99                                 | 121                                | 99                                 | 121                                | 99                                 |
| within R-squared                                  | 0.220                              | 0.281                              | —                                  | —                                  | —                                  | —                                  |
| Country FE                                        | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                |
| Year FE                                           | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                |
| AIC                                               | —                                  | —                                  | -3469.3                            | -2770.6                            | -3488.9                            | -2799.5                            |
| BIC                                               | —                                  | —                                  | -3452.2                            | -2754.4                            | -3471.8                            | -2783.3                            |
| Ho: OSI is exogenous                              | —                                  | —                                  | 0                                  | 0                                  | 0                                  | 0                                  |
| Cragg-Donald Wald F statistic                     | —                                  | —                                  | 15.903                             | 11.858                             | 20.010                             | 14.462                             |
| Kleibergen-Paap rk Wald F statistic               | —                                  | —                                  | 7.5326                             | 7.0684                             | 10.142                             | 8.5522                             |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 2, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

<sup>\*</sup>  $p < 0.10$ , <sup>\*\*</sup>  $p < 0.05$ , <sup>\*\*\*</sup>  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.33. Sensitivity: By Voice and Accountability, Estimate, Avg. 2014-22

|                                              | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|----------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]             | 0.0032<br>(0.0030)     | 0.0115*<br>(0.0050)    | 0.0986***<br>(0.0051)       | 0.1475***<br>(0.0113)         | 0.0789***<br>(0.0067)       | 0.1266***<br>(0.0173)         |
| OSI X Voice and Acc., Estimate, Avg. 2014-22 | 0.0298***<br>(0.0051)  | 0.0516**<br>(0.0120)   | 0.0171<br>(0.0141)          | 0.0499*<br>(0.0280)           | 0.0274***<br>(0.0087)       | 0.0570***<br>(0.0194)         |
| Tax Policy Yield, exc. Trade Tax and SSC     | 0.2965***<br>(0.0396)  | 0.2733***<br>(0.0428)  | 0.3284***<br>(0.0113)       | 0.3068***<br>(0.0237)         | 0.3206***<br>(0.0135)       | 0.2989***<br>(0.0203)         |
| #Tax Staff/LaborForce                        | 0.4251**<br>(0.1109)   | 0.5036**<br>(0.1261)   | 0.5204***<br>(0.0837)       | 0.5980***<br>(0.0975)         | 0.4959***<br>(0.0887)       | 0.5835***<br>(0.1048)         |
| Sq(#Tax Staff/Labor Force)                   | -1.9380***<br>(0.4074) | -2.4550***<br>(0.4684) | -2.2091***<br>(0.3452)      | -2.6251***<br>(0.4384)        | -2.1333***<br>(0.3609)      | -2.6019***<br>(0.4496)        |
| Active Taxpayer/Labor Force                  | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0000<br>(0.0001)           | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Real GDP growth, lagged                      | 0.0006***<br>(0.0000)  | 0.0007***<br>(0.0001)  | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         | 0.0006***<br>(0.0000)       | 0.0008***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged            | 0.0131<br>(0.0165)     | 0.0175<br>(0.0129)     | 0.0160<br>(0.0178)          | 0.0248*<br>(0.0130)           | 0.0142<br>(0.0194)          | 0.0229<br>(0.0141)            |
| Sq(Log (GDP per capita, USD)), lagged        | -0.0014<br>(0.0011)    | -0.0019*<br>(0.0009)   | -0.0016<br>(0.0012)         | -0.0024***<br>(0.0009)        | -0.0015<br>(0.0013)         | -0.0023**<br>(0.0010)         |
| Trade openness (% of GDP), lagged            | 0.0203***<br>(0.0032)  | 0.0256***<br>(0.0055)  | 0.0176***<br>(0.0039)       | 0.0211***<br>(0.0072)         | 0.0185***<br>(0.0035)       | 0.0222***<br>(0.0065)         |
| External debt (% of GDP), lagged             | -0.0001<br>(0.0004)    | -0.0161***<br>(0.0028) | -0.0008<br>(0.0006)         | -0.0150***<br>(0.0018)        | -0.0007<br>(0.0006)         | -0.0151***<br>(0.0019)        |
| Inflation, lagged                            | -0.0229***<br>(0.0033) | -0.0228***<br>(0.0035) | -0.0258***<br>(0.0028)      | -0.0303***<br>(0.0035)        | -0.0247***<br>(0.0027)      | -0.0288***<br>(0.0042)        |
| Terms of Trade (2000=1), lagged              | 0.0178*<br>(0.0069)    | 0.0190**<br>(0.0066)   | 0.0141<br>(0.0100)          | 0.0146<br>(0.0092)            | 0.0146<br>(0.0098)          | 0.0152<br>(0.0092)            |
| Oil exports (% of GDP), lagged               | -0.1172***<br>(0.0105) | -0.1488***<br>(0.0163) | -0.0973***<br>(0.0139)      | -0.1226***<br>(0.0244)        | -0.1023***<br>(0.0115)      | -0.1277***<br>(0.0206)        |
| Log (Agri, % of GDP), lagged                 | -0.0072<br>(0.0049)    | -0.0093*<br>(0.0037)   | -0.0127**<br>(0.0052)       | -0.0157***<br>(0.0039)        | -0.0115**<br>(0.0055)       | -0.0145***<br>(0.0044)        |
| Control Corruption, lagged                   | 0.0023<br>(0.0014)     | 0.0036<br>(0.0038)     | 0.0006<br>(0.0015)          | 0.0020<br>(0.0044)            | 0.0009<br>(0.0014)          | 0.0023<br>(0.0042)            |
| Observations                                 | 529                    | 424                    | 529                         | 424                           | 529                         | 424                           |
| Number of countries                          | 121                    | 99                     | 121                         | 99                            | 121                         | 99                            |
| within R-squared                             | 0.221                  | 0.287                  | —                           | —                             | —                           | —                             |
| Country FE                                   | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                      | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                          | —                      | —                      | -3476.7                     | -2775.9                       | -3494.5                     | -2799.9                       |
| BIC                                          | —                      | —                      | -3459.6                     | -2759.7                       | -3477.4                     | -2783.7                       |
| Ho: OSI is exogenous                         | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic                | —                      | —                      | 10.942                      | 10.361                        | 18.519                      | 14.806                        |
| Kleibergen-Paap rk Wald F statistic          | —                      | —                      | 28.493                      | 41.880                        | 297.59                      | 7.9695                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert-weighted OSI on the Tax-to-GDP ratio, excluding trade taxes and social contributions. Columns 1, 3, and 5 present regressions based on EMs, while columns 3, 4, and 6 focus on LICs. In columns 3 and 4 (and columns 5 and 6), we use the intensity of FTEs used in tax administration from IMF Capacity Development over the last four (five) years as an instrumental variable. When interacting the confounding variable with OSI, we do not include its additive term, as it is absorbed by the country fixed effects, given that it is time-invariant.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.34. Sensitivity: Alternative Dependent Variable: Tax on Income and Profits to GDP Ratio

|                                          | (1)<br>OLS All                     | (2)<br>OLS EMDEs                   | (3)<br>IV All<br>[-4 to -2]        | (4)<br>IV EMDEs<br>[-4 to -2]      | (5)<br>IV All<br>[-5 to -2]        | (6)<br>IV EMDEs<br>[-5 to -2]      |
|------------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Operational Strength Index [0,1]         | -0.0067<br>(0.0041)                | -0.0015<br>(0.0097)                | -0.0107<br>(0.0112)                | 0.0406 <sup>*</sup><br>(0.0231)    | -0.0044<br>(0.0103)                | 0.0475 <sup>***</sup><br>(0.0183)  |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.1181 <sup>***</sup><br>(0.0212)  | 0.0515<br>(0.0477)                 | 0.1171 <sup>***</sup><br>(0.0291)  | 0.0528 <sup>*</sup><br>(0.0288)    | 0.1187 <sup>***</sup><br>(0.0312)  | 0.0531 <sup>**</sup><br>(0.0268)   |
| #Tax Staff/LaborForce                    | 0.2949 <sup>***</sup><br>(0.0436)  | 0.1308 <sup>**</sup><br>(0.0364)   | 0.2919 <sup>***</sup><br>(0.0667)  | 0.1610 <sup>***</sup><br>(0.0484)  | 0.2966 <sup>***</sup><br>(0.0666)  | 0.1660 <sup>***</sup><br>(0.0454)  |
| Sq(#Tax Staff/Labor Force)               | -1.3236 <sup>***</sup><br>(0.2556) | -0.3841 <sup>**</sup><br>(0.0856)  | -1.3160 <sup>***</sup><br>(0.3484) | -0.4201 <sup>***</sup><br>(0.0522) | -1.3279 <sup>***</sup><br>(0.3455) | -0.4260 <sup>***</sup><br>(0.0515) |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)                 | 0.0000<br>(0.0000)                 | 0.0000<br>(0.0000)                 | 0.0000<br>(0.0000)                 | 0.0000<br>(0.0000)                 | 0.0000<br>(0.0000)                 |
| Real GDP growth, lagged                  | 0.0001 <sup>**</sup><br>(0.0000)   | 0.0002 <sup>**</sup><br>(0.0001)   | 0.0001 <sup>***</sup><br>(0.0000)  | 0.0002 <sup>***</sup><br>(0.0001)  | 0.0001 <sup>***</sup><br>(0.0000)  | 0.0002 <sup>***</sup><br>(0.0001)  |
| Log (GDP per capita, USD), lagged        | 0.0240<br>(0.0155)                 | 0.0178<br>(0.0113)                 | 0.0237<br>(0.0224)                 | 0.0256<br>(0.0175)                 | 0.0242<br>(0.0224)                 | 0.0269<br>(0.0172)                 |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0020<br>(0.0010)                | -0.0018<br>(0.0008)                | -0.0020<br>(0.0015)                | -0.0023 <sup>*</sup><br>(0.0012)   | -0.0020<br>(0.0015)                | -0.0024 <sup>**</sup><br>(0.0012)  |
| Trade openness (% of GDP), lagged        | 0.0184 <sup>**</sup><br>(0.0044)   | 0.0197 <sup>***</sup><br>(0.0042)  | 0.0184 <sup>***</sup><br>(0.0042)  | 0.0193 <sup>***</sup><br>(0.0042)  | 0.0184 <sup>***</sup><br>(0.0042)  | 0.0192 <sup>***</sup><br>(0.0042)  |
| External debt (% of GDP), lagged         | -0.0003<br>(0.0005)                | -0.0045 <sup>***</sup><br>(0.0008) | -0.0002<br>(0.0005)                | -0.0044 <sup>***</sup><br>(0.0012) | -0.0003<br>(0.0005)                | -0.0043 <sup>***</sup><br>(0.0014) |
| Inflation, lagged                        | -0.0064<br>(0.0036)                | -0.0043<br>(0.0035)                | -0.0063 <sup>**</sup><br>(0.0025)  | -0.0077 <sup>***</sup><br>(0.0024) | -0.0064 <sup>**</sup><br>(0.0025)  | -0.0082 <sup>***</sup><br>(0.0025) |
| Terms of Trade (2000=1), lagged          | 0.0140 <sup>**</sup><br>(0.0043)   | 0.0172 <sup>***</sup><br>(0.0033)  | 0.0142 <sup>**</sup><br>(0.0056)   | 0.0150 <sup>***</sup><br>(0.0044)  | 0.0138 <sup>**</sup><br>(0.0057)   | 0.0147 <sup>***</sup><br>(0.0043)  |
| Oil exports (% of GDP), lagged           | 0.0082<br>(0.0395)                 | -0.0509 <sup>**</sup><br>(0.0128)  | 0.0066<br>(0.0486)                 | -0.0369 <sup>**</sup><br>(0.0175)  | 0.0091<br>(0.0484)                 | -0.0345 <sup>**</sup><br>(0.0160)  |
| Log (Agri, % of GDP), lagged             | -0.0073<br>(0.0049)                | -0.0129 <sup>*</sup><br>(0.0053)   | -0.0070<br>(0.0053)                | -0.0158 <sup>**</sup><br>(0.0068)  | -0.0075<br>(0.0054)                | -0.0163 <sup>**</sup><br>(0.0067)  |
| Control Corruption, lagged               | -0.0054<br>(0.0033)                | -0.0057 <sup>*</sup><br>(0.0023)   | -0.0054<br>(0.0041)                | -0.0067 <sup>*</sup><br>(0.0036)   | -0.0055<br>(0.0041)                | -0.0069 <sup>*</sup><br>(0.0036)   |
| Observations                             | 509                                | 396                                | 509                                | 396                                | 509                                | 396                                |
| Number of countries                      | 123                                | 99                                 | 123                                | 99                                 | 123                                | 99                                 |
| within R-squared                         | 0.309                              | 0.439                              | —                                  | —                                  | —                                  | —                                  |
| Country FE                               | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                |
| Year FE                                  | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                | Yes                                |
| AIC                                      | —                                  | —                                  | -3742.2                            | -3152.3                            | -3742.3                            | -3143.0                            |
| BIC                                      | —                                  | —                                  | -3725.3                            | -3136.3                            | -3725.4                            | -3127.1                            |
| Ho: OSI is exogenous                     | —                                  | —                                  | 0                                  | 0                                  | 0                                  | 0                                  |
| Cragg-Donald Wald F statistic            | —                                  | —                                  | 25.995                             | 13.292                             | 32.062                             | 16.776                             |
| Kleibergen-Paap rk Wald F statistic      | —                                  | —                                  | 10.656                             | 7.0032                             | 12.720                             | 9.5892                             |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

<sup>\*</sup>  $p < 0.10$ , <sup>\*\*</sup>  $p < 0.05$ , <sup>\*\*\*</sup>  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.35. Sensitivity: Alternative Dependent Variable: Tax on Property to GDP Ratio

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | -0.0019<br>(0.0016)    | -0.0031**<br>(0.0009)  | 0.0283***<br>(0.0099)       | 0.1580<br>(0.2253)            | 0.0281***<br>(0.0071)       | 0.0504***<br>(0.0214)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.0210<br>(0.0117)     | -0.0211<br>(0.0113)    | 0.0218**<br>(0.0099)        | -0.0634<br>(0.1039)           | 0.0218**<br>(0.0098)        | -0.0352**<br>(0.0146)         |
| #Tax Staff/LaborForce                    | -0.0539***<br>(0.0094) | -0.0639**<br>(0.0155)  | -0.1059***<br>(0.0278)      | -0.4497<br>(0.5034)           | -0.1056***<br>(0.0233)      | -0.1921***<br>(0.0460)        |
| Sq(#Tax Staff/Labor Force)               | 0.1835***<br>(0.0275)  | 0.2516***<br>(0.0359)  | 0.2799***<br>(0.0551)       | 0.8660<br>(0.8437)            | 0.2793***<br>(0.0462)       | 0.4557***<br>(0.0845)         |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)     | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | 0.0000<br>(0.0000)            | -0.0000<br>(0.0000)         | 0.0000<br>(0.0000)            |
| Real GDP growth, lagged                  | -0.0001***<br>(0.0000) | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | 0.0004<br>(0.0005)            | -0.0000<br>(0.0000)         | 0.0001***<br>(0.0000)         |
| Log (GDP per capita, USD), lagged        | 0.0053**<br>(0.0017)   | 0.0026**<br>(0.0008)   | 0.0064**<br>(0.0028)        | 0.0237<br>(0.0207)            | 0.0064**<br>(0.0027)        | 0.0096**<br>(0.0021)          |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0004***<br>(0.0001) | -0.0001***<br>(0.0000) | -0.0004***<br>(0.0002)      | -0.0014<br>(0.0012)           | -0.0004***<br>(0.0002)      | -0.0006***<br>(0.0001)        |
| Trade openness (% of GDP), lagged        | -0.0024<br>(0.0014)    | -0.0017***<br>(0.0002) | -0.0024**<br>(0.0011)       | 0.0015<br>(0.0082)            | -0.0024**<br>(0.0011)       | -0.0006<br>(0.0016)           |
| External debt (% of GDP), lagged         | -0.0002<br>(0.0001)    | 0.0033*<br>(0.0012)    | -0.0003<br>(0.0002)         | 0.0074*<br>(0.0040)           | -0.0003<br>(0.0002)         | 0.0047**<br>(0.0020)          |
| Inflation, lagged                        | -0.0016<br>(0.0008)    | -0.0029*<br>(0.0013)   | -0.0021<br>(0.0014)         | -0.0150<br>(0.0131)           | -0.0021<br>(0.0014)         | -0.0069***<br>(0.0019)        |
| Terms of Trade (2000=1), lagged          | 0.0010**<br>(0.0003)   | 0.0007***<br>(0.0001)  | -0.0013*<br>(0.0008)        | -0.0100<br>(0.0170)           | -0.0013**<br>(0.0006)       | -0.0029<br>(0.0021)           |
| Oil exports (% of GDP), lagged           | -0.0051<br>(0.0031)    | -0.0005<br>(0.0013)    | 0.0064<br>(0.0043)          | 0.0484<br>(0.0860)            | 0.0063<br>(0.0041)          | 0.0158<br>(0.0123)            |
| Log (Agri, % of GDP), lagged             | -0.0008***<br>(0.0001) | 0.0013**<br>(0.0003)   | -0.0014***<br>(0.0004)      | 0.0038<br>(0.0034)            | -0.0014***<br>(0.0003)      | -0.0021***<br>(0.0006)        |
| Control Corruption, lagged               | -0.0001<br>(0.0004)    | -0.0009***<br>(0.0001) | -0.0004<br>(0.0004)         | -0.0008<br>(0.0018)           | -0.0004<br>(0.0004)         | -0.0008<br>(0.0006)           |
| Observations                             | 327                    | 222                    | 327                         | 222                           | 327                         | 222                           |
| Number of countries                      | 79                     | 57                     | 79                          | 57                            | 79                          | 57                            |
| within R-squared                         | 0.112                  | 0.234                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3396.7                     | -1864.4                       | -3397.8                     | -2303.5                       |
| BIC                                      | —                      | —                      | -3381.5                     | -1850.8                       | -3382.7                     | -2289.9                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 7.8473                      | 0.04178                       | 9.9848                      | 0.5008                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 49.917                      | 0.3145                        | 69.266                      | 5.4692                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.36. Sensitivity: Alternative Dependent Variable: Taxes on Sales and Production to GDP Ratio

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0249***<br>(0.0016)  | 0.0288***<br>(0.0054)  | 0.1059***<br>(0.0094)       | 0.1341***<br>(0.0112)         | 0.0765***<br>(0.0072)       | 0.0843***<br>(0.0201)         |
| Tax Policy Yield, exc. Trade Tax and SSC | 0.2002***<br>(0.0480)  | 0.2579***<br>(0.0341)  | 0.2206***<br>(0.0421)       | 0.2598***<br>(0.0264)         | 0.2132***<br>(0.0517)       | 0.2589***<br>(0.0310)         |
| #Tax Staff/LaborForce                    | 0.0127<br>(0.0711)     | 0.0691<br>(0.1059)     | 0.0711<br>(0.0534)          | 0.1419*<br>(0.0743)           | 0.0499<br>(0.0524)          | 0.1075<br>(0.0798)            |
| Sq(#Tax Staff/Labor Force)               | 0.0090<br>(0.1682)     | -0.4820<br>(0.2666)    | -0.1384<br>(0.1464)         | -0.5636***<br>(0.1825)        | -0.0850<br>(0.1403)         | -0.5250***<br>(0.2037)        |
| Active Taxpayer/Labor Force              | -0.0000<br>(0.0000)    | 0.0000<br>(0.0000)     | -0.0000<br>(0.0000)         | -0.0000<br>(0.0000)           | -0.0000<br>(0.0000)         | -0.0000<br>(0.0000)           |
| Real GDP growth, lagged                  | 0.0004***<br>(0.0000)  | 0.0004***<br>(0.0000)  | 0.0004***<br>(0.0000)       | 0.0005***<br>(0.0000)         | 0.0004***<br>(0.0000)       | 0.0005***<br>(0.0001)         |
| Log (GDP per capita, USD), lagged        | -0.0027<br>(0.0037)    | 0.0006<br>(0.0106)     | 0.0042<br>(0.0046)          | 0.0205<br>(0.0173)            | 0.0017<br>(0.0042)          | 0.0111<br>(0.0165)            |
| Sq(Log (GDP per capita, USD)), lagged    | 0.0002<br>(0.0002)     | -0.0002<br>(0.0007)    | -0.0001<br>(0.0003)         | -0.0015<br>(0.0012)           | -0.0000<br>(0.0003)         | -0.0009<br>(0.0011)           |
| Trade openness (% of GDP), lagged        | 0.0048***<br>(0.0008)  | 0.0033***<br>(0.0012)  | 0.0047***<br>(0.0015)       | 0.0020<br>(0.0012)            | 0.0048***<br>(0.0013)       | 0.0026***<br>(0.0011)         |
| External debt (% of GDP), lagged         | 0.0009***<br>(0.0002)  | -0.0146***<br>(0.0020) | 0.0003<br>(0.0002)          | -0.0139***<br>(0.0030)        | 0.0005***<br>(0.0002)       | -0.0142***<br>(0.0022)        |
| Inflation, lagged                        | -0.0254***<br>(0.0028) | -0.0192***<br>(0.0018) | -0.0275***<br>(0.0021)      | -0.0283***<br>(0.0065)        | -0.0268***<br>(0.0019)      | -0.0240***<br>(0.0056)        |
| Terms of Trade (2000=1), lagged          | 0.0059***<br>(0.0014)  | 0.0044***<br>(0.0018)  | 0.0007<br>(0.0030)          | -0.0010<br>(0.0034)           | 0.0026<br>(0.0026)          | 0.0016<br>(0.0036)            |
| Oil exports (% of GDP), lagged           | -0.0511***<br>(0.0099) | -0.0374***<br>(0.0050) | -0.0191*<br>(0.0109)        | -0.0018<br>(0.0037)           | -0.0307***<br>(0.0115)      | -0.0186***<br>(0.0057)        |
| Log (Agri, % of GDP), lagged             | -0.0025<br>(0.0033)    | -0.0037<br>(0.0038)    | -0.0080<br>(0.0049)         | -0.0106*<br>(0.0059)          | -0.0060<br>(0.0044)         | -0.0074<br>(0.0058)           |
| Control Corruption, lagged               | 0.0040<br>(0.0031)     | 0.0029<br>(0.0040)     | 0.0021<br>(0.0034)          | 0.0003<br>(0.0036)            | 0.0028<br>(0.0036)          | 0.0015<br>(0.0039)            |
| Observations                             | 508                    | 395                    | 508                         | 395                           | 508                         | 395                           |
| Number of countries                      | 123                    | 99                     | 123                         | 99                            | 123                         | 99                            |
| within R-squared                         | 0.190                  | 0.230                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3894.7                     | -2972.2                       | -3950.0                     | -3056.7                       |
| BIC                                      | —                      | —                      | -3877.8                     | -2956.3                       | -3933.1                     | -3040.8                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 27.032                      | 14.298                        | 33.034                      | 17.772                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 9.8954                      | 6.5730                        | 11.981                      | 8.9397                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.37. Sensitivity: Alternative Dependent Variable: Taxes not Elsewhere Classified to GDP Ratio

|                                          | (1)<br>OLS All         | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|------------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | 0.0098<br>(0.0069)     | 0.0151<br>(0.0100)     | 0.0284*<br>(0.0151)         | 0.0102<br>(0.0093)            | 0.0128<br>(0.0140)          | -0.0090<br>(0.0082)           |
| Tax Policy Yield, exc. Trade Tax and SSC | -0.0584**<br>(0.0196)  | -0.0999***<br>(0.0169) | -0.0508<br>(0.0403)         | -0.0995***<br>(0.0121)        | -0.0572*<br>(0.0330)        | -0.0979***<br>(0.0078)        |
| #Tax Staff/LaborForce                    | 0.0917**<br>(0.0287)   | 0.1555*<br>(0.0698)    | 0.1004***<br>(0.0382)       | 0.1568**<br>(0.0710)          | 0.0930***<br>(0.0348)       | 0.1620***<br>(0.0615)         |
| Sq(#Tax Staff/Labor Force)               | -0.2997**<br>(0.0801)  | -0.5566<br>(0.2835)    | -0.3144***<br>(0.1056)      | -0.5816**<br>(0.2510)         | -0.3020***<br>(0.0944)      | -0.6789***<br>(0.1645)        |
| Active Taxpayer/Labor Force              | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0000<br>(0.0000)           | -0.0000<br>(0.0000)         | 0.0000<br>(0.0000)            |
| Real GDP growth, lagged                  | 0.0000**<br>(0.0000)   | 0.0000<br>(0.0000)     | 0.0001<br>(0.0000)          | 0.0000<br>(0.0000)            | 0.0000<br>(0.0000)          | -0.0000<br>(0.0001)           |
| Log (GDP per capita, USD), lagged        | 0.0244**<br>(0.0056)   | 0.0269**<br>(0.0065)   | 0.0265***<br>(0.0028)       | 0.0256***<br>(0.0054)         | 0.0247***<br>(0.0029)       | 0.0203***<br>(0.0036)         |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0014***<br>(0.0003) | -0.0015**<br>(0.0004)  | -0.0016***<br>(0.0001)      | -0.0014***<br>(0.0003)        | -0.0014***<br>(0.0001)      | -0.0011***<br>(0.0002)        |
| Trade openness (% of GDP), lagged        | 0.0005<br>(0.0009)     | -0.0020<br>(0.0016)    | 0.0005<br>(0.0007)          | -0.0020<br>(0.0014)           | 0.0005<br>(0.0008)          | -0.0018<br>(0.0016)           |
| External debt (% of GDP), lagged         | 0.0001<br>(0.0002)     | 0.0074***<br>(0.0007)  | -0.0001<br>(0.0001)         | 0.0073***<br>(0.0011)         | 0.0001<br>(0.0001)          | 0.0071***<br>(0.0017)         |
| Inflation, lagged                        | 0.0055<br>(0.0050)     | 0.0029<br>(0.0044)     | 0.0050<br>(0.0064)          | 0.0033<br>(0.0050)            | 0.0055<br>(0.0059)          | 0.0050<br>(0.0050)            |
| Terms of Trade (2000=1), lagged          | -0.0052**<br>(0.0017)  | -0.0039**<br>(0.0014)  | -0.0063*<br>(0.0034)        | -0.0037**<br>(0.0018)         | -0.0054*<br>(0.0032)        | -0.0028<br>(0.0020)           |
| Oil exports (% of GDP), lagged           | 0.0491***<br>(0.0081)  | 0.0572***<br>(0.0075)  | 0.0553***<br>(0.0137)       | 0.0559***<br>(0.0081)         | 0.0501***<br>(0.0132)       | 0.0509***<br>(0.0105)         |
| Log (Agri, % of GDP), lagged             | 0.0093***<br>(0.0015)  | 0.0135***<br>(0.0018)  | 0.0083***<br>(0.0012)       | 0.0138***<br>(0.0015)         | 0.0092***<br>(0.0011)       | 0.0147***<br>(0.0014)         |
| Control Corruption, lagged               | -0.0011<br>(0.0038)    | 0.0025<br>(0.0031)     | -0.0017<br>(0.0049)         | 0.0027<br>(0.0036)            | -0.0012<br>(0.0048)         | 0.0032<br>(0.0037)            |
| Observations                             | 435                    | 329                    | 435                         | 329                           | 435                         | 329                           |
| Number of countries                      | 107                    | 83                     | 107                         | 83                            | 107                         | 83                            |
| within R-squared                         | 0.059                  | 0.092                  | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                    | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                      | —                      | -3353.6                     | -2565.8                       | -3357.7                     | -2560.1                       |
| BIC                                      | —                      | —                      | -3337.3                     | -2550.6                       | -3341.4                     | -2544.9                       |
| Ho: OSI is exogenous                     | —                      | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                      | —                      | 24.524                      | 9.8672                        | 29.338                      | 12.411                        |
| Kleibergen-Paap rk Wald F statistic      | —                      | —                      | 13.017                      | 4.8718                        | 15.172                      | 6.5544                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

Appendix Table AIII.38. Sensitivity: Alternative Dependent Variable: Non-tax Other Revenue to GDP Ratio

|                                          | (1)<br>OLS All        | (2)<br>OLS EMDEs       | (3)<br>IV All<br>[-4 to -2] | (4)<br>IV EMDEs<br>[-4 to -2] | (5)<br>IV All<br>[-5 to -2] | (6)<br>IV EMDEs<br>[-5 to -2] |
|------------------------------------------|-----------------------|------------------------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|
| Operational Strength Index [0,1]         | -0.0135*<br>(0.0063)  | -0.0393***<br>(0.0046) | 0.0301<br>(0.0274)          | 0.0442<br>(0.0500)            | 0.0225<br>(0.0257)          | 0.0201<br>(0.0412)            |
| Tax Policy Yield, exc. Trade Tax and SSC | -0.0228<br>(0.0849)   | -0.0683<br>(0.0748)    | -0.0124<br>(0.1028)         | -0.0684<br>(0.1091)           | -0.0142<br>(0.1011)         | -0.0684<br>(0.1004)           |
| #Tax Staff/LaborForce                    | -0.2701*<br>(0.1093)  | -0.4926**<br>(0.1303)  | -0.2378**<br>(0.1184)       | -0.4311***<br>(0.1181)        | -0.2434**<br>(0.1216)       | -0.4488***<br>(0.1254)        |
| Sq(#Tax Staff/Labor Force)               | 0.3786<br>(0.3260)    | 1.0845*<br>(0.4976)    | 0.2986<br>(0.3699)          | 1.0142*<br>(0.5284)           | 0.3126<br>(0.3808)          | 1.0344*<br>(0.5465)           |
| Active Taxpayer/Labor Force              | 0.0000<br>(0.0000)    | -0.0000<br>(0.0000)    | -0.0000<br>(0.0000)         | -0.0001***<br>(0.0000)        | -0.0000<br>(0.0000)         | -0.0000**<br>(0.0000)         |
| Real GDP growth, lagged                  | -0.0001<br>(0.0001)   | -0.0002<br>(0.0001)    | -0.0001**<br>(0.0000)       | -0.0001***<br>(0.0000)        | -0.0001**<br>(0.0001)       | -0.0002***<br>(0.0000)        |
| Log (GDP per capita, USD), lagged        | 0.0245*<br>(0.0098)   | 0.0236**<br>(0.0077)   | 0.0282***<br>(0.0087)       | 0.0392***<br>(0.0093)         | 0.0276***<br>(0.0087)       | 0.0347***<br>(0.0095)         |
| Sq(Log (GDP per capita, USD)), lagged    | -0.0020**<br>(0.0006) | -0.0017**<br>(0.0005)  | -0.0022**<br>(0.0005)       | -0.0027***<br>(0.0005)        | -0.0021***<br>(0.0005)      | -0.0024***<br>(0.0006)        |
| Trade openness (% of GDP), lagged        | -0.0179**<br>(0.0043) | -0.0123***<br>(0.0024) | -0.0180***<br>(0.0047)      | -0.0135***<br>(0.0022)        | -0.0180***<br>(0.0047)      | -0.0132***<br>(0.0023)        |
| External debt (% of GDP), lagged         | 0.0032***<br>(0.0005) | 0.0048<br>(0.0031)     | 0.0029***<br>(0.0009)       | 0.0056**<br>(0.0023)          | 0.0029***<br>(0.0008)       | 0.0053**<br>(0.0026)          |
| Inflation, lagged                        | 0.0089<br>(0.0097)    | 0.0175<br>(0.0129)     | 0.0077<br>(0.0081)          | 0.0100<br>(0.0076)            | 0.0079<br>(0.0081)          | 0.0121<br>(0.0075)            |
| Terms of Trade (2000=1), lagged          | 0.0112*<br>(0.0051)   | 0.0078<br>(0.0058)     | 0.0084<br>(0.0079)          | 0.0036<br>(0.0096)            | 0.0089<br>(0.0077)          | 0.0048<br>(0.0093)            |
| Oil exports (% of GDP), lagged           | 0.3640***<br>(0.0551) | 0.3809***<br>(0.0597)  | 0.3811***<br>(0.0562)       | 0.4093***<br>(0.0647)         | 0.3781***<br>(0.0553)       | 0.4011***<br>(0.0620)         |
| Log (Agri, % of GDP), lagged             | 0.0078<br>(0.0070)    | -0.0016<br>(0.0098)    | 0.0051<br>(0.0083)          | -0.0066<br>(0.0111)           | 0.0056<br>(0.0082)          | -0.0051<br>(0.0110)           |
| Control Corruption, lagged               | -0.0012<br>(0.0044)   | -0.0008<br>(0.0049)    | -0.0022<br>(0.0044)         | -0.0029<br>(0.0042)           | -0.0021<br>(0.0045)         | -0.0023<br>(0.0042)           |
| Observations                             | 515                   | 402                    | 515                         | 402                           | 515                         | 402                           |
| Number of countries                      | 125                   | 101                    | 125                         | 101                           | 125                         | 101                           |
| within R-squared                         | 0.3631                | 0.3993                 | —                           | —                             | —                           | —                             |
| Country FE                               | Yes                   | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| Year FE                                  | Yes                   | Yes                    | Yes                         | Yes                           | Yes                         | Yes                           |
| AIC                                      | —                     | —                      | -3352.1                     | -2574.9                       | -3354.6                     | -2585.8                       |
| BIC                                      | —                     | —                      | -3335.1                     | -2559.0                       | -3337.6                     | -2569.8                       |
| Ho: OSI is exogenous                     | —                     | —                      | 0                           | 0                             | 0                           | 0                             |
| Cragg-Donald Wald F statistic            | —                     | —                      | 27.043                      | 14.283                        | 33.377                      | 18.116                        |
| Kleibergen-Paap rk Wald F statistic      | —                     | —                      | 9.6570                      | 6.1545                        | 11.853                      | 8.5984                        |

Notes: OLS (columns 1 and 2) and IV (columns 3 to 6) panel fixed-effects regressions of expert weighted OSI on Tax-to-GDP ratio excluding trade taxes and social contributions. Columns 1, 3 and 5 are regressions based on full sample, while columns 2, 4 and 6 are regressions based on EMDEs only. In columns 3 and 4 (columns 5 and 6), we use as instrumental variable the intensity of FTE used in tax administration IMF Capacity Development over the past four (five) to two years.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Robust standard errors in parentheses.

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## PUBLICATIONS

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