INTERNATIONAL MONETARY FUND

Closing the Gap: How Tax Administration Performance Shapes Compliance

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WP/25/209

2025
October

WORKING PAPER

 WP/25/209

IMF Working Paper
Fiscal Affairs Department

Closing the Gap: How Tax Administration Performance Shapes Compliance

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Authorized for distribution by Vitor Gaspar
October 2025

ABSTRACT: This paper examines the impact of tax administration performance on tax compliance gaps across countries. Building on the Allingham and Sandmo framework, we consider institutional effectiveness and the social acceptability of the tax system as key determinants of taxpayer behavior. We use a novel panel dataset of VAT gap estimates, results of standardized tax administration diagnostic assessments (TADAT), and tax administration institutional and operational data (ISORA). We test the model empirically by combining the Hausman-Taylor and Mundlak-Krishnakumar frameworks. Our findings reveal a robust negative relationship between tax administration effectiveness—based on TADAT scores—and VAT compliance gaps. We find that an increase in a tax administration's TADAT score from 1.85 to 2.32 (approximately D+ to C+) is associated with an 0.6 percentage point increase in VAT revenue as a share of GDP, reflecting reduced VAT noncompliance. Including spillover effects on Corporate Income Tax (CIT) compliance, the total revenue gain could reach 1.3 percent of GDP. We also find that higher social acceptability of the tax system is linked to lower noncompliance. These results underscore the critical role of strengthening institutions to improve tax compliance and enhance tax revenue.

RECOMMENDED CITATION: Baer, K., Barra, P., Benitez, J. C. (2025). Closing the gap: How tax administration performance shapes compliance. IMF Working Paper, WP/25/209. International Monetary Fund, Washington, DC.

JEL Classification Numbers:	H2, H26, H83, H20
Keywords: [Type Here]	Tax Evasion; Tax Compliance;Tax Administration Effectiveness
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* The authors are grateful to Vitor Gaspar, Ruud De Mooij, Mick Keen, Philippe Wingender, Shafik Hebous, James Alm, and the participants of the IMF's Fiscal Affairs Department's seminar series for their comments and suggestions. The views expressed here are those of the authors and not necessarily those of the IMF, its Executive Board, or management.

WORKING PAPERS

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Contents

APPENDIX TABLES

Glossary

AE	Advanced Economy
A-S	Allingham and Sandmo
CASE	European Union Center for Social and Economic Research
CIT	Corporate Income Tax
CRM	Compliance Risk Management
EME	Emerging Market Economy
EU	European Union
FC	Final Consumption
FCS	Fragile and Conflicted-Affected States
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
GTED	Global Tax Expenditure Database
IMF	International Monetary Fund
ISORA	International Service on Revenue Administration
LIDC	Low Income Developing Country
MoF	Ministry of Finance
OECD	Organization for Economic Co-operation and Development.
PIT	Personal Income Tax
RA-GAP	IMF's Revenue Administration Gap Analysis Program
TA	Tax Administration
TADAT	Tax Administration Diagnostic Assessment Tool
VAT	Value Added Tax
WB	World Bank
WEO	IMF's World Economic Outlook
WGI	World Bank's Worldwide Governance Indicators

I. Introduction

There is a common understanding among tax theorists and practitioners that more effective tax administration performance[1] is associated with higher tax compliance, but what is the evidence of this relationship? This paper addresses the question using an empirical analysis based on a theoretical framework. With many tax administrations globally having invested in strengthening their institutional performance, particularly regarding the Value Added Tax (VAT), it is reasonable for them to expect the compliance gap would shrink. But quantifying the relationship between these two variables is not so straightforward, not least because neither tax administration performance nor tax compliance are easy to measure.

The role of the tax administration in tax compliance has been studied in the literature, but without addressing how the strength of the tax administration system *as a whole* translates into compliance outcomes (see Appendix I). Silvani and Brondolo (1993) and Agha and Haughton (1996) were the first to carry out a cross-country empirical analysis of the determinants of VAT compliance. Silvani and Brondolo (1993) correlate the characteristics of VAT design with the compliance gap in 20 countries, but they recognized that tax administration effectiveness was an important omitted variable in their model given the lack of data. Agha and Haughton (1996), in a similar analysis for 17 OECD countries, set out to represent the effect of tax administration through the size of its budget resources. Following this line of analysis a series of other studies have emerged which we use as the basis to develop our analysis, including Christie and Holzner (2006), Reckon (2009), Keen (2015), Das-Gupta et al (2016), Crivelli (2018), CASE (2020), and Butu (2021) (See Appendix I).

We use the standard Allingham and Sandmo (A-S) theoretical framework to analyze the correlation between tax administration performance and VAT compliance gaps (see Appendix II). We apply the theoretical model developed by Allingham and Sandmo (1972) and Sandmo (2005) to the VAT. The model's main assumption is that a representative VAT payer decides to evade a given portion of his/her liability based on a compliance risk portfolio decision. We complement the model by adding a variable relating to tax morale: the degree of the taxpayer's social acceptability of the tax system.[2] The advantage of using this well-known (if simple) compliance model is that it identifies the factors representing the tax administration's actions and

[1] In this paper, *tax administration performance* refers to the relative strengths and weaknesses of the entire tax administration system, including its institutional and operational aspects. This includes core processes such as registration, filing, payment, audit, collection, and dispute resolution; governance and transparency mechanisms that ensure institutional integrity, accountability, and internal control; risk management and compliance strategies based on risk segmentation and the use of third-party data; taxpayer services that emphasize accessibility, assistance, digital channels, and perceived fairness; institutional capacity in terms of human resources, technological infrastructure, and strategic planning; and operational outcomes such as revenue attributable to administrative actions, reductions in compliance gaps, and improvements in voluntary compliance. All of these elements are reflected in the design and application of the Tax Administration Diagnostic Assessment Tool, or TADAT (see https://www.tadat.org/). TADAT measures outcomes, not inputs, and is applied in a standardized way across countries.

[2] There have been several adaptations of the A-S tax evasion model in the literature. Initially focused on individual decision-making under uncertainty, later work expanded to include imperfect enforcement—such as partial penalties and late payments, or models based on game theory, where the compliance gap can result from different strategies between tax administration and taxpayers. Kleven and others (2011), for instance, extended the model to take third-party information into account to explain tax evasion. Behavioral models introduced factors like trust, fairness, and social norms, notably through the "slippery slope" framework. The model was also adapted to firms and macro-level analysis, broadening the approach to estimating tax gaps. Finally, the A-S model has informed optimal audit strategies and policy design, including balancing enforcement costs with compliance outcomes.

performance, and it considers taxpayer behavior. The model mirrors closely the modern Compliance Risk Management (CRM) approach that tax administrations adopt when designing compliance strategies.

We measure tax administration performance using well-established assessment tools and estimate its impact on compliance gaps (the difference between what should have been collected based on the tax laws and what is actually collected). Our empirical model is based on a panel dataset consisting of data generated via the following tools: Tax Administration Diagnostic Assessment Tool (TADAT), Revenue Administration Gap Analysis Program (RA-GAP), and International Survey on Revenue Administration (ISORA). We use the TADAT dataset to calculate an average performance score ranging from 'A' (best) to 'D' (worst) based on an array of different tax administration characteristics and practices. For the VAT compliance gap, we use estimates by country and year obtained through a method we call the 'reverse RA-GAP'. We use the ISORA dataset to obtain information on the tax administration's budget and human resources. We also use datasets of macroeconomic variables, VAT rates, and international indexes from IMF and World Bank datasets. In some cases, we supplement this information with data from each country's official MoF website. The resulting panel includes 111 countries—mainly EMEs and LIDCs—during the period 2010–2023.

Our main finding is that better tax administration performance is associated with a lower VAT compliance gap, showing that it does matter—and quite substantially. We estimated an elasticity of -0.7, so if a tax administration were to raise its TADAT score from 1.85 (close to a 'D+') to 2.32 (close to a 'C+'), one could expect an increase of 0.6 percent to GDP in additional VAT revenue. If we also incorporate the fall in the CIT compliance gap induced by the decrease in the VAT compliance gap, one could expect an additional 0.7 percent of GDP in CIT revenue. Thus, the total effect would be approximately 1.3 percent of GDP in additional revenue from both taxes.

Based on our results we also establish that:

Investing efforts in improving tax administration performance can lead to reduced noncompliance as a result mobilizing additional domestic revenue, although it may take time to generate such gains. Based on the data, we observe that achieving an improvement from 1.85 (close to a D+) to 2.32 (close to a C+) is not a short-term endeavor; based on the evidence from the sample of countries that have undertaken a repeat TADAT (about 30 countries) this could take an average of 5.8 years.

If the social acceptability of the tax system could be improved, with the tax administration (and other public agencies) playing an active role in fostering a national environment that promotes this objective, it will open another channel for reducing the compliance gap and increasing associated revenue. We estimate a semi elasticity of -0.13, which suggests that if the actions of the various government institutions can lead to an increase in this indicator from -0.62 to -0.57, this could raise revenues on the order of 0.04 percent of GDP, on average, by reducing both VAT and CIT compliance gaps.

The tax administration's compliance strategy should take into account the structure of the economy given the latter's role in determining compliance. In countries where the VAT is primarily collected at the border, customs administrations can help improve compliance by strengthening import controls and systematically providing revenue-related information to the tax administration; the latter can use this as a source of 'third party' information, for example, to check taxpayers' compliance with their domestic VAT obligations. Tax administrations face greater challenges in economies dominated by the agricultural sector

(given the prevalence of many small enterprises that are often informal and operate on a cash basis) and must apply tailored and robust compliance risk strategies to detect and address noncompliance effectively.

The rest of the paper is organized as follows. Section II describes the theoretical framework used to estimate the impact of tax administration performance on the VAT compliance gap. Section III presents the empirical model based on country panel data. Section IV concludes.

II. Framework

A. Theoretical Motivation

Our approach is based on the standard tax compliance risk theory[3] (Allingham and Sandmo (1973) and Sandmo (2005)). The theory considers a representative taxpayer who rationally decides to evade a portion Γ of his/her liability based on the financial benefits derived from such action (See Appendix II). With a certain probability, p, his/her noncompliance behavior can be detected and penalized by the tax administration, and with another probability, $(1\text{-}p)$, it can go undetected, resulting in a net gain derived from the noncompliance action. Based on individual's income level, I; the tax rate, τ; the perceived probability of detection, p; and the fine rate, X, applied in case of being detected, the optimal level of evasion, Γ^*, comes from maximizing the expected return of the risk portfolio over these two probabilistic scenarios.

$$\Gamma^* = \Gamma^*(I, \tau, p, X). \quad (1)$$

The first-order condition predicts that both the fine rate and the probability of detection have a negative effect on the compliance gap, while the effects of income and the tax rate are indeterminate.[4]

We characterize the income level and the tax rate based on a representative business subject to VAT. In the model, the representative business produces a single product that is taxable for VAT purposes (see Appendix II). The business's income corresponds to the true value added it generates, which also defines the base subject to VAT. We refer to this variable as the VAT-able base. For the tax rate, we consider the standard VAT rate applicable to the business's single product.

The probability of detection is often represented in the literature by the tax administration's expenditure (See Agha and Haughton (1993) and Feltenstein et al. (2022)). The probability of detection is associated with the volume of resources that the administration has available to enforce tax compliance with

[3] Tax compliance risk theory is also referred to in the literature as the "portfolio theory," the "expected utility model," and the "deterrence model." This theory is also in connection with Gary S. Becker's framework, in which individuals are rational agents who make decisions by comparing the expected benefits and costs of illicit behavior—including the probability of detection and punishment. In this paper, we use the concept of 'tax compliance risk theory' because it mirrors the concept of compliance risk management (CRM) that many tax administrations currently use to design their compliance strategies. CRM frames tax compliance as a decision influenced by the risk of detection and penalties. Accordingly, tax administrations segment taxpayers based on risk and tailoring strategies—like audits or education—to influence their behavior. Both approaches aim to improve compliance by understanding and managing taxpayer responses to enforcement and incentives (see Figure 1) (Betts (2022)).

[4] The algebra of the compliance risk model is extensively documented in the literature, starting with the seminal paper by Allingham and Sandmo (1973), so we do not include it here.

(continued…)

respect to the universe of potentially enforceable transactions or taxpayers. One could express this in several ways, e.g., the tax administration's expenditure compared to GDP, the number of audits executed compared to the universe of potential audits, or the number of staff compared to the total population.

The fine rate is typically established in the tax law, but the ability to effectively apply it can also reflect the tax administration's expenditure. In the tax law, fines usually depend on the severity and intent of the evasion. In monetary terms, statutory fines can be two, three or more times the amount evaded.[5] But in practice, the tax administration's ability to apply fines effectively may be a more important determinant than the amount of the fine as per the tax law. Often, the effective application of the penalty regime implies a years-long effort by the administration to pursue the imposition of such fines through the courts. Thus, achieving effective penalty enforcement will depend more on the tax administration's efforts than on the level of the penalties themselves. For this reason, we also use the tax administration's expenditure to represent this determinant.

In our analysis it is not only the magnitude of the tax administration's expenditure, e_{TA}, that affects the probability of detection, p, and the actual fine rate, X, but also the effectiveness with which it spends its resources, η (See Christie et al. (2006) and Reckon (2009)). This implies that two tax administrations with the same level of resources can generate different levels of probability of detecting noncompliance depending on their performance. For example, adopting a Compliance Risk Management (CRM) approach in many tax administrations has made it possible to increase the probability of detection without necessarily adding new resources or staff.[6] Something similar can be observed in two tax administrations that operate with the same level of fine rates for VAT noncompliance but one is more effective in applying such fines.[7] The following equations reflect the effect of the tax administration's expenditure to GDP, e_{TA}, and the administration's effectiveness in applying its resources, η_{TADAT},[8] to the probability of detection, p, and the fine rate X.

$$p = p(e_{TA}, \eta_{TADAT}) \quad (2)$$

$$X = X(e_{TA}, \eta_{TADAT}) \quad (3)$$

Other variables can facilitate or hinder the probability of detection and the imposition of an actual fine. 'Facilitating' variables include the application of VAT on imports, the existence of legal powers to control and sanction noncompliance, and the degree of simplicity of the tax legislation, the existence of third-party data

[5] Based on Ernst and Young's Worldwide VAT, GST and Sales Tax Guide – 2024, we examine nominal fine rates, focusing on the maximum pecuniary penalty for repeatedly and intentionally using false invoices. We found average fines of 170 percent of the evaded amount in AEs, 201 percent in EMEs, and 154 percent in LIDCs. However, quantifying the impact of other penalties—such as imprisonment or complex fine structures—is difficult. Since translating nominal fines into effective deterrence is challenging, we approximate their impact using indicators of tax administration effectiveness and the rule of law, which partly reflect the effectiveness of judicial enforcement.

[6] See Betts (2022).

[7] From a taxpayer's viewpoint, a determining factor influencing their behavior is their perception of the probability of detection and application of fines, and not necessarily the effective application of these. Even so, the tax administration's resources and effectiveness are considered equally decisive in achieving a greater perception of risk as relates to these two variables.

[8] We use the '*TADAT*' subscript in this variable to refer that the effectiveness of the tax administration will be based on the indicator derived from a TADAT assessment (See next chapter).

(continued…)

(customs, financial, etc.) among others.[9] The most recognized 'hinderers' are a large agriculture sector, special country conditions (Fragile and Conflicted-Affected States (FCS), Small Island) often associated with weak institutional capacity, the prevalence of small enterprises transacting in cash, etc. We test the effect of some of these in the next section.

Beyond tax *enforcement* variables, non-financial determinants of tax compliance are also found important under the broad umbrella of tax morale (See Alm (2019)). These may include the perceived value of government services that are financed via taxation, trust that the tax administration acts fairly, the social value of complying with norms, the cost of compliance[10], and the government's political legitimacy. We will use the concept of 'social acceptability of the tax system' (Diamond and Saez (2011)) to capture most of the non-financial factors affecting VAT compliance. [11] The variable a will represent these factors as follows:

$$a = a\,(value\ of\ government\ services, trust\ in\ tax\ administration, social\ norms, ..) \quad (4)$$

B. The Model

Next, we model the VAT to present the compliance gap as a function of tax enforcement parameters and non-financial compliance factors. Based on equations (1) to (4), we propose the following, where ε represents the estimation error:

$$Log(\Gamma^*) = \alpha + \beta Log(e_{TA}) + \gamma Log(\eta_{TADAT}) + \lambda Log(a) + \nu Log(I) + \rho Log(\tau) + \varepsilon \quad (5)$$

Equation (5) gives us a theoretically motivated empirical equation to estimate the relationship between the VAT compliance gap (Γ^*, as a percent of potential VAT liability) [12] **and the effectiveness of the tax administration's performance.** In the next sections, we present our empirical measures of the key variables and propose an identification approach.

To summarize the expected estimation outcomes based on our hypotheses: First, the key question of the paper is whether β and γ are negative and statistically significant; i.e., we expected the measure the tax administration's expenditure and the overall effectiveness of such expenditure, respectively, to lower the VAT compliance gap, as the tax compliance risk model presented above implies that both increase the relative cost

[9] Slemrod (2018) reviews research using various methods to assess the impact of key tax enforcement instruments: audits, information reporting, and remittance regimes to raise compliance. Morrow et al (2019) conclude that international border controls improve VAT compliance; based on their model they observe an unambiguous positive correlation between imports and aggregate VAT revenues when there is high domestic noncompliance. This relationship does not hold when there are high levels of compliance with the domestic tax system.

[10] The cost of compliance refers to the expenses that a taxpayer must incur to comply with their tax obligations (registration, payment, declaration, etc.), including tax advisors and their own time. Part of taxpayers' costs of complying with the VAT could be explained by the complexity of the VAT law. Another part would depend directly on the tax administration's resources and effectiveness, especially those deployed to simplify procedures, provide taxpayer assistance services, and even offer pre-populated VAT returns.

[11] Crivelli and Gupta (2015) argue that the effectiveness of IMF conditionality in improving tax revenue depends heavily on the institutional quality of the recipient country. Even when technical conditions are well-designed—such as those targeting tax policy or administration—weak institutions can undermine their impact. Their findings emphasize that institutional strength and the social acceptability of the tax system are just as critical as the technical content of reforms for achieving meaningful improvements in revenue performance.

[12] From this point onward, we refer to the concept of the *VAT compliance gap to potential* simply as the *VAT compliance gap*.

of detecting noncompliance for the taxpayer. Second, a higher social acceptability of the tax system (as measured by a) is expected to decrease noncompliance, so we would expect the sign of λ to be negative. Finally, we control for individual's income level (I) and the tax rate (τ), as suggested by theory. Figure 1 summarizes the various aspects of our hypothesis regarding the causal relationship between the key variables discussed above and the VAT compliance gap.

Figure 1. VAT Compliance Gap *à la Allingham and Sandmo* (A-S)

Determinants (A-S model's expected sign)			
Tax policy	Tax Administration	Whole-of-government	Other
VAT-able base(?) VAT rate (?)	Probability of detection (-) • Tax administration expenditure to GDP or staff to taxpayer universe • Tax administration's effectiveness in detecting noncompliance • Detection 'facilitators or hinderers': Import-to-GDP ratio; size of agriculture sector; FCS; tax policy complexity; size of small business segment, etc. Fine rate (-) • Tax administration expenditure to GDP or staff to taxpayer universe • Tax administration effectiveness in sanctioning noncompliance	Social acceptability of the tax system (-) • Perceived value of the services provided by the government financed with taxes • Trust that tax administration acts fairly • Social value of complying with norms • Political legitimacy of the authorities	Uknown/ Unidentified

Dependent variable: VAT compliance gap		
• Sales without invoices • False invoices • Personal consumption • Over-claims of refunds	• Mispricing sales/purchases • Misuse of exemptions • Misuse of reduced rates/special treatments • Misclassification of goods and services	• Double accounting • Registering and de-registering • Business splitting • Etc.

Source: Authors based on A-S model.

III. Empirical Analysis

A. Data

The Dependent Variable – VAT Compliance Measure

An obstacle to undertaking the empirical analysis required to estimate model (5) is the lack of a comprehensive dataset on the VAT compliance gap. Several studies use tax collection (usually VAT revenues to GDP) as a proxy for the VAT compliance gap, which can be problematic. This is primarily because VAT revenue as a share of GDP is influenced by the compliance gap (the extent of taxpayers' compliance with

their VAT obligations under the law) and also by the tax policy gap (e.g., if there are large sectors of the economy that are VAT exempt this will affect the size of the VAT base, and thus the potential revenue to be collected). Additionally, the VAT-to-GDP ratio is affected by the standard VAT rate and the final consumption-to-GDP ratio (see Appendix III). Thus, empirical analyses that use VAT revenue to GDP must control the tax policy gap, the standard rate, and the final consumption-to-GDP ratio. While data for the latter two can be compiled from available sources, there are currently no global datasets for the tax policy gap. Obtaining reliable proxies for the policy gap across countries has remained a major challenge in this type of empirical modeling approach. Thus, relying on proxies instead of direct measures of the policy gap has, until now, introduced a significant degree of imprecision of the results.

We use a VAT compliance gap measure based on a novel methodology that allows us to build a time series of comparable data for over 100 countries (Box 1). Until now, studies that use VAT compliance as dependent variable have had samples of not more than 30 countries (see Appendix I). They have focused on a specific geographic region or have been based on compliance gap estimates whose methodologies vary from country to country, itself a source of imprecision. The novel methodology, the RA-GAP Reverse Method, allows us to construct a dataset of annual VAT compliance gap estimates using a consistent methodology for 111 countries over the period 2010–2023.

A related benefit of this methodology is that it allows us to estimate the tax policy gap consistently, through an accounting identity that links C-efficiency, the compliance gap, and the tax policy gap. We use this accounting identity to conduct a robustness check of our model's results (see Appendix V).

Because it is 'top-down', this methodology has the advantage that all forms of noncompliance are (in principle) included in the estimation.[13] The VAT compliance gap is expressed as percentage points of the potential VAT liability. The potential VAT liability is the revenue that would have been obtained if taxpayers complied fully with their obligations as stipulated in the VAT law.

The tax policy variables, VAT-able base, I, and VAT standard rate, τ, are from the IMF's databases. In our model, the VAT-able base corresponds to the true value added subject to VAT for a representative taxpayer. The total value of the VAT-able base in the economy can be approximated by final consumption; it can be expressed per taxpayer by dividing final consumption by the number of businesses required to register for VAT. As this latter figure is not available, we assume that the number of VAT payers is a relatively fixed proportion of the country's population. Thus, our proxy for the VAT-able base is per capita final consumption. We use per capita final consumption in constant US dollars, based on per capita PPP (IMF datasets) for 2010-2023. The standard VAT rate is also from IMF databases for the period 2010–2023.[14] In some cases, this information has been supplemented with official Ministry of Finance statistics from each country's website.

[13] Top-down estimation techniques typically use national accounts to estimate potential VAT from both the production and consumption sides. Another type of technique is the bottom-up approach, which is based on random or operational audits and extrapolates discrepancies between what taxpayers declared and what they should have declared according to the law. The advantage of the Reverse Method, like other top-down approaches, is that it captures all types of tax noncompliance. In contrast, bottom-up techniques are better suited for detailed segmentation but are less accurate in estimating the overall level of tax compliance. This is mainly explained by the fact that a bottom-up technique does not directly account for undetected noncompliance in audits, non-filers, and unregistered taxpayers.

[14] We consider the standard VAT rate to be the default rate applied to most goods and services, excluding those subject to reduced, zero, or special rates. It is the rate used for general taxation purposes under a VAT system and is typically the benchmark for measuring VAT performance and efficiency.

Box 1. The Reverse Method – An Indirect VAT Compliance Gap Estimation Technique

What Is The Reverse Method?

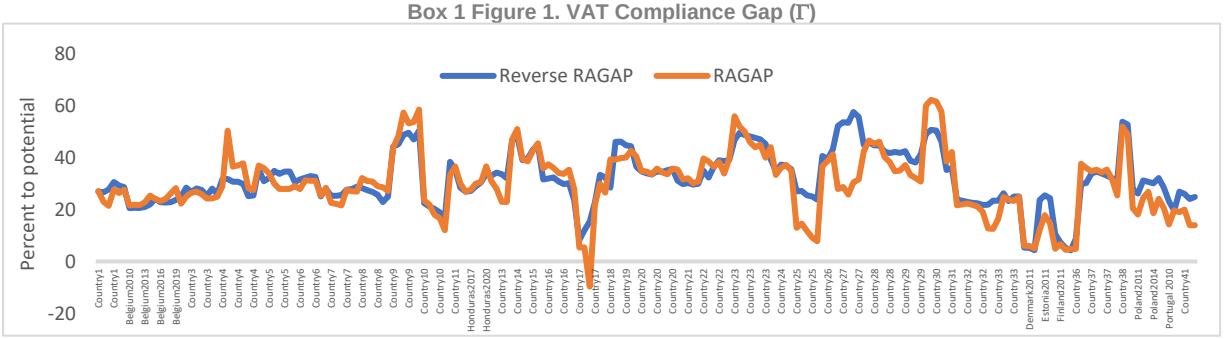
It is an indirect technique for estimating the VAT compliance gap. This method is based on the accounting identity of C-efficiency (Ec), which compares actual VAT revenue to potential revenue if VAT were perfectly enforced at the standard rate on all consumption. The method uses C-efficiency and the tax policy gap to estimate the compliance gap (Γ) as a residual. The tax policy gap is divided into the tax expenditure gap and the nontaxable goods and services gap. The tax expenditure gap to potential (TEG/PV2) is defined as the difference between the potential VAT revenue under full compliance and a normative tax policy structure compared to the actual VAT collection, expressed as a percentage of the former. The nontaxable goods and services gap to potential (NTG/PV3) is defined as the difference between the potential VAT revenue under full compliance and a comprehensive tax policy structure compared to the potential VAT collection under full compliance and a normative tax policy structure, expressed as a percentage of the former. The normative tax policy structure will be one where all goods and services are taxable at the standard rate, except public administration, public education, and public health. The comprehensive tax policy structure would be one where all goods and services are taxable at the standard rate, with no exemptions. Thus, applying the standard C-efficiency identity, the compliance gap can be obtained as follows,

$$(1-\Gamma) \equiv \frac{E_C}{\left(1-\frac{TEG}{PV2}\right)\left(1-\frac{NTG}{PV3}\right)} \qquad (1)$$

How Is This Method Applied to Produce Gap Estimates?

Only for a small number of countries (25) is precise information available for the variables in identity (1), based on RA-GAP missions. To expand the sample to more countries, proxies are used and calibrated against RA-GAP compliance gap estimates. Ec figures come from public datasets (IMF FAD), TEG is approximated using GTED (Global Tax Expenditure Datasets), and NTG is approximated from GDP of sectors public administration, education, and health. The figure below illustrates the calibration process of actual RA-GAP estimates against the proxies for the three variables (Ec, TEG/PV2, and NTG/PV3) over a sample of 208 VAT gap observations from 43 countries from IMF's RA-GAP direct top-down estimates during the period 2010–2023.

Box 1 Figure 1. VAT Compliance Gap (Γ)



Source: Barra and Prokof'yeva (2025). Note: Each point in the orange line represents one annual observation obtained by a standardized IMF's RA-GAP VAT gap assessment mission and each point in the blue line represents the results of the calibrated reversed method for the "CountryX". The names of the countries have been included only in cases where authorization for the publication of the RA-GAP mission results has been granted.

Results and Caveats

The Reverse Method was used to approximate VAT compliance gaps in more than 100 countries. While useful, it relies on indirect estimates, not direct measurements. The proxies for C-efficiency, tax expenditure gap, and non-taxable gap data have limitations mainly due to different methodological nuances in their elaboration. The calibration model helps to smooth out those differences, although naturally not all of them can be captured. Figure 1 illustrates the type of approximation obtained through the RA-GAP assessments. The main advantage of the Reverse Method is that it provides broad, cross-country estimates of the VAT compliance gap, serves as a comprehensive tool based on public data, enables multi-year analysis, offers rough estimates in data-scarce settings, and allows consistency checks with standard top-down approaches (see Appendix III for some individual country results).

Source: Barra and Prokof'yeva (2025)

The Independent Variable – Tax Administration Strength Measure

TADAT effectiveness data, η_{TADAT}, are from the IMF's Tax Administration Diagnostic Assessment Tool (TADAT) datasets (Box 2). We calculate an average performance score based on all tax administration characteristics and practices. TADAT assesses 55 areas of TA performance, grouped into nine dimensions, and has been applied in more than 100 countries. It has a key advantage compared to other effectiveness measurement tools: it is a standardized assessment applied across all countries, conducted by an independent external team of assessors, and based on evidence. For convenience, we convert the standard TADAT performance categories—'A', 'B', 'C', and 'D'—into numeric scores: 1 for 'D' (worst performance), 2 for 'C', 3 for 'B', and 4 for 'A' (best performance).The unweighted average of the 55 TADAT performance dimension scores represents the overall TA effectiveness score, η_{TADAT}. We calculate this figure for the year in which the first TADAT assessment was conducted in a country.[15] Although there are other tools or formulas to measure tax administration effectiveness, we use TADAT because it is a standardized tool and applied uniformly across countries. It is not self-reported: each performance dimension is assessed and scored by trained external evaluators; the results are subject to review and discussion with the tax administration before a final assessment is reached.

Box 2: Understanding TADAT and Its Value for Assessing Tax Administration Performance

What is TADAT?

TADAT (Tax Administration Diagnostic Assessment Tool) is a standardized, evidence-based framework developed by the IMF and international partners to objectively assess the performance of tax administrations worldwide. Launched in 2014, TADAT enables countries to benchmark their tax administration systems against international good practices, identify strengths and weaknesses, and monitor progress over time. It is used by governments and capacity development providers to inform reforms and help mobilize domestic revenues.

Performance Outcome Areas and Dimensions

TADAT evaluates tax administration performance across 9 Performance Outcome Areas (POAs), each broken down into specific indicators and 55 dimensions. These areas are: (POA1) Integrity of the Registered Taxpayer Base; (POA2) Effective Risk Management; (POA3) Supporting Voluntary Compliance; (POA4) Timely Filing of Tax Declarations; (POA5) Timely Payment of Taxes; (POA6) Accurate Reporting in Declarations; (POA7) Effective Tax Dispute Resolution; (POA8) Efficient Revenue Management; and (POA9) Accountability and Transparency. Each area is assessed using a set of quantitative and qualitative dimensions, scored from D or 1 (lowest) to A or 4 (highest), allowing for detailed analysis and comparison. For more detailed information on the scoring criteria used for each performance outcome area, see the latest version of the TADAT Field Guide at www.tadat.org/en/resources/field-guide.html

Advantages of TADAT Compared to Other Tax Administration Performance Measurement Tools

[15] In the context of evaluating a tax administration's capacity to detect noncompliance and enforce penalties, the TADAT framework considers all dimensions important, though several are worth highlighting for purposes of this analysis. Performance Outcome Area (POA) 2 emphasizes the importance of a structured compliance risk management framework, assessing whether the administration systematically identifies, ranks, and mitigates risks associated with taxpayer noncompliance. POAs 4 and 5 examine the administration's ability to monitor non-filers and enforce timely payment, respectively—both critical for identifying and responding to delinquent behavior. POA 6 evaluates the effectiveness of audit and verification programs, which are central to detecting inaccurate reporting and applying corrective measures, including fines. Together, these dimensions provide a robust diagnostic lens through which the administration's enforcement capacities can be assessed, offering insights into its readiness to ensure compliance through detection and deterrence mechanisms.

- Standardization & Comparability: TADAT is the first globally harmonized tool, enabling objective, cross-country, and over-time comparisons using the same methodology and scoring system.
- Outcome-Focused: Unlike many previous tools that focused on inputs or processes, TADAT emphasizes outcomes—what tax administrations actually achieve in practice.
- Evidence-Based: Assessments require documented evidence, ensuring rigor and credibility.
- Comprehensive Coverage: By covering 9 key areas and 55 dimensions, TADAT provides a holistic view of tax administration performance, from registration and compliance to transparency and dispute resolution.
- Supports Reform & Capacity Development: TADAT results help countries identify reform priorities, monitor progress, and coordinate support from international partners.
- Peer Learning & Transparency: Publication of Performance Assessment Reports (PARs) fosters peer-to-peer learning and accountability.
- Global Adoption: Used in over 100 countries, TADAT has become the international standard for tax administration assessment, with over 4,000 officials trained in its methodology.

Source: TADAT 10-Year Report: "10 Years of Assessing Tax Administrations Globally: Developments, Achievements and Remaining Challenges" (IMF, June 2024).

The data on tax administration resources data are from the ISORA database. The tax administration expenditure to GDP ratio, e_{TA}, is from the ISORA 2018–2022 operational expenditure datasets and GDP data are from the IMF's WEO database. Data on tax administration staff per million inhabitants, L_{TA}, which we consider an alternative measure representing tax administration expenditure, are from the ISORA 2018–2022 data on full-time equivalent staff (FTE) per million inhabitants.

The social acceptability of the tax system, a, is captured by the World Bank's *Rule of Law* Annual Index. We use the annual levels of this index for 2010–2023.[16]

Other data are from IMF and WB datasets, including imports-to-GDP, *Imp*, the size of the agriculture sector-to-GDP, *Agr*, and dummies for fragile and conflict-affected states as classified by the IMF. The number of VAT rates, representing VAT policy complexity, is from IMF Fiscal Affairs Department datasets and complemented with official sources from each jurisdiction. We consider the standard rate plus any other VAT rate that is included in the VAT legislation (excluding the zero rate). The summary statistics for the variables employed are shown in Table 1.

[16] The Rule of Law Indicator is part of the Worldwide Governance Indicators (WGI) project, which measures the extent to which agents have confidence in and abide by the rules of society. This includes (a) judicial independence, (b) compliance with courts, (c) public sector corruption, and (d) access to justice. This index ranges from -2.50 (worst) to 2.50 (best).

Table 1. Summary Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
VAT compliance gap (Reverse RAGAP method)	1,461	34.46683	12.87028	0.277445	68.95093
Average TADAT score	1,554	2.184229	0.611021	1.085106	3.717283
Final consumption per capita (in USD in PPP)	1,504	11085.67	9836.082	491.7177	69644.1
VAT general rate (in percent)	1,487	15.87872	4.105571	3	25
Rule of Law Index	1,430	-0.25939	0.726583	-1.83763	2.124782
Imports to GDP	1,489	46.63105	20.70977	10.79023	191.4582
Agriculture to GDP	1,537	12.33571	10.25236	0.456543	64.35418
FTEs per million in habitants	1,400	339.6279	347.2633	20.61503	2028.169
Revenue Administration operating expenditure as a share of GDP	1,428	0.611655	4.509766	0.007683	45.89782

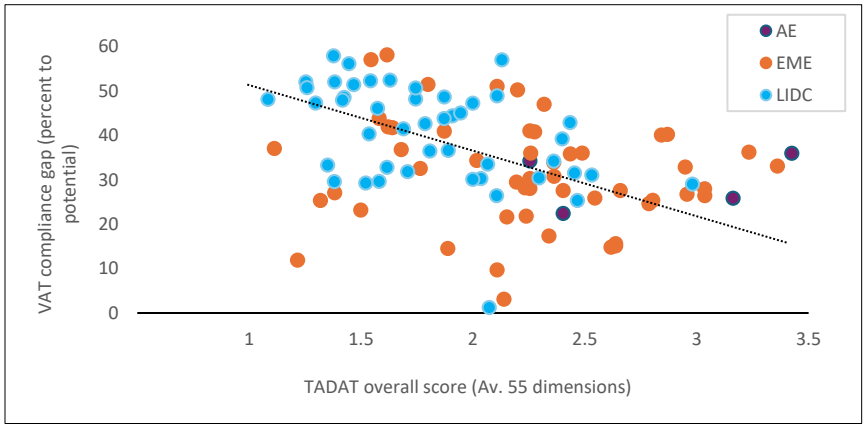
Source: Authors' own calculations.

B. Initial Data Inspection

A simple scatter plot (Fig. 2) shows there is an inverse relationship between the overall TADAT score and the VAT compliance gap: a higher TADAT score, η_{TADAT}, is associated with a lower VAT compliance gap, Γ^*. The data are grouped in three categories: Advanced Economies (AE), Emerging Market Economies (EME), and Low-Income Developing Countries (LIDC).

Unsurprisingly, perhaps, the group of LIDCs is clustered closer to the region with lower TADAT scores and higher VAT compliance gaps. EME are much more dispersed in terms of the relationship between their TADAT scores and their VAT noncompliance scores. Clearly, the LIDC group shows the greatest potential for improving overall tax administration effectiveness and reducing VAT noncompliance.

Figure 2. Relationship between TADAT Scores and VAT Compliance Gap



Source: Authors based on Barra and Prokof'yeva (2025), and TADAT.
Note: Each point represents a TADAT score in year t, the year when the TADAT was conducted, and the average of three compliance gap estimates for the years t-1, t, and t+1. The TADAT score corresponds to the first assessment (repeat assessments are not included).

When inspecting the data, we also considered performance indicators other than the simple average TADAT score. First, we identified several TADAT dimensions that are closely linked to compliance (for example, the application of compliance risk management techniques, the effectiveness of audit and enforcement, the quality of taxpayer services) and gave them greater weight in a composite score. We also built alternative TADAT scores focused on VAT and CIT administration (e-invoicing, timely filing of VAT and CIT declarations, on-time tax payments, etc.). These approaches did not significantly improve the model's results compared to using the overall score. This may reflect the fact that tax administrations are complex organizations whose performance across many dimensions (that in practice interact with one another) will affect outcomes. Also, different administrations may use different combinations of inputs to achieve similar compliance outputs. That said, further work is needed to analyze the rich TADAT data on individual performance indicators and investigate what impact they may have individually, or in specific combinations, on overall compliance levels.

Next, we develop an empirical multivariate model that will allow us to explore the relationship between the VAT compliance gap and other variables. In the following subsections we present the empirical model, the results, and a robustness check.

C. Estimation Model

For almost all variables, we have data that allow us to estimate equation (5) as specified in Section II. However, for some variables there is only one observation for the period analyzed. The variables corresponding to tax administration resources (operating expenditure and staff) and effectiveness (TADAT score) are only available for a few years for the former and only one year for the latter. For the rest of the variables, including the dependent variable, there is data for each year of the series.

The second challenge is potential endogeneity of the relation between compliance and tax administration. The most relevant reverse causality relates to the TADAT score and tax administration resources. An administration with a high compliance gap in a given year could increase its resources that year, distorting the effect measured via a simple correlation. The tax rate could also give rise to endogeneity: a large compliance gap could prompt an increase in tax rates to meet revenue targets. Finally, a large compliance gap could create a perception of a weaker rule of law among economic agents.

To address time-invariant variables and potential endogeneity, we apply the Mundlak-Krishnakumar framework (Adan et al. 2023), combined with the standard Hausman-Taylor estimators. This paired strategy tackles time-invariant regressors and correlation within unit-effects by separating sources of bias and sources of identification. The Mundlak-Krishnakumar framework augments a random-effects model with the unit means of all time-varying regressors, soaking up the correlation between these regressors and the unobserved individual effect; this allows us to estimate within-consistent estimates for the time-varying coefficients while preserving coefficients on the time-invariant variables. The Hausman-Taylor supplies instruments when some regressors remain endogenous to the unit effect, even after using the Mundlak controls, by using within variation of exogenous time-varying variables to instrument time-invariant variables suspected of correlation within the unit effect, and between (unit-mean) variation in strictly exogenous variables to instrument time-varying regressors that are endogenous with respect to the unit effect. When combined, the

Mundlak-Krishnakumar shifts the identifying assumption from "random effects is uncorrelated with regressors" to "random effects is uncorrelated conditional on unit means" reducing bias. Hausman-Taylor, on the other hand, provides the instrumental variable structure to estimate coefficients for the time-invariant regressors (including those correlated with the unit effect) and for time-varying regressors flagged as endogenous. In our dataset, only 25 countries in our sample have more than one TADAT score (repeat TADAT), which effectively translates into a time-invariant endogenous variable that could be correlated with unobserved institutional, political, or structural factors that affect the VAT compliance gap. Therefore, relying solely on fixed effects or random effects for panel data could lead to biased results since these approaches do not address time-invariant variables. To address this issue, we implement the Mundlak-Krishnakumar framework by identifying time-invariant exogenous variables through Hausman tests; we use these as instruments to obtain Hausman-Taylor estimates[17] that allow us to isolate the effect of the tax administration's performance on VAT compliance gaps [18].

Equation (5) now can be expanded to apply the Mundlak-Krishnakumar and Hausman-Taylor framework:

$$\Gamma^*_{it} = \alpha_1 + \alpha_2(X_i) + \alpha_3(Z_{it-1}) + \alpha_4(N_i) + T_t + v_i + \theta_{it} \qquad (6)$$

The description of the variables in equation (6) is as follows. Γ^*_{it} is the VAT compliance gap for each country "i" in period "t"; X_i is the set of time invariant variables from TADAT and ISORA for each country: they include the tax administration effectiveness as measured by TADAT scores, η_{TADAT}, the administration's expenditure to GDP ratio, or e_{TA}, or alternatively, the administration's staff per million inhabitants, L_{TA}. Then, Z_{it-1} are the time-varying lagged[19] macro and institutional variables expected to influence VAT compliance gaps, namely: per capita final consumption, I; imports to GDP, Imp; agriculture to GDP, Agr; the standard VAT rate, τ; the number of VAT rates; and the Rule of Law Index, a. Finally, N_i are a set of exogenous time-invariant instruments; T_t are time fixed effects; v_i are the unobserved country random effects; and θ_{it} is the error term.

D. Results

Table 2 shows the results of the Hausman-Taylor estimation of equation (6). Column 1 shows the results obtained using the TADAT score as a measure of tax administration performance. Columns 2 and 3 add the administration's operating expenditures to GDP and staff per million inhabitants, respectively. Column 4 is similar to the formulation of Column 1 but adds the number of VAT rates as another explanatory variable. To apply the Mundlak-Krishnakumar framework we consider two invariant exogenous variables: the mean of the Rule of Law Index, $\bar{a}$, and the log of the mean agriculture to GDP ratio, $\overline{Log(Agr)}$.

[17] The Hausman–Taylor estimator is tailored for panel data; it helps overcome the resulting endogeneity bias by providing a way to instrument these variables using information from the time-varying regressors.

[18] Adan and others (2023) use the same approach. More recently, Atsebi and others (2025) explore an alternative approach by using an operational strength index of tax administration based on the International Survey on Revenue Administration which allows them to build a 5-year panel and therefore employ an empirical strategy based on fixed effects with instrumental variables.

[19] Lagged variables mitigate concerns of reverse causality by establishing a clear time sequence between the control variables and the outcome.

Our results show that stronger tax administration performance (or higher effectiveness) is associated with a lower VAT compliance gap, confirming the simple relationship shown in Fig. 2. The Hausman-Taylor estimates show an inverse relationship between the VAT compliance gap and TADAT scores across the different specifications (Columns 1–4). Put differently, improving the effectiveness of the tax administration by one percent is correlated with a reduction in the VAT compliance gap of between 0.47 and 0.78 percent, all else being equal. The results are statistically significant at the 5 and 10 percent levels throughout the different specifications.

Table 2. Determinants of the VAT Compliance Gap

Variable	(1)	(2)	(3)	(4)
Time invariant endogenous				
Log (η_{TADAT})	-0.710**	-0.690**	-0.466*	-0.784**
Log (e_{TA})		0.00708		
Log (L_{TA})			-0.124	
Time invariant exogenous				
$\bar{a}$	-0.107	-0.0805	-0.0925	-0.0901
$\overline{Log(Agr)}$		0.0818	0.00903	
Time varying exogenous				
Lagged Log (I)	0.143***	0.181***	0.124**	0.143***
Lagged (a)	-0.127***	-0.105**	-0.117***	-0.119***
Lagged Log (τ)	0.0292	0.0152	0.0598	0.0239
Lagged Log (Imp)	-0.195***	-0.193***	-0.193***	-0.184***
Lagged Log (Agr)	0.119***	0.145***	0.0993**	0.125***
Log (No. rates)				-0.0645
Constant	3.107***	2.588***	3.748***	3.148***
Observations	1,315	1,224	1,199	1,265
Number of Countries	109	101	99	109
Year FE	YES	YES	YES	YES

Notes: Standard errors are not shown for simplicity. *** p<0.01, ** p<0.05, * p<0.1. We use a logarithmic transformation for most of the variables except for the Rule of Law Perception Index (a).
Source: Authors' own calculations.

Using the estimated elasticity of -0.71 (Table 2, Column 1) one can simulate the effects of improving the tax administration's TADAT score. This specification was chosen because it maximizes the number of observations. For illustrative purposes, we simulate a scenario in which a hypothetical tax administration improves its TADAT score from 1.85 (approximately a D+) to 2.32 (approximately a C+).[20] The results indicate that such an improvement is associated with a 6.6 percentage point reduction in the VAT compliance gap—from 42.8 to 36.2 percent—leading to an increase in VAT revenue equivalent to 0.6 percent of GDP.

We also consider the reduction in the CIT compliance gap induced by the decrease in the VAT compliance gap, assuming that taxpayers are consistent in their compliance behavior (that is, if they evade the VAT they will also engage in evasion in other taxes); on this basis we could expect

[20] Our model does not account for intertemporal compliance dynamics, which could be explored in the future as more countries undergo repeated TADAT assessments. For now, we focus on the eight tax administrations that recorded the highest percentage increase in TADAT scores following a second evaluation. For this group, improvement in their scores from 1.85 (D+) to 2.32 (C+) took on average, 5.8 years.

(continued…)

approximately 1.3 percent of GDP in additional revenue from both taxes.[21] This estimate is based on the expectation that each underreported sale or overreported purchase for VAT purposes will result in underreported income or overreported expenses for CIT purposes. Using data from a sample of 12 EME, we estimate that a reduction of 0.6 percent to GDP in the VAT compliance gap is associated with a reduction of 0.7 percent to GDP in the CIT compliance gap, based on average standard CIT and VAT rates. The fact that the effect is greater in CIT than in VAT may seem counterintuitive, but it is simply explained by the higher average statutory CIT rate (τ_{CIT}) compared to the VAT rate (τ) in most countries. Put differently, an undeclared sale of 100 dollars would evade $100 \times \tau$ in VAT, whereas the same transaction, if consistently undeclared as business income, would evade $100 \times \tau_{CIT}$ in CIT, where $\tau < \tau_{CIT}$ (see Appendix IV).

The tax administration's operating expenditure to GDP ratio and staff per million inhabitants do not appear to be statistically significant. This result is counterintuitive. Typically, one would expect that a higher volume of resources allocated to tax administration would be associated with a greater probability of detection.[22] One explanation could be related to measurement errors or data accuracy. As previously noted, ISORA is a survey based on self-reported data by tax administrations; such data may reveal discrepancies that are sometimes found in self-reported data series. Another explanation is that tax agencies' organizational structures and institutional mandates can vary significantly across countries; [23] thus, the data reported may not accurately reflect the actual resources deployed to detect and sanction tax noncompliance. For future studies, improvements and new data collection processes in future rounds of ISORA will help improve data quality relating to tax administrations' budget expenditure**.** A final explanation is simply that a more comprehensive measure of tax administration effectiveness, the overall TADAT score, which reflects the impact of the use of the administration's resources across all core functions, inherently reflects the level and appropriateness of budget resources, and is thus a stronger variable.

Social acceptability of the tax system, as proxied by the Rule of Law Index, shows a negative and statistically significant relationship to the VAT compliance gap. As suggested by our theoretical whole-of-government model (Figure 1), this determinant cannot be attributed solely to tax administration; several other institutions also influence this index. We estimate a semi elasticity of -0.13, which suggests that if the effect of different government institutions collaborating more effectively to administer the tax system can increase this indicator from -0.62 to -0.57,[24] this could raise revenues by 0.04 percent of GDP, on average, by reducing VAT and CIT noncompliance.

[21] A reduction in the CIT compliance gap also may, under the "consistent evader" hypothesis, lead to a corresponding reduction in the PIT compliance gap of partners, owners, or shareholders of a business that has initially reduced its VAT evasion. This is because undeclared business income is likely to be withdrawn without being reported for PIT purposes. While estimating VAT-induced evasion in CIT is already challenging, doing so for PIT is even more complex. For instance, it requires assumptions about the marginal tax rate that would have applied to the undeclared withdrawal if it had been reported (see Appendix IV). This represents a limitation of our current analysis, but it is a promising line of future research.

[22] See Agha and Haughton (1996), Keen (2015), and CASE (2020).

[23] For example, in some countries the tax administration shares resources with other agencies such as customs, treasuries, or certain units within the Ministry of Finance. This can lead to varying criteria when reporting operational expenditures. In other cases, some operational expenses may be treated as off-budget, such as those financed through development assistance. Additionally, accurately identifying personnel can be complex; for example, staff under limited or flexible contracts may or may not be included in the total staff count. It is not clear whether these factors are significant enough to affect cross-country comparability, but this aspect of our analysis warrants further research.

[24] These values reflect the average variation observed among the eight tax administrations with the highest percent increase in TADAT scores following a second assessment.

Per capita final consumption is directly related to the VAT compliance gap, while the standard VAT rate does not show a statistically significant effect. Most previous empirical studies tend to suggest an inverse relationship between the tax base and the VAT gap and a positive one for the rate. Some of these studies are based on lab experiments that examine individual tax evasion behavior on income tax (see Alm et al (2021)). Based on the A-S model the sign of the variables associated with the tax base, and the tax rate is ambiguous, and a clear positive or negative sign emerges only under restrictive assumptions (see Appendix II). Our results point to a positive relationship between per capita final consumption and the compliance gap; this result requires more detailed research to prove the underlying causes.

A higher import to GDP ratio and a lower agriculture to GDP ratio are correlated with a lower VAT compliance gap. In our A-S conceptual framework, a higher ratio of VAT revenue collection on imports to GDP may raise the probability of detection: even though VAT paid on imports is not a final tax it can be claimed as a credit (and thus detected) in subsequent stages of commercialization. By contrast, a higher agriculture-to-GDP ratio lowers the probability of detection given the inherent difficulties in monitoring agriculture sector activities.

Finally, our simple proxy for complexity, the number of rates, is not significant in terms of determining VAT compliance. Although the number of VAT rates varies over time in certain countries, most countries (91 out of 111) in our sample remain consistently at two rates during the period of analysis, which may explain why this variable does not appear as having a significant impact on VAT compliance. We also used dummies to control for FCS and Small Island States,[25] but the resulting coefficients were not statistically significant.

E. Robustness Check

To test the robustness of our results, we introduce an alternative specification using the VAT-to-GDP ratio as the dependent variable. Our earlier reservations regarding the use of the tax-to GDP ratio as the dependent variable can be overcome because we do not rely on proxies for the policy gap, but rather on direct measurement. To do this consistently, we use consistent measures of the tax policy gap, through the accounting identity that links C-efficiency, the compliance gap, and the tax policy gap (see Appendix V). Then, we can use the policy gap measures obtained to estimate the model, using VAT revenue as a share of GDP as the dependent variable, and controlling for the tax rate and final consumption-to-GDP ratio[26].

The results are similar when we use the VAT-to-GDP as the dependent variable. Based on the resulting estimated elasticity of 0.76 (Appendix V), an improvement in a tax administration's TADAT score from 1.85 (approximately a D+) to 2.32 (approximately a C+) would be associated with an increase of 0.7 percentage points to GDP in VAT revenue stemming from an improvement in the tax administration's effectiveness. This

[25] In some countries, the main components of foreign tourists' spending—such as hotels, transportation, and tourism services—are VAT-exempt, while in others they are not, thus generating VAT revenue. These components are not included in domestic final consumption, which affects our measure of the VAT-able base. This distinction can affect tourism-oriented economies significantly, especially Small Island States. For this reason, we include a control for this variable.

[26] As an additional robustness check, we also estimated the model on a subset of the data, using only countries for which the VAT compliance gap had been estimated by an IMF revenue administration mission. We then applied the Mundlak-Krishnakumar/Hausman-Taylor framework. Not surprisingly, the coefficients for TADAT become statistically non-significant but the sign is still negative (as per our hypothesis) and the magnitude is in line with those of our preferred specifications. The reduction in statistical significance is attributable to the introduction of selection bias in the countries being assessed, which has eliminated identifying variation in time-invariant TADAT scores among countries. Consequently, we observe decreased variance within the countries, resulting in inflated standard errors.

(continued…)

result is very similar to the one obtained when using the VAT compliance gap as the dependent variable (0.6 percentage points to GDP).

F. Comparison with a Prior Analysis

To further test our results, we compare them with those obtained in Adan et al. (2023). In that study, total revenue (not the tax compliance gap) is used as the dependent variable, and the authors control for the effect of changes in tax policy to isolate the yield of the tax administration reform measures.[27] Adan et al. (2023) estimate that an increase in the strength of the tax administration—from the 40th to the 60th percentile in a sample of LIDCs and EMEs—is associated with an increase in total tax revenues (excluding trade taxes and social contributions) of 1.4 percent of GDP when regressing against a TADAT strength score and 1.8 percent when regressing against a composite ISORA strength index.[28] In our model, an equivalent variation in the TADAT score to that assumed in their study is associated with a decrease in the compliance gap equivalent to an additional 0.4 percent of GDP in VAT collection and 0.5 percent of GDP in CIT collection, totaling 0.9 percent of GDP.

IV. Conclusions

The question that motivated this paper is: how does tax administration performance shape compliance? The empirical results provide suggestive evidence that tax administration effectiveness is a key mechanism. Measured by a composite TADAT score, it shows an elasticity of -0.71, meaning that if a tax administration were to raise its TADAT score from 1.85 (approximately a 'D+') to 2.32 (approximately a 'C+'), one can expect additional VAT revenue equivalent to 0.6 percent to GDP from improved compliance. If we also incorporate the reduction in the CIT compliance gap induced by the decrease in the VAT compliance gap, one could expect an additional 0.7 percent of GDP in CIT revenue. Thus, the total effect would be approximately 1.3 percent of GDP in additional revenue from both taxes. The answer to our question thus appears to be: tax administration performance (as a whole, reflecting the interaction of all its key aspects) does shape compliance and appears to matter significantly for compliance and revenue outcomes.

There are, of course, some caveats. One of this study's limitations is the lack of a time series for tax administration performance (effectiveness) variables. In the case of the TADAT score, data is only available for the year in which the assessment was conducted. This study presents a first step to address this limitation, by applying a methodology that combines time-invariant variables within a panel data framework. In the future, the availability of a time series (for example, based on repeat TADAT assessments) will enable more accurate estimates.

The VAT compliance gap is also subject to a certain degree of imprecision, which is inherent to the nature of an unobservable variable. It cannot be measured with complete accuracy based on currently available methodologies. Our estimates are based on an indirect approach that uses data on C-efficiency, tax

[27] The study attempts to control for variations in tax policy based on changes in the rates of major taxes and differences between projected and actual revenue collection from one year to the next. The authors assume that such variations reflect increases or decreases in revenue attributable to changes in tax policy.

[28] The authors build an ISORA operational strength index based on different sub-indexes measuring the strength of specific tax administration practices and characteristics.

expenditures, and national accounts. Measurement of the VAT compliance gap could be further refined in the future as the underlying data are updated and become more accurate, and as new individual country (standardized) RA-GAP assessments for the VAT are added to the sample.

There is also inevitably a risk of endogeneity inherent in models such as the ones used here. Compliance levels may also influence the effectiveness of tax administration, meaning the relationship is not strictly unidirectional. To address this possibility, we employed recently developed econometric tools to mitigate potential endogeneity effects. An alternative approach would be to conduct event studies to explore the relationships analyzed in this paper using a completely different methodology. There is also potential to leverage individual TADAT indicators in various ways to fully capture the richness of the data.

Taking the above empirical caveats into account, the central finding of the analysis is that investments in strengthening tax administration yield returns by reducing noncompliance and, in turn, enhancing domestic tax revenue. That said, reducing noncompliance visibly and consistently requires strengthening many aspects of tax administration (registration, filing, payment, compliance risk management, audit, dispute resolution, accountability and transparency – all performance aspects that TADAT measures). This suggests that targeting only one aspect of compliance may not yield the desired compliance effect over a sustained period, especially when the tax administration's capacity is weak. As well, the process may take years (not months), as evidenced by the countries that have most improved their TADAT scores. Thus, strengthening the tax administration system in a comprehensive way — which some countries have achieved over an average period of 5.81 years — could lead to a significant reduction in the compliance gap, resulting in higher tax collection.

If the tax administration, along with the whole government, assumes an active role in fostering an environment that promotes the social acceptability of the tax system, it will open another channel for reducing the compliance gap. This channel is highly significant in our results. While the effectiveness of other institutions plays a role, tax administrations can be instrumental in leading a whole-of-government approach to tax compliance and in promoting the tax system's legitimacy.

Finally, the tax administration's compliance strategy should take into account the structure of the economy; the latter plays a key role in determining compliance. In countries where the VAT is primarily collected at the border, customs administrations can help improve compliance by strengthening import controls and systematically providing this information to the tax administration, which in turn can use this as a source of third-party information to ensure compliance. Tax administrations face greater challenges in economies dominated by the agricultural sector and must apply appropriately designed compliance risk strategies to detect and address noncompliance effectively.

Appendix I. Literature

Several cross-country analyses have examined the role of tax administration in determining VAT compliance, though most fall short of analyzing the relationship directly.

Silvani and Brondolo (1993) and Agha and Haughton (1996) were among the first to conduct such analyses. Silvani and Brondolo correlated VAT design characteristics—such as rate level, number of rates, and years in force—with the compliance gap in 20 countries. However, they acknowledged that tax administration effectiveness was an important omitted variable due to a lack of data.

Agha and Haughton (1996) conducted a similar study for 17 OECD countries, attempting to capture the effect of tax administration on VAT compliance by using the volume of budgetary resources as a percentage of VAT collection to represent administrative effectiveness.

Christie and Holzner (2006) and Reckon (2009) developed models to estimate the determinants of the VAT compliance gap in EU countries. The former used a judicial/legal effectiveness index to represent the tax administration's audit capacity, while the latter used the corruption perception index as a proxy for institutional robustness.

Keen (2015) developed a VAT compliance gap model using estimates from the European Commission and individual EU countries for the period 2000–2011, incorporating tax administration budgetary resources as a key variable. More recently, CASE (2020) developed a VAT compliance gap model for EU countries using specific tax administration variables. These include the number of staff, administrative costs, IT expenditure share, number of audits, and the VAT electronic filing rate. However, this approach still falls short of capturing tax administration performance fully.

Building on these efforts, Butu (2021) expanded the model by incorporating broader institutional indicators such as fiscal freedom, government effectiveness, the Human Development Index, the Corruption Perceptions Index, and the share of people at risk of poverty or social exclusion.

In a different context, Das-Gupta et al. (2016) constructed a comprehensive effectiveness index for subnational tax administrations in India and correlated it with tax compliance levels. Lacking subnational compliance gap estimates they used tax collection as the dependent variable.

Similarly, Crivelli (2018) developed a tax administration strength score for 33 OECD countries. In this analysis the focus is on a collection efficiency index. Again, due to data limitations, this study considered tax revenue collection as the dependent variable, not compliance gaps.

AI.1 Synthesis of the Literature and the Current Analysis

Analysis	Dep. Variable	VAT Gap Estimation Methodology	Model	Observations/ period	Tax Administration Performance Variable (sign found)
Silvani and Brondolo (1993)	VAT compliance gap	Value-added model using Nat. Accounts	Cross-country	20 countries, years 1991/1992/1993	Years administering the VAT (-)
Agha and Haughton (1996)	VAT compliance gap	Consumption side estimation, based on proportions for UK VAT	Cross-country	17 OECD countries, 1987	Tax administration's budget resources (-), years administering the VAT (-)
Christie et al. (2006)	VAT compliance gap	EU Commission	Panel	29 OECD countries, 116 obs. 2000-2003	Judicial/legal effectiveness index to represent the tax administration's audit capacity (-)
Reckon (2009)	VAT compliance gap	EU Commission	Panel	23 OECD countries, 161 obs. 2000-2006	Country's corruption perception index as a proxy for the robustness of an institution such as the tax administration (-)
Keen (2015)	VAT compliance gap	EU Commission and countries' own estimates	Panel	27 countries, 297 obs. 2000-2011	Tax administration's budget resources (-)
CASE (2020)	VAT compliance gap	EU Commission	Panel	26 OECD countries, 468 obs. 2013-2019	Staff, administrative costs, IT expenditure share (-), number of audits (?), and VAT electronic filing rate (?)
This study: Baer and others (2025)	VAT compliance gap	IMF RAGAP Reverse Method	Panel	111 countries, 1,315 obs. 2010-2023	TADAT effectiveness (-), ISORA number of resources (staff) (?), contribution to promoting greater social acceptability of the tax system (-).

Source: authors based on references.

Appendix II. Allingham and Sandmo (A-S) Tax Compliance Risk Theory

Personal Income Tax

The tax compliance risk theory (Allingham and Sandmo (2005) and Sandmo (2005)) is based on a taxpayer who decides to evade a portion Γ of her/his tax obligation (Γ is the compliance gap). The taxpayer faces two possible scenarios. In the first scenario, she/he gets his way and obtains the return of the evaded amount. In the second scenario, she/he is detected by the tax agency and must pay the tax obligation and a fine rate *X* over the evaded amount. Considering *I* as the before-tax true income and and τ as the tax rate, then the first and second after-tax income scenarios would be $I_1 = I(1 - \tau(1 - \Gamma))$ and $I_2 = I(1 - \tau - \tau X\Gamma)$, respectively. The taxpayer will decide the level of Γ that allows her/him to maximize the expected return of the risk portfolio:

$$\max_{\Gamma} E[(1 - p)U(I_1) + pU(I_2)] \quad (2.1)$$

Where p, U(.), and E[.], represent the perceived probability of being detected by the tax agency, the individual utility function, and the expected value function, respectively. By maximizing equation (1) with respect to Γ, the standard predictions are obtained over its optimal level, Γ^*. A higher probability of detection, *p*, is associated with a decrease in Γ^*. A higher penalty rate, *X*, is associated with a lower Γ^*. The effect of the income, *I*, and the rate, τ, in the standard model requires some additional assumptions to be unambiguously predicted. The basic reason for this is that, in the model, the fine is expressed as a percentage of the product of the rate and income. This implies that if either of these variables changes—whether in the scenario of not being caught or of being caught—the return is affected. Therefore, the sign of the effect will depend on the relative magnitudes. For example, under the assumption of decreasing relative risk aversion, Γ^* would decrease when income declines. Under other assumptions, for example under an intertemporal compliance decision framework, a negative income shock in one period would increase Γ^* (Fishlow and Friedmann (1994)).

Indirect (or consumption-based) Taxes

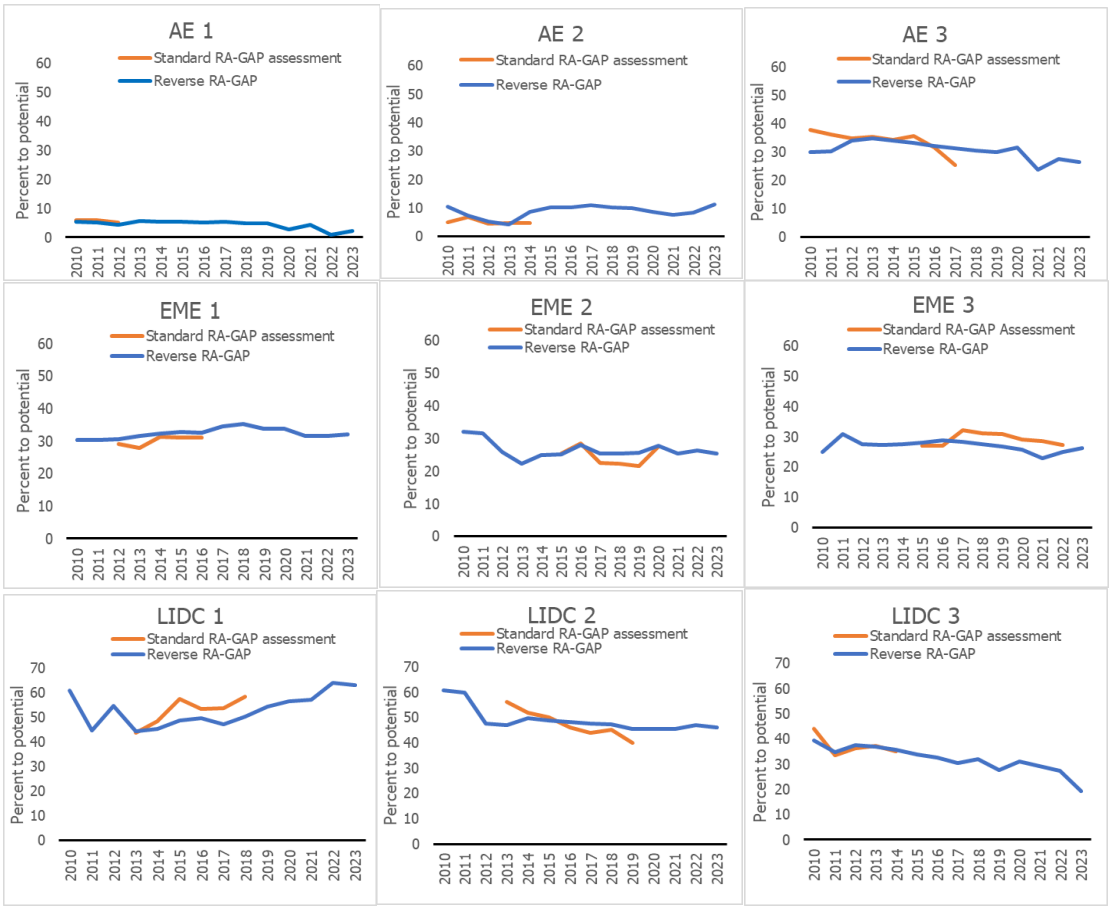
Sandmo (2005) carries out an extension of the compliance risk model for a firm that must decide the production and the level of evasion of a sales tax on its product. The firm produces a single output in the amount *O* with a production cost of *C*, sells it at a tax-inclusive price *Q*, and pays a sales tax τ per unit of output. It reports sales of $O(1 - \Gamma)$, where Γ is the portion of underreported sales. The firm will decide the levels of *C* and Γ that allow it to maximize the expected profits of the risk portfolio, considering a probability *p* of being detected and a fine of *X*. In the equation (2.1), the two after-tax profit scenarios would be $\Pi_1 = (Q - C)O - (1 - \Gamma)\tau O$ and $\Pi_2 = (Q - C)O - \tau O - X\Gamma\tau O$, where Π_1 and Π_2 would represent the after-tax profits in each scenario, respectively. The interesting prediction in this model is that the output decision is independent of the probability of detection and the fine, while these two variables continue having an effect on the sales tax compliance gap.

Extensions of tax compliance risk theory and alternatives approaches (based on Alm (2019))

One of the main criticisms of the compliance risk approach is that considering realistic values of the probability of detection and fines, the observed levels of noncompliance are far below those predicted by theory. In this sense, a series of extensions to the current model attempt to include other determinants in the individual taxpayer's decision. These extensions include the impact of withholding systems on income tax, the relationship between income evasion and labor supply, the existence of additional non-monetary fines, the existence of a moral cost or disutility of evasion (or a reward for honesty), the effects of complexity and compliance costs, the value of the government services financed by tax payments, etc. An alternative approach to the risk model comes from behavioral sciences. These alternative approaches typically consider that the variables perceived by the taxpayer do not always respond to rational criteria. Thus, the perception of the probability of detection in the minds of taxpayers would be far above the real probability of detection. The same non-rational perception can apply to the benefits and costs of the decision to evade. Another approach considers it is the social context that determines the noncompliance decision. Thus, the degree of evasion of an individual taxpayer could be influenced by the degree of evasion of the social group relevant to that individual. All these extensions and alternative approaches maintain as a central element the deterrent effects of the probability of detection and sanctions.

Appendix III. VAT Compliance Gap Estimates Based on the RA-GAP Reverse Method

AIII.Figure 1. VAT Compliance GAP in Selected Countries



Source: Based on Barra and Prokof'yeva (2025). Note: Country names have been omitted, considering that in several cases the standard RA-GAP assessment is not publicly available.

Appendix IV. VAT-induced CIT Compliance Gap

Concept

This concept operates with the following assumptions: (i) consistent compliance behavior by the representative VAT taxpayer and (ii) the representative VAT taxpayer is also subject to Corporate Income Tax (CIT). Under these assumptions, each underreported sale or overreported purchase for VAT purposes is expected to result in a corresponding underreporting of income or overreporting of expenses for CIT purposes.

Let's illustrate. Assume a standard VAT rate of 10 percent, and a taxpayer decides to evade VAT on a $100 sale. The VAT evaded would be $10. If the taxpayer is a "consistent evader", they would also omit this $100 from their CIT declaration (assuming a 15 percent CIT rate). The VAT-induced CIT evasion would then be $15. If detected, the taxpayer would owe $10 in VAT and $15 in CIT for that undeclared sale of $100. Additionally, we could consider that this income would also be underreported as a profit withdrawal by the "consistent evader" owner, partner, or shareholder of the company. In this case, the specific features of the average marginal PIT rate, as well as the role of credits or rebates, come into play—making it much more difficult to simply extrapolate the VAT-induced effect on PIT compliance.

Now, more formally, if we define τ_{CIT} as the standard CIT rate and τ as the standard VAT rate, then the VAT-induced CIT compliance gap will be determined by:

$$VAT - induced\ CIT\ Compliance\ Gap\ Amount = (\frac{\tau_{CIT}}{\tau})\ x\ VAT\ Compliance\ Gap\ Amount \quad (A4.1)$$

Assumption (i) seems reasonable: it is unlikely that a taxpayer would evade VAT on a transaction and then report it correctly for CIT purposes. Regarding assumption (ii), it is likely that in most tax systems, some VAT taxpayers are not subject to CIT, meaning that only a fraction of VAT evasion will lead to CIT noncompliance. Additionally, while most VAT noncompliance is typically linked to misreported sales or purchases, there may be other forms of noncompliance—for instance, product misclassification. But let us continue with the more general case. The total CIT gap will also include other forms of noncompliance arising through channels unrelated to VAT, so to estimate the total CIT compliance gap, we would need to add the component not induced by VAT. We will assume that there is a constant proportion representing this component, so if we use the variable K (where K > 1), the relationship between the two variables would be defined as follows:

$$Total\ CIT\ Compliance\ Gap\ Amount = K\ x\ (\frac{\tau_{CIT}}{\tau})\ x\ VAT\ Compliance\ Gap\ Amount \quad (A4.2)$$

Data

To estimate the relationship (A4.2) between VAT evasion and CIT evasion, we need to use cross-country data. Unfortunately, there are currently no comparable estimates of the CIT compliance gap by country based on a standard methodology using the same assumptions as those applied to the VAT compliance gap. Therefore, we will attempt an empirical estimation of equation (A4.2) in log-log form, using information provided by ECLAC

for a group of 12 Latin American countries,[29] all of which are classified as emerging market economies (EMEs). All estimates were calculated by the tax authorities of their respective countries using a standardized top-down method based on national accounts—specifically, gross operating surplus—to determine the potential tax base. This methodology was introduced by the IMF's RA-GAP (see Ueda (2018)).

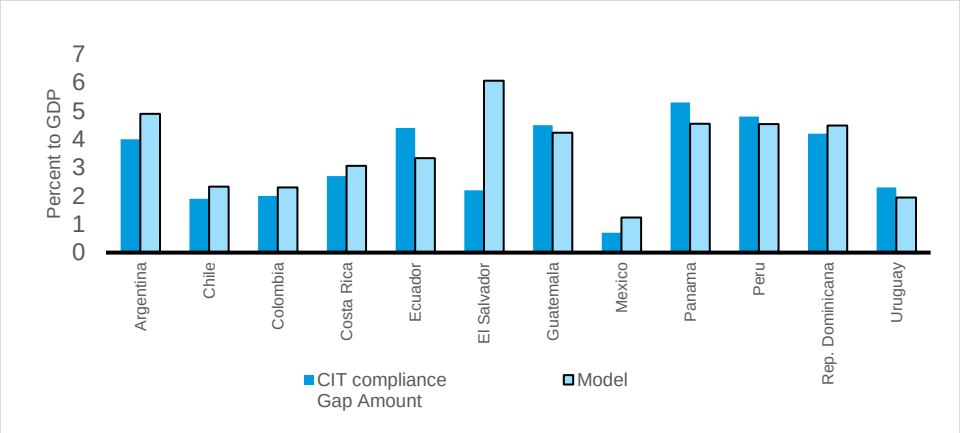
Results

The estimation model results are the following,

$$Log(CIT\ Compliance\ Gap\ Amount) = 0.00482799 + 0.575622 Log\left(\frac{\tau_{CIT}}{\tau}\right) + \\ + 0.986122\ Log(VAT\ Compliance\ Gap\ Amount) \quad \text{(A4.3)}$$

R2 Adj.=0.64
N=12 observations

AIV.Figure 1. CIT Compliance Gap Amount: Actual vs Model



Source: Authors based on ECLAC (2020).

We observe that the CIT compliance gap that is estimated based on our model is a fairly good fit (Figure AIV.1).

Estimating the VAT-induced CIT Compliance Gap for an LIDC with an average TADAT score

We input the world average CIT standard rate of 20 percent, the world average VAT standard rate of 15 percent, and the 0.6 percent of GDP variation in the VAT compliance gap from our exercise into equation (A4.3), and we obtain an associated impact of 0.7 percent of GDP in the CIT compliance gap due to VAT-induced variation. This figure does not change significantly when using the average CIT and VAT rates of 22.5 and 13.5 percent, respectively, for the case of the LIDCs we consider in our exercise.

[29] Economic Commission for Latin America and the Caribbean (ECLAC), Fiscal Panorama of Latin America and the Caribbean, 2020 (LC/PUB.2020/6-P), Santiago, 2020.

Appendix V. Robustness Check: VAT Revenue to GDP as the Dependent Variable

Arithmetic analysis

Following Keen (2013), we will use the two basic C-Efficiency, $C - Eff$, identities

$$C - Eff = (100 - \Gamma)(100 - P) \qquad (5.1)$$

$$C - Eff = \frac{VAT}{FC' x\, \tau} \qquad (5.2)$$

Where,
Γ :*Compliance gap to potential (in percent points)*
P :*Policy gap to potential (in percent points)*
VAT: Actual VAT collection
FC': *Final consumption* VAT-based ($FC - AVN$at. *A*cc.)
AVNat. *A*cc.: *Actual VAT collection from National Accounts*
τ : VAT standard rate
GDP: Gross Domestic Product

Combining (5.1) and (5.2), and dividing by GDP,

$$\frac{VAT}{GDP} = \frac{FC' x\, \tau\, x\, (100-\Gamma)(100-P)}{GDP} \qquad (5.3)$$

If we apply Log to both sides of equation (5.3) we obtain an empirical model as follows,

$$Log\ \left(\frac{VAT}{GDP}\right) = a + b\ Log\left(\frac{FC\prime}{GDP}\right) + c\ Log(\tau) + d\ Log\ (100 - \Gamma) + e\ Log\ (100 - P) + f \qquad (5.4)$$

Now, we could express our empirical model in a different but equivalent formulation, with (100 - Γ^*) instead of Γ^* as the dependent variable, in this form,

$$Log(100 - \Gamma^*) = \alpha' + \beta' Log(e_{TA}) + \gamma' Log(\eta_{TADAT}) + \lambda' Log(a) + \nu' Log(I) + \rho' Log(\tau) + \varepsilon' \qquad (5.5)$$

And if we replace (5.5) in (5.4),

$$Log\ \left(\frac{VAT}{GDP}\right) = a + b\ Log\left(\frac{FC\prime}{GDP}\right) + c\ Log(\tau) + e\ Log\ (100 - P) + f + d\ \{\alpha' + \beta' Log(e_{TA}) + \gamma' Log(\eta_{TADAT}) + \lambda' Log(a) + \nu' Log(I) + \rho' Log(\tau) + \varepsilon'\ \} \qquad (5.6)$$

Thus, an alternative equation using VAT to GDP as the dependent variable would be as follows:

$$Log\ \left(\frac{VAT}{GDP}\right) = a + b\ Log\left(\frac{FC'}{GDP}\right) + (c + d\ x\ \rho')Log(\tau) + e\ Log\ (100 - P) + dx\alpha' + dx\beta' Log(e_{TA}) + dx\gamma' Log(\eta_{TADAT}) + dx\lambda' Log(a) + dx\nu' Log(I) + f + dx\varepsilon' \qquad (5.7)$$

Results

Column (5.1) in Table AV.1 reflects the results of the last equation in the prior section, obtained using the TADAT score as a measure of tax administration performance. Columns (5.2) and (5.3) add the tax administration's operating expenditures to GDP ratio and staff per million inhabitants, respectively. Colum (5.4) considers the formulation of Column (5.1) but adds the number of VAT rates as another explanatory variable. To apply the Mundlak-Krishnakumar framework we consider two invariant exogenous variables: the Rule of Law Index mean,$\bar{a}$, and the agriculture to GDP ratio mean in logarithm, $\overline{Log(Agr)}$.

AV. 1: Dependent Variable: VAT to GDP

Variable	(5.1)	(5.2)	(5.3)	(5.4)
Time invariant endogenous				
Log (η_{TADAT})	0.756***	0.957**	0.462*	0.722***
Log (e_{TA})		0.125		
Log (L_{TA})			0.344***	
Time invariant exogenous				
$\bar{a}$	0.0960	0.0856	0.136	0.0555
$\overline{Log(Agr)}$		-0.0212	0.00966	
Time varying exogenous				
Lagged Log (I)	-0.0417	-0.104**	-0.0805**	-0.0235
Lagged (a)	0.0436	0.0367	0.0313	0.0533*
Lagged Log ($100 - P$)	0.647***	0.457***	0.668***	0.632***
Lagged Log (FC'/GDP)	-0.134***	-0.148***	-0.132***	-0.145***
Lagged Log (τ)	0.357***	0.286***	0.310***	0.478***
Lagged Log (Imp)	0.142***	0.143***	0.146***	0.133***
Lagged Log (Agr)	0.0120	-0.0374	0.0186	0.00803
Log (No. rates)				-0.0234
Constant	0.745*	-0.642	1.715***	0.365
Observations	1,315	1,224	1,199	1,265
Number of Countries	109	101	99	109
Year FE	YES	YES	YES	YES

Notes: Standard errors are not shown for simplicity. *** p<0.01, ** p<0.05, * p<0.1. We use a logarithmic transformation for most of the variables except for the rule of law perception index (a). P=Policy Gap to Potential. FC'/GDP=Final Consumption to GDP.
Source: Authors' own calculations.

Conclusion

Using the estimated effectiveness elasticity of 0.756, improving a tax administration's TADAT score from 1.85 (close to a D+) to 2.32 (close to a C+) would result in an increase of 0.7 percentage points of GDP. This is quite similar to the results obtained in our model when we use VAT compliance gap as the dependent variable.

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Closing the Gap: How Tax Administration Performance Shapes Compliance

Working Paper No. WP/2025/209