TECHNICAL

NOTES & MANUALS

Using Top-Down Compliance Gap Techniques to Supplement the Compliance Risk-Management Framework

TNM 2025/03

TECHNICAL NOTES AND MANUALS

Using Top-Down Compliance Gap Techniques to Supplement the Compliance Risk-Management Framework

Elena D'Agosto, Michael Hardy, Stefano Pisani, and Anthony Siouclis

Authorized for distribution by Ruud De Mooij

This note was prepared by Elena D'Agosto, Michael Hardy, Stefano Pisani, and Anthony Siouclis. It was reviewed by Debra Adams, Ruud De Mooij, Nikolay Gueorguiev, Andrew Kazora Okello, Sebastien Leduc, Andrea Lemgruber, Soren Pederson, Jim Sorensen, Rebecca Sparkman, Frank van Brunschot, and Graham Whyte.

Cover Design: IMF Creative Solutions

Cataloging-in-Publication Data
IMF Library

Names: Pisani, Stefano, author. | D'Agosto, Elena, author. | Hardy, Michael Andrew, author. | Siouclis, Anthony, author. | International Monetary Fund, publisher.
Title: Using top-down compliance gap techniques to supplement the compliance risk-management framework / Stefano Pisani, Elena D'Agosto, Michael Hardy, and Anthony Siouclis
Other titles: Technical notes and manuals.
Description: Washington, DC : International Monetary Fund, 2025. | TNM 2025/03. | Jan. 2025. | Includes bibliographical references.
Identifiers: ISBN:
9798400291555 (paper)
9798400291845 (ePub)
9798400291791 (web PDF)
Subjects: LCSH: Tax administration and procedure. | Tax collection. | Taxpayer compliance.
Classification: LCC HJ2305.P5 2025

Recommended citation:
D'Agosto, Elena, Michael Hardy, Stefano Pisani, and Anthony Siouclis. 2025. "Using Top-Down Compliance Gap Techniques to Supplement the Compliance Risk-Management Framework." IMF Technical Notes and Manuals 2025/03. International Monetary Fund, Washington, DC.

Please send orders to:
International Monetary Fund, Publication Services
PO Box 92780, Washington, DC 20090, USA
Tel: (202) 623–7430 | Fax: (202) 623–7201
publications@IMF.org
eLibrary.IMF.org
bookstore.IMF.org

Contents

ABBREVIATIONS

ARC	audit results on a cash basis
ARE	actual revenue
AREI	actual revenue at invariant compliance
ARR	audit yield collected on an accrual basis
CG	compliance gap
CRM	compliance risk management
DCG	diachronic compliance gap
DEA	direct effect of audit
FAD	Fiscal Affairs Department (of the IMF)
GCG	gross compliance gap
IMF	International Monetary Fund
MCPQ	macroeconomic changes in price and quantity
NCG	net compliance gap
NCI	non compliance index
ΔNCI	difference in NCI between two different time periods and can be decomposed into "behavioral" indices, ΔbNCI, and "compositional" indices, ΔcNCI
OECD	Organisation for Economic Co-operation and Development
TA	tax administration
VAT	value-added tax
VPI	voluntary payment indicator

I. Introduction

This note outlines how top-down compliance gap (CG) and compliance risk management (CRM)[1] techniques can be used together to provide an even more powerful tool for tax administrations (TAs) to measure and improve taxpayer compliance. This technical note describes, for experts who are working in CRM, how to use CG to supplement CRM. The advances in the granularity of CG allow it to be used (1) in a clustered fashion to support CRM, (2) to improve the consistency of likelihood and consequence ratings for risk assessments, (3) to identify emerging areas of risk, and (4) to better disaggregate direct and indirect revenue effects, including identifying the "behavioral component" within indirect effects and using the disaggregation of direct effects to determine optimal revenue recovery from each segment. These ideas are further described in the following sections.

CRM approaches are an established strategic approach adopted by TAs to maximize the overall level of compliance with tax laws (see, for example, Betts 2022). CRM processes have been formalized, documented, and recommended as good practices by international institutions for many years (see, for example, TADAT Field Guide 2015; OECD 2004). On reflection it would seem neglectful, and might diminish reader confidence in this note, if we did not also mention some of the early work on CRM reported by the OECD. Prior to this, many TAs had been starting to implement the individual processes used in CRM, although not necessarily as part of an integrated strategic approach.

CG estimates are a tool to measure the overall level of compliance with tax laws. Because CG estimates are a quantitative measurement of the extent of taxpayer compliance, a logical nexus already exists between CG and CRM. A CG estimate measures the amount of tax revenue forgone. A reduction in the CG estimate over time can be an indicator of the revenue effectiveness of CRM approaches applied over the same time period and vice versa.[2] This is the most straightforward use of CG techniques to supplement the CRM process. The creation of more granular CG estimates and using the data in more advanced ways will be called advanced CG[3] in this note.

This note describes how top-down CG methods can be used in conjunction with CRM.[4] A top-down CG method uses data within the TA that are combined with data external to the TA, usually from national accounts. To maximize the benefits of using advanced CG with CRM, a TA needs access to relevant, timely data, data with appropriate granularity, and the ability to perform some robust mathematic transformations.[5] Because TAs are continuously improving their access to data and their ability to use it, as well as their analytical capabilities, it is timely to demonstrate how the techniques of CRM and advanced CG can be powerfully combined.

1 This note assumes that the reader is familiar with CG and CRM concepts, including the use of risk matrices to plot likelihood and consequence assessments of risk. Further information about compliance gaps and CRM can be found at the IMF's Revenue Portal: https://www.imf.org/en/Topics/fiscal-policies/Revenue-Portal.

2 IMF (2015) "Current Challenges in Revenue Mobilization: Improving Tax Compliance," April, page 2. "The aim is not to eliminate gaps but reducing them can raise significant amounts: reduced value-added tax (VAT) gaps in Latin America in the early 2000s, for example, may have raised revenue by about 15 percent."

3 Advanced CG techniques might also be used to make revenue estimates of the value of taxpayer service initiatives. Estimating the revenue value of taxpayer services is not explored in this paper.

4 Other empirical approaches suggested by the literature such as tax efficiency or econometric methods are not appropriate for integrating CG into CRM. They do not take into account tax structure details when estimating CG.

5 Some of these transformations are explained in the body and appendix to this paper.

II. CG Clusters to Support CRM

Traditional CG techniques based on top-down estimates provide a measure of the aggregate consequences of noncompliance but provide limited granularity. Traditional CG techniques, such as for estimating a value-added tax (VAT) gap, attempt to quantify the total revenue lost through noncompliance with the tax law. The estimate is the difference between the theoretical amount of total tax that should be collected under full compliance and what is observed as being paid. The difference, excluding tax policy gaps, is the quantification of the total revenue lost through noncompliance. In risk terms, this is the quantification of the circumstances where the likelihood of noncompliance is 100 percent. However, traditional CG techniques identify an aggregate outcome without much, if any, granularity about where the noncompliance manifests. This traditional CG is an estimate of a gap at the level of a tax type, such as VAT, but it has limitations in its usefulness for treating the underlying noncompliance risks.

CRM techniques seek to identify compliance risks for treatment by estimating the likelihood and the consequence of the risks at a granular level. CRM techniques, among other things, assess risks of noncompliance with taxation law by attempting to assess the likelihood and consequence of each identified and described risk. The techniques attempt to identify the presence of risk at least at an industry sector or market segment level and then at a particular taxpayer level, if required, to allow for tailored treatment. However, the challenge to adequately review every industry or market sector and assign likelihood estimates is significant. Furthermore, the review process can be affected by matters such as confirmation bias. Where the risk assessment of an industry in a prior period has proven to be correct, there may be more data available for the subsequent assessment of the industry. Consequently there is a possibility that it could be assigned a higher likelihood of noncompliance because of the availability of data.

A Two-Step Process for Calculating CG Clusters

Advanced CG estimation techniques allow for more granular insights by industry, market segment, or any other type of cluster.[6] It is possible to estimate CG at levels below the tax-type level if the data are available. Calculating CG for clusters is a two-step process. Depending on the data available, a TA could develop a CG for clusters based on industry groups,[7] for example. A simple analysis might rank the industries from the largest contributor to a CG to the smallest. The same ranking, done with CRM data, should sort the industries into the same order. However, it is possible that there will be differences in the sorting based on the two different techniques because traditional CRM approaches may not have universal detailed coverage of all industries.

A comprehensive taxpayers' segmentation of CG clustering should consider both the industry sector and its economic size class. The risks to be addressed vary according to the characteristics of the production process, such as whether it is labor- or capital-intensive, and to the type of customer, that is, household or business. Dissection by industry sector and economic activity helps in clustering both of these characteristics. However, risks vary according to the economic size of the taxpayers; for example, the shadow economy is mainly concentrated in small entities, whereas sophisticated avoidance arrangements are more likely

6 "Clusters" are any type of subdivision of the data and might include subdivision by industry type, by entity size, by geographic location, or by a combination of these, such as VAT for medium-sized businesses in the transport industry in the southern region. To avoid confusion with the concept of "market segmentation," which is typically a division of taxpayers by size, the term "clusters" will be used in this paper for subdivisions of a tax-type CG.

7 Clusters might be much more granular than this, further divided by taxpayer size or geographic region or both. For personal income tax (PIT), for instance, it could also be on the line-item level of the tax return.

seen in large, complex enterprises. Classification by industry sector and economic size can be obtained by applying a two-step process.[8]

In the first step, a standardized top-down methodology is used to obtain the estimated CG by sector of economic activity. The most common methodology for a VAT gap estimation, for example, is to obtain national accounts statistical data, principally the supply–use or input–output tables. The method adds the tax applicable to the domestic output and subtracts credits applicable to intermediate demand and gross fixed capital formation (see Hutton 2017).

In the second step, ad hoc methodologies are used to make additional estimates. The second step needs to be adapted to the information available in each country to break down the CG by sector into the size classes. This step cannot be standardized because of the heterogeneity of the country's needs, so bespoke approaches are chosen. In the second step, the appropriate estimation procedures are used to derive a CG estimate broken down into key clusters. These estimates are made within the boundary provided by the CG results obtained in the first step. This two-step process makes it possible to reduce the degree of uncertainty in the final estimates because the methodologies followed in the first step are based on a transparent and standardized approach.

The VAT CG by sectors of economic activity determines the boundaries within which further cluster dissection can be carried out. VAT CG estimates by economic activity sector, obtained through the IMF's Revenue Administration Gap Analysis Program (RA-GAP) methodology,[9] could be the result of the first step of the procedure. These estimates provide the value of each sector's potential VAT (pVAT), that is, the maximum VAT that would be possible to collect under current legislation and under the assumption of full compliance. pVAT can be decomposed into two components: the VAT actually paid, aVAT, and a multiplicative factor indicating the propensity not to pay VAT correctly, *pr* = CG/aVAT.

In the second step, each sector's pVAT is disaggregated by size class of taxpayer. The second step of this procedure does not require estimation of pVAT level by size class but only requires an estimation of *pr* for each size class. The estimation of *pr* depends on the available data and information. Table 1 shows an example tabulation of VAT CG, including the relationships between *pr*, aVAT, and pVAT.

Table 1. Example Tabulation of VAT CG by Market Segments

Dimensional Class	*pr* = C	aVAT	pVAT = (1 + *pr*)´ aVAT
Large	Unknown	Known	Inferred
Medium	Unknown	Known	Inferred
Small	Unknown	Known	Inferred
Total	**Known**	**Known**	**Known**

Source: Authors.

Note: CG = compliance gap; VAT = value-added tax.

[8] A bottom-up methodology based on research audits can also provide the level of granularity required for segmentation. A research audit program can ensure the breakdown by industry sector and economic size class. This methodology can be applied by more developed countries, although it is relatively expensive in smaller countries because, to ensure an accurate degree of reliability to the estimates for each cluster, the audit sample must be large enough. Note: A research audit program, such as a randomized control trial, may consist of audits that are selected by a random process. If the audits are selected by random method, because this is what is required to provide the research data, it is pejorative to call the audits "random audits," and they should correctly be called research audits.

[9] Selection bias correction can be done by applying both statistical and econometric techniques, such as propensity score matching or using other econometric tools.

For countries that do not have a consolidated information system, the estimate of *pr* can be obtained by relying on operational data and the experience of tax auditors. For example, a Delphi[10] technique may be used to collect the opinions of expert auditors on the value of *pr* for each size class. For countries that have a sufficiently mature information system, the results of risk-based audits corrected by selection bias can be used.

$$\text{pVAT} = \text{aVAT} + \text{CG} = \text{aVAT} + pr \times \text{aVAT} = \text{aVAT}(1 + pr)$$

It is necessary to consider the degree of reliability of the first- and second-step estimates. It is very likely that the second-step estimates have a lower degree of reliability than the first-step estimates because they require more assumptions to be made. Therefore, it is advisable to use these results only for internal TA operational purposes. The results can be used to determine the best allocation of compliance resources across size classes to address the CG based on both the size of CG for each size class and the propensity to pay, which itself can be a measure of noncompliance.

[10] The Delphi Method is a group technique used to gather reliable consensus from knowledgeable individuals through a series of questionnaires, particularly useful for predicting trends, setting standards, and forming guidelines.

III. Improved Consistency of Risk Likelihood and Consequence Ratings

Risk prioritization in the CRM framework uses likelihood and consequence ratings. In CRM, a risk matrix[11] is used to help prioritize risks. The matrix considers the likelihood or probability of a risk occurring and the consequences if the risk does occur.

Advanced CG can improve the consistency of likelihood ratings. Conceptually, determining the probability of a risk occurring is simple, but practical questions arise. In response to the question, "What is the probability of a business not declaring all of its cash sales income?," a TA might answer "80 percent." In response to the question, "What is the probability of a business being involved in transfer pricing?, a TA might answer "Only 10 percent of businesses have cross-border related-party transactions, but we think that 80 percent of them are involved in transfer pricing." Is the likelihood 80 percent because it is 80 percent of the population that could engage in transfer pricing, or is the likelihood 8 percent because this is the likelihood as assessed against the total business population? The answer may depend on the judgment and experience of the officers assigned the task. Because different teams may be assigned to different likelihood estimations, there can be a lack of consistency and true comparability in the ratings.

Using advanced CG, likelihood is the share of the CG of a cluster in proportion to the potential collection of the same cluster. Suppose there are only two clusters, "A" and "B", in the economic system. "A" has a potential revenue of 1,000, and "B" has a potential revenue of 100. The potential revenue of the whole economy is 1,100 ("A"+"B"). Suppose, further, that the CG of "A" is 110 and that of "B" is 22. The likelihood calculation for cluster "A" is 0.11 (110/1,000), and for cluster "B" it is 0.22 (22/100).

Using advanced CG, the consequence is the size of a CG of a cluster relative to the total potential collection across all clusters. As a CG estimates the actual observed gap in revenue collection, it measures the sum of all the risks that have been realized. With likelihood a constant,[12] this makes it easier to estimate the consequence. Using the same details as discussed earlier, the consequence of cluster "A" is 0.10 (110/1,100), and the consequence of cluster "B" is 0.02 (22/1,100). Note that this is just the consequence as measured in tax revenue. TAs may also need to consider consequences in terms of societal expectations or other variables.

Rather than just being ranked in order, risks are typically mapped onto a compliance risk matrix.[13] The risk matrix will often have color coding, such that pairings of a higher likelihood and a higher consequence are colored red, pairings of a lower likelihood and a lower consequence are colored green, and intermediate combinations are colored yellow. Table 2 provides an example of a compliance risks matrix displaying risks for a set of clusters, A–S.

[11] See Table 2 for an example of a risk matrix.

[12] As the risk has been realized, the likelihood value is 100 percent.

[13] To provide a clearer interpretation of the compliance risk matrix, the two indicators derived for each segment of the population are converted into a ranking scale that includes five risk categories: low, low-medium, medium, medium-high, and high.

Table 2. Illustration of a Compliance Risk Matrix

Indicator	Likelihood					
Consequences	**Categories**	**Low**	**Low-medium**	**Medium**	**Medium-high**	**High**
	High	**A, F, K**	**R**		**C, G, H**	**I, O**
	Medium-high		**J, S**		**B**	
	Medium			**M**	**N**	
	Low-medium		**D, E**	**L**		**P, Q**
	Low					

Source: Authors.

IV. Identification of Emerging Risks

Advanced CG can also help identify emerging risks. If the likelihood and consequence ratings for any cluster are compared at two or more points in time, a trend in likelihood and in consequence can be established for each cluster. The change in either likelihood or consequence can be ordered into categories, such as High Decrease, Medium Decrease, Stable, Medium Increase, and High Increase. This allows for a dynamic compliance risk matrix to be constructed, as represented in Table 3. Again, green, yellow, and red colors are assigned to support the interpretation of the matrix.

A summary table provides an overview of the analysis of compliance risks for each cluster. A compliance risk description table can illustrate findings for each cluster by rearranging the results from Tables 2 and 3 into a combined table, as shown in Table 4. For the clusters shown, cluster L, currently considered "green," displays increases in both likelihood and consequence.[14] It is therefore trending "red" and represents a risk with a trend indicator that shows it is likely to have a higher risk rating in the future if the trend persists over time. The same approach can be used within an industry or market segment population to identify the changes in likelihood and consequence over time for a particular taxpayer.

Table 3. Example of Dynamic Compliance Risk Matrix

Indicator	Likelihood					
Consequences	**Categories**	**High Decrease**	**Medium Decrease**	**Stable**	**Medium Increase**	**High Increase**
	High increase	**R**	**F, K**		**B**	**I**
	Medium increase		**J**	**C**	**L**	**O, P**
	Stable	**A**	**G**	**D, E**	**M, N**	
	Medium decrease		**H**	**S**		**Q**
	High decrease					

Source: Authors.

Table 4. Example of Compliance Risk Description Table

Cluster	Consequence		Likelihood		Total	
	Level	**Trend**	**Level**	**Trend**	**Level**	**Trend**
A	High	Stable	Low	High decrease		
C	High	Medium increase	Medium-high	Stable		
L	Low-medium	Medium increase	Medium	Medium Increase		

Source: Authors.

[14] Typically, there is greater variability in likelihood ratings over time compared with consequence ratings.

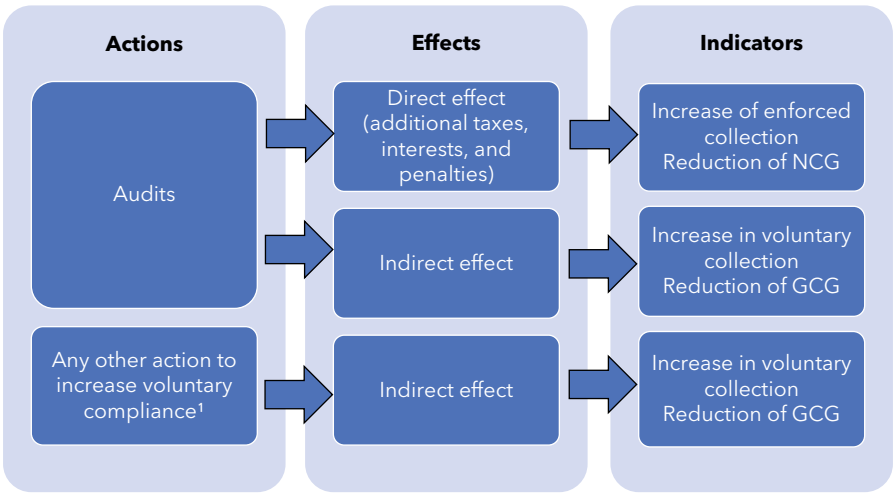
V. Disaggregating Direct and Indirect Revenue Effects

TAs deploy a wide range of techniques to improve and assure compliance with the tax laws. These include providing education to taxpayers about how to understand and voluntarily comply with their obligations, simplifying administrative procedures, providing services such as the prefilling of tax returns with known data from third parties, offering binding rulings, improving the tax morale of the community by engendering trust and confidence in the integrity of the TA and by conducting audits of taxpayers assessed as having a higher risk of not voluntarily complying with their obligations.

Some TA compliance techniques have direct and indirect effects on tax revenues (see Figure 1). The direct revenue effect of TA activities consists of the additional taxes, interest, and penalties collected through audits and taxpayer disclosures made by the taxpayer during the course of a compliance activity initiated by the TA. This measure, audit yield, is easily measured and is sometimes the only compliance measure used by TAs. The indirect revenue effect refers to the increase of revenue because of the change in voluntary tax compliance as a result of the TA's efforts in activities, such as education, publicity, or taxpayer service. Furthermore, there is an indirect effect on taxpayers who have been subject to audit in the years directly after the year in which the audit is completed (see, for example, Beer and others 2019, or Kasper and Alm 2022).

Both direct and indirect revenue effects have an influence on a CG. At any point in time, it is possible to say that a CG was reduced by the direct revenue effects for the year. However, it is also useful to know the reduction in the CG as a result of the indirect revenue effects. CGs have a gross component and a net component. The gross CG (GCG) is the difference between the amount of potential tax and the amount of tax that was actually paid on time. In this definition, late payments and payments as a result of enforced collections are not included in the comparator against the potential tax. The GCG can be considered an indicator of voluntary compliance because it represents payments made on time and without direct intervention by the TA. The net CG (NCG) is the difference between the amount of the potential tax and the comparator consisting of the GCG with the addition of late payments and enforced collections. GCG focuses more on voluntary compliance, whereas the NCG includes the results of the TA's enforcement activities. Figure 1 represents the logical links that exist between TA actions, their direct and indirect effects, and their influences on CG. It shows that the GCG is not affected by the direct effect of audits (DEAs), which only affect the NCG.

Figure 1. Link Between TA Action, Their Effects, and Their Influences on CG



Source: Authors.

Note: GCG = gross compliance gap; NCG = net compliance gap.

[1]For example, change in the penalty regime, taxpayer education, simplified administration, prefilling, binding rulings, or other taxpayer service initiatives.

Estimating the Indirect Revenue Effects

The indirect revenue effect has two components—a "compositional component" and a "behavioral component." The specific component of greatest interest is the "behavioral component," which is the estimation of that part of a change in the GCG, which is explained by a change in taxpayer behavior. Isolating the "behavioral component" requires mathematical transformations that adjust (1) for the relationship between GCG and NCG, (2) for macroeconomic changes in price and quantity (MCPQ), (3) for monetary gains or losses, (4) for changes in tax policy, and (5) for the removal of the "compositional component."

Begin by considering the changes in the GCG along with other indicators. Specifically, the GCG is the initial indicator to monitor the indirect revenue effect. Because other factors may affect it, GCG should be read together with the NCG to start inferring the significance of the effect of enforcement activities.

The MCPQ affects revenue collection. The tax base and the changes in prices and quantities of commodities and services are quoted in nominal values, so the CG can vary according to changes in the prices and the quantities of commodities and services sold in the market. These changes also affect revenue collection and can influence the GCG.[15] To account for this, it is useful to normalize the tax gap in percentage terms, which takes account of changes in Gross Domestic Product (GDP) (see Ebrill and others 2001, p. 40). This normalization is usually made by dividing GCG by GDP. The time series of this ratio shows the trend of GCG adjusted by MCPQ.

The GCG is influenced by changes in tax policy. Any innovation in the tax policy framework, for example, new exemptions or changes in tax rates, increases or decreases the actual tax collected and the potential tax that should be paid by taxpayers, and in turn, influences the GCG.[16] Tax law changes are not captured

[15] Assume that a construction company carries out a renovation of an apartment worth $5,000 without declaring it to the TA. If the same taxpayer's tax burden is 30 percent, then his evasion would amount to $1,500. Assume that in the following year he makes a renovation identical to the previous year, but, in the meantime, prices have increased, and the cost has risen to $6,000. Therefore, the taxpayer's evasion also increased from $1,500 in the previous year to $1,800 in the current year, even though the taxpayer's behavior remained the same.

[16] For the purposes of this note, we consider only changes in policy that have an effect on the determination of the tax base, for example, through changes in the exemption thresholds, and on tax rates.

by the comparison with the macroeconomic indicators because they do not directly or fully influence the calculation of these indicators.[17]

The potential tax calculated in the GCG analyses considers both aspects. The methods used for estimating the GCG involve calculating the potential tax, that is, the theoretical amount of tax estimated in the case of full compliance with the current tax law. So, the potential tax incorporates both MCPQ and the changes in tax legislation.

The ratio between the GCG and the potential tax is the Noncompliance Index (NCI). It can be calculated at a tax-type level or at a cluster level. It is equivalent to the likelihood value for a cluster. The higher the indicator, the lower the degree of taxpayer compliance.[18] NCI removes the effect of tax changes and MCPQ.

NCI makes it possible to quantify monetary gains and losses as a result of changes in the compliance rate. The "Actual Revenue at Invariant Compliance" (AREI) indicator allows for quantifying the gains and losses as a result of changes in tax compliance. This indicator answers the question, "What is the amount of revenue that would have been collected if the noncompliance rate, NCI, in period t were the same as in period $t - 1$?"

From a theoretical point of view, AREI is founded on the construction of a counterfactual scenario based on the assumption of the invariance of NCI over two different time periods, for example, year t and year $t + 1$. The counterfactual scenario is calculated by multiplying the potential tax (PTAX) estimated in the year $t + 1$ by the $(1 - \text{NCI})$ of the year t.

$$\text{AREI}_{t+1} = (1 - \text{NCI}_t) \times \text{PTAX}_{t+1}$$

The actual revenue (ARE) change can be decomposed as follows:

$$\text{ARE}_{t+1} - \text{ARE}_t = (\text{ARE}_{t+1} - \text{AREI}_{t+1}) - (\text{ARE}_t - \text{AREI}_{t+1}),$$

given that

$$\text{ARE}_t = \text{PTAX}_t \times (1 - \text{NCI}_t) \text{ and } \text{ARE}_{t+1} = \text{PTAX}_{t+1} \times (1 - \text{NCI}_{t+1}),$$

then

$$\text{ARE}_{t+1} - \text{ARE}_t = (\text{NCI}_t - \text{NCI}_{t+1}) \times \text{PTAX}_{t+1} + (1 - \text{NCI}_t) \times (\text{PTAX}_{t+1} - \text{PTAX}_t),$$

where

$$(\text{NCI}_{t+1} - \text{NCI}_t) \times \text{PTAX}_{t+1}$$

is the gain or loss because of the change in voluntary compliance (NCI), given the new potential revenue and

$$(1 - \text{NCI}_t) \times (\text{PTAX}_{t+1} - \text{PTAX}_t)$$

is the gain or loss because of the change in PTAX that is affected by the change both in price and quantity and in tax legislation at given compliance.

[17] For example, if a new VAT exemption of a commodity is induced, the GCG of that commodity goes to zero, whereas the national account household consumption figure is only marginally reduced, because the previous tax base remains unchanged and only the part of the VAT actually paid goes to zero.

[18] It assumes a value of zero in the case of perfect compliance and 100 in the case of utter lack of compliance.

To quantify the dynamics of tax compliance more accurately, in addition to the two factors already mentioned, the effects of the change in economic structure (compositional component) must be considered.

Changes in Taxpayer Behavior Measured through the NCI (ΔNCI)

The dynamic representation of NCI shows the change in the rates of noncompliance. A dynamic representation is obtained by taking the first difference of NCI, which is equal to NCI_t minus NCI_{t-1}, which is referred to as ΔNCI. If the result is negative, it can be assumed that there has been a recovery in the compliance rate, and if it is positive, there has been a decline in the compliance rate.

Understanding the "compositional component" of NCI: for instance, let us consider the case of exogenous shocks caused by the COVID-19 pandemic. Restrictions introduced by countries to contain the contagion selectively affected different sectors of economic activity. For discussion, assume that the tourism sector has a higher NCI than the utilities sector. Under COVID-19 policies, government regulation may have shut down the tourism sector, although utilities continued to operate. Under this circumstance, all else being equal, ΔNCI would show an increase in compliance behavior. In this instance, NCI changes because of underlying factors other than compliance. This is known as the "compositional component."

Controlling for the "compositional component" makes it possible to focus on the "behavioral component." To address the changes in compliance behavior for each taxpayer segment examined, a behavioral NCI, ΔbNCI, can be constructed. This varies if, and only if, at least one segment of taxpayers has changed its NCI.[19] By applying a simple algebraical transformation to ΔNCI, it is possible to decompose it into the part capturing the compositional component, ΔcNCI, and the part related to the behavioral component, ΔbNCI.

ΔNCI Decomposition

ΔNCI is affected by the "behavioral component," ΔbNCI, and by the "compositional component," ΔcNCI; this link can be expressed by the following equation:

$$\Delta NCI = \Delta bNCI + \Delta cNCI$$

ΔNCI can be written as follows:

$$\Delta NCI = \sum_{i=1}^{n} \frac{GCG_{it}}{PTAX_{it}} \times \frac{PTAX_{it}}{\sum_{i=1}^{n} PTAX_{it}} - \sum_{i=1}^{n} \frac{GCG_{it-1}}{PTAX_{it-1}} \times \frac{PTAX_{it-1}}{\sum_{i=1}^{n} PTAX_{it-1}},$$

where *i* is the sector of economic activity and PTAX is the potential tax.

ΔbNCI = Behavioral component

$$\Delta bNCI = \sum_{i=1}^{n} \frac{GCG_{it}}{PTAX_{it}} \times \frac{PTAX_{it-1}}{\sum_{i=1}^{n} PTAX_{it-1}} - \sum_{i=1}^{n} \frac{GCG_{it-1}}{PTAX_{it-1}} \times \frac{PTAX_{it-1}}{\sum_{i=1}^{n} PTAX_{it-1}}$$

ΔcNCI = Compositional component

$$\Delta cNCI = \Delta NCI - \Delta bNCI$$

The "behavioral component" is designated as ΔbNCI and is a measure of the change in the taxpayers' willingness to comply with tax laws. The procedure to calculate ΔbNCI allows for the removal, as much as

[19] See Italian Ministry of Economy and Finance (2020, pp. 16–17) for further details on the methodology. This approach has the disadvantage of not being invariant to the level of disaggregation adopted in the calculation. So, it is advisable to apply the most granular decomposition available.

possible, of other causes influencing the variations of the CG, except for taxpayers' willingness to comply. That is, ΔbNCI can be considered a proxy of changes in taxpayers' compliance behavior.

ΔbNCI can be influenced by several factors, generally slow-moving. The changes in taxpayer's behavior may be affected by the strength and stability of the TA. Exogenous factors include tax morale and changes in the business cycle. Generally, these exogenous factors change slowly over time, except for the reaction taxpayers have to abrupt changes in the business cycle. Many studies have analyzed how the business cycle can influence taxpayers' behavior,[20] and the results from most of these studies suggest that there are reduced levels of taxpayer voluntary compliance during downturns in the business cycle.

Monitoring the Indirect Effect in Practice

The time-series analysis of the benchmark indicators can inform the TA about the path they are following to increase levels of tax compliance. The benchmark indicators for the most developed countries are ΔbNCI and CG. The basic requirement for the analysis is the availability of a sufficiently long time series of ΔbNCI, AREI, or both to determine how the CG will react to the different phases of the business cycle. The analysis should first focus on the identification of medium-term trends in the CG. Insights on how the CG reacts to the different phases of the business cycle can also be derived.[21]

Use caution when applying ΔbNCI and AREI as outcome indicators. ΔbNCI and AREI provide target indicators of the TA's objective of collecting the revenue payable as required by the law. However, caution should be exercised as both indicators can be affected by residual exogenous factors and statistical error. So, the TA should set realistic targets to be achieved over several years by setting a confidence interval[22] with a maximum and minimum value. This is a target range within which the target is still considered to be achieved.

ΔbNCI and AREI cannot be used as automatic indicators to assess the performance of the tax agency. The inclusion of the CG as a benchmark indicator (or a revenue performance indicator) is necessary for familiarizing TA staff with the following concepts of the tax gap assessment: the key definitions of gap methodology, the trend analysis of the gap, and the correlation between the actions of the TA and the fluctuations in the gap. When TAs have become sufficiently familiar with how to interpret the evolution of the CG, they might consider introducing ΔbNCI and AREI as reference indicators. In any case, these indicators should not only be linked to incentives or disincentives for improving the CG but rather be used as a part of the "prompt" or "nudge" type[23] interventions that can improve voluntary compliance and, therefore, voluntary revenue collected.

Estimating the Direct Revenue Effects

CRM, *among other things*, directs audit interventions in the current year, but which are typically audits of prior year activities. Audit outcomes are a component of the NCG, but they are typically a component of audits that began in an earlier period. It is not correct to assume that audit revenues in period *t* relate solely

[20] See, among others, IMF (2015), CASE (2020), Ueda (2017), Brondolo (2009), Alabede, Ariffin, and Idris (2011), Batrancea and others (2019), Baum and others (2017), Marandu, Mbekomize, and Ifezue (2015), Carfora and others (2020), and D'Agosto, Marigliani, and Pisani (2014).

[21] ΔbNCI and AREI, as well as all statistical estimates, may have large margins of error. Therefore, when interpreting results, distinguishing between significant changes in the trend from the fluctuations because of statistical errors is critical. This ensures that what is being seen is signal rather than noise.

[22] The confidence interval represents the ranges of ΔbNCI and AREI that we have confidence is unaffected by variations induced by exogenous factors.

[23] The approach steers people in certain directions while maintaining their freedom of choice with the recognition that many decisions are not made completely consciously. Nudges have been proposed as an effective way to change behavior at a lower cost than traditional tools based on incentives and disincentives. See Thaler and Cass (2008).

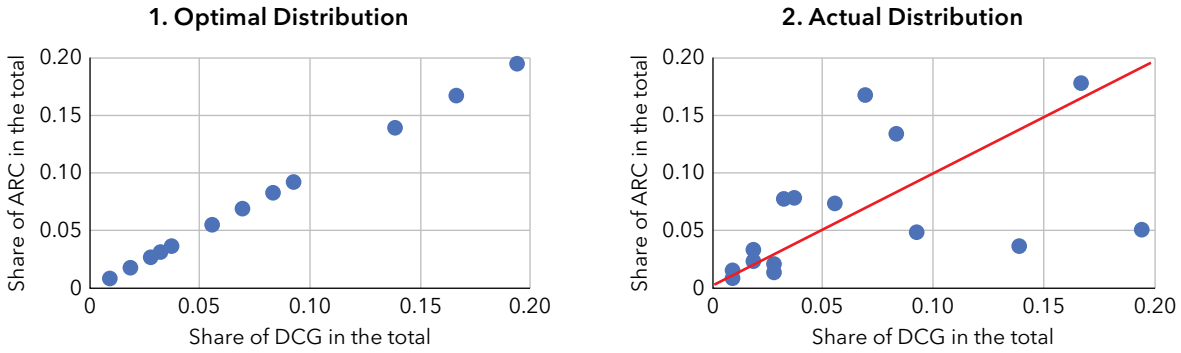
to the CG for period *t*. If a TA has the authority to audit up to four years prior to the most recent return that was filed by a taxpayer and the TA conducts an audit in year *t*, covering the years $t-1$, $t-2$, $t-3$, and $t-4$, the audit may have an effect on the size of the CG in those prior years, depending on if any of the revenue adjustment relates to those years. Furthermore, the size of the revenue adjustment related to $t-1$, $t-2$, $t-3$, and $t-4$ is likely to be different and will represent a different proportion of the CG for the relevant periods. Most typically, audit results are reported on a cash basis in period *t* but relate to adjustments to the tax that should have been paid in prior periods.

For advanced CG to supplement CRM, the CG estimates need to be adjusted to take into account the timing effects of how audit results are reported. Once the adjustments are made, advanced CG techniques can identify the effectiveness of the audit interventions in their effect on the CG. The detailed adjustments are explained in Appendix 1. The calculations create several important variables, notably the Audit Results on a Cash Basis (ARC), the Audit Results on a Cash Basis in period *t* (ARC^t), and the Diachronic CG (DCG).[24] DCG is a weighted average CG at a particular period, *t*, which incorporates components of CG in periods prior to period *t*, in the same way, that audit adjustments in period *t* reflect adjustments to the tax that should have been paid in periods prior to period *t*.

The comparison of ARC and DCG can be mapped. The DCG and the ARC from each taxpayer cluster are divided by the respective totals, and these percentages are reported in Figure 2, where each dot represents a taxpayer cluster.

When the ARC^t ratio is equivalent to the DGC_t ratio, the direct revenue results from audits are proportionate to the CG estimate for the cluster. This is indicative of the direct audit revenue recovered from each cluster being in proportion to that clusters' contribution to the overall CG. Allowing that direct audit revenue recovery is reflective of investment of compliance resources, if the ARC^t ratio is equivalent to the DGC_t ratio for any cluster, the TA has invested an "optimal" amount of resources into compliance for that cluster. Additional resources may recover additional revenue, but the revenue will be in excess of the proportion of the contribution of the cluster to the overall CG, and such investment is likely to mean an opportunity cost of under-recovering revenue from some other cluster. Visually, the proportionate investment is where each dot lies on the line bisecting the axes (Figure 2, panel 1 graph). More likely, real-world calculations would reveal a distribution where direct audit revenue is either higher or lower than the optimal recovery (Figure 2, panel 2 graph). The ratio between ARC^t and DCG_t is known as the DEA.

Figure 2. Comparison Between the Distribution of DCG and the Distribution of ARC among Different Clusters of Taxpayers



Source: Authors.

Note: ARC = audit yield collected on a cash basis; DCG = diachronic compliance gap.

[24] See Appendix 1 for detailed discussions.

Using Direct Effects to Model Optimal Revenue Recovery from Each Segment

There are several statistical methodologies that will enable calculations of the difference between the actual and the optimal distribution.[25] To optimize an audit program with the intent of recovering revenue from a cluster in proportion to the contribution of that cluster to the CG, more effort should be put into clusters that plot below the bisecting line, and less effort can be applied to clusters plotting above the bisecting line.

DEA can assist a TA in applying resources to the areas of greatest compliance risk. The TA has a fixed amount of resources to devote to tax audits because of public budget constraints. These constraints make it difficult to increase the number of tax audits to improve effectiveness against noncompliance. Effectiveness can also be improved by changing the allocation of audits among different categories of taxpayers, redirecting effort toward the most noncompliant groups. The DEA indicator can be used to assist this reallocation.

[25] The "mean absolute percentage error" is one of the simplest indicators that is commonly used as a loss function for regression problems (https://en.wikipedia.org/wiki/Regression_analysis) and in model evaluation because of its intuitive interpretation in terms of relative error.

VI. Conclusion

Advanced CG supports a TA in pursuing its goal of increasing voluntary tax compliance when integrated with CRM. It provides a metric to measure gains and losses because of compliance fluctuation and, in this way, can help the TA contain risks and monitor outcomes. To implement this approach, CG should integrate with CRM. This note has explained how making the mathematical transformations to estimate a CG at a cluster level (advanced CG) can allow for comparison with the typical market segment or subsegment analysis undertaken in CRM. Advanced CG estimates allow for likelihood and consequence estimates to be made and for comparisons between different clusters to guide the application of resources to best reduce the CG. Furthermore, changes in the estimates of likelihood and consequence from CG estimates can be used to identify emerging risks, and dissection of the CG at the cluster level can reveal the influence of direct or indirect compliance effects, including the change in the indirect effect that can be attributed to a change in taxpayer behavior. Other possibilities for advanced CG to supplement CRM include estimating the revenue value of taxpayer service initiatives.

APPENDIX 1. Adjusting for Timing Differences in Audit Results and CG Estimates

Audit revenue outcomes are a component of the NCG.[26] The direct compliance effect of a TA's enforcement activity is observable in the CG framework. Indeed, ideally, the greater the CG for a cluster of taxpayers, the greater the tax assessed by tax audits, provided the CRM strategies are aligned to addressing the key risks that are driving the CG.

CG provides a further indicator for monitoring the effectiveness of audits.[27] As a first step, the results of tax audits should be reclassified according to the same principle of CG time recording. This means that the results of tax audits should be classified according to the tax period in which the economic activity occurs (the reporting period). Usually, the results of the audits are recorded according to the collection period, the period in which the activity is completed, the tax liability is raised, or the tax is paid. The classification of the audit according to the reporting period is defined as accrual reporting, whereas the classification based on the collection period is defined as cash reporting.

An adequate reporting system for audits is required. Adequate reporting should be based on a cross-classification of the audit according to both the reporting (accrual), ARR, and the collection (cash) periods, ARC. An example of this classification is provided in Appendix Table 1.1, where AR represents the tax assessed through the audit activity and paid by taxpayers, the superscript is the collecting year, and the subscript is the reporting year.

Typically, audit yields are recorded on a cash basis. There are two main reasons for this: first, the TA is focused on the public budget, which usually adopts a cash accounting rule; second, exhaustive data based on the reporting period are available only after a large time lag because the complexity of the audit process makes it time-consuming. The example in Appendix Table 1.1 shows that exhaustive results for the reporting period are available with a time lag of five years.[28] In fact, the exhaustive result for the fiscal year $t - 6$ (ARR$t - 6$) is available in the collecting year $t - 1$ and for the year $t - 5$ (ARRt $- 5$) in the collecting year t.

[26] The amount of revenue collected is the metric used to monitor the direct effect of the tax audit. At this stage, we assume that all the tax audits are based on an accurate risk analysis and then a positive correlation between the number of audits conducted and the results in terms of tax collected can be accepted. This simplified hypothesis could be relaxed according to the data availability and to the economic context of each country in which we apply the monitoring. The empirical indicator used to quantify the effect of tax audit should be chosen carefully. In this case, two options could be available: (1) the amount of revenue paid by taxpayers as a result of the audit activity, and (2) the amount of liability assessed through the audit activity. Both measures have pros and cons that should be evaluated according to each country's situation.

[27] CG estimates can supplement results from research audits and can be used to perform an evaluation of the deterrence effect of audit programs The deterrence effect measures the increase in voluntary reported tax liability because of a program of taxpayer's audit. A method for estimating the deterrence effect of the audits is by comparing randomized control trials or quasi-experimental techniques, which compare the revenue reported by two samples in the tax period after the audit, a sample of the audited taxpayers and a sample of unaudited taxpayers. If the former is greater than the latter, this is evidence of the existence of the deterrence effect.

[28] The lag between the reporting year and the collection year will be different for market segments. Market segments with simpler, and therefore shorter, audits will observe a smaller lag between the reporting year and the collection year. Another problem that has become evident is that cash collections in year t rarely relate to reporting period t in some market segments. This means that it will be impossible to generate a CG estimate for year t unless collections can be estimated.

Appendix Table 1.1. Audit Classified by Reporting and Collection Period: Amount of Taxes Collected by Tax Audits

Reporting period	Collecting Period								
		$t-6$	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$	T	**Total Reporting**
	….	…	…	…	…	…			…
	$t-6$	AR_{t-6}^{t-6}	AR_{t-6}^{t-5}	AR_{t-6}^{t-4}	AR_{t-6}^{t-3}	AR_{t-6}^{t-2}	AR_{t-6}^{t-1}		ARR_{t-6}
	$t-5$		AR_{t-5}^{t-5}	AR_{t-5}^{t-4}	AR_{t-5}^{t-3}	AR_{t-5}^{t-2}	AR_{t-5}^{t-1}	AR_{t-5}^{t}	ARR_{t-5}
	$t-4$			AR_{t-4}^{t-4}	AR_{t-4}^{t-3}	AR_{t-4}^{t-2}	AR_{t-4}^{t-1}	AR_{t-4}^{t}	*Partial*
	$t-3$				AR_{t-3}^{t-3}	AR_{t-3}^{t-2}	AR_{t-3}^{t-1}	AR_{t-3}^{t}	*Partial*
	$t-2$					AR_{t-2}^{t-2}	AR_{t-2}^{t-1}	AR_{t-2}^{t}	*Partial*
	$t-1$						AR_{t-1}^{t-1}	AR_{t-1}^{t}	*Partial*
	T							AR_{t}^{t}	*Partial*
	Total collection	ARC^{t-6}	ARC^{t-5}	ARC^{t-4}	ARC^{t-3}	ARC^{t-2}	ARC^{t-1}	ARC^{t}	

Source: Authors.

To prepare contemporaneous CG estimates, audit yield for recent years may need to be projected based on the risk and audit program. In some cases identified earlier, audit yield in the most recent year will be unavailable on an accrual basis. In this instance, audit yield will have to be projected. This is particularly important where audit yield is a key component in deriving the CG estimate, that is, where the CG is constructed using a bottom-up approach based on operational data.[29] The issue of projected audit yield in estimating the CG in Australia can be seen in the example presented in Appendix Table 1.2. This example shows the audit yield used to construct the 2019–20 large corporate group's income tax gap. Because of the time it takes for the audit to resolve, the latest year's result comprises a higher proportion of projected amendments. Even as far back as 2015–16, 32 percent of the amendments in the CG estimates are projected because of cases still in progress, disputes, or litigation.

Appendix Table 1.2. Projected Amendments in Estimating the Large Corporate Group's Income Tax Gap (Australia)

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Amendments ($m)	1,035	847	891	803	309	289
Projected amendments ($m)	477	709	895	1,140	1,270	1,408
Total amendments ($m)	1,512	1,555	1,785	1,943	1,579	1,697
Percentage projected (%)	32	46	50	59	80	83

Sources: Australian Taxation Office 2024; and IMF staff calculations.

[29] Includes regression analysis and extreme value theory methods, https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Tax-gap/Principles-and-approaches-to-measuring-gaps/?page=5#Choosing_the_methodology.

The audit yield on a cash basis cannot be compared with the CG. A comparison between the audit yield on a cash basis (ARC) and CG of the same period is biased. AR must be considered to perform a proper comparison. ARR from each year represents the share of the CG from the same year that is eventually collected through enforcement activity.

The CG needs to be transformed to make it comparable with the audit on a cash basis. To make an unbiased comparison between the ARC and the CG, it is necessary to introduce the concept of Diachronic CG (DCG). The DCG_t is a weighted average[30] of the CGs for various years. For example, in Appendix Table 1.1, DCG_t is a "weighted average" of the CGs for the years from t to $t - 5$. The "weights" are the shares of audit yields classified by the reporting in the audit yield classified by the collecting period. In practice, the greater the revenue collected in one year, the more important the CG of that year will be in calculating the "weighted average."[31] The DCG_t allows us to do an unbiased comparison between the CG and ARC^t.

The use of DCG implies several advantages. DCG is comparable with the results of audits recorded on a cash basis and so allows us to do an up-to-date analysis of the direct effect. If DCG were not used, the CG would have to be used, which is comparable with the results of audits recorded on an accrual basis, but the latter requires several years before complete data are obtained (see Appendix Tables 1.1 and 1.2), so it would not be possible to make an up-to-date analysis of the direct effect.

The ratio between the ARC^t and DCG_t provides a measure of the effectiveness of tax audits in reducing the CG. More precisely, this indicator, called the DEA, provides a measure for DEA enforcement, namely how much of the CG is recovered through tax audits. The advantages of this indicator are twofold:

- It establishes a time-consistent link between the CG and the ARC.
- It allows for an up-to-date analysis.

[30] A weighted average is an average resulting from the multiplication of each component by a factor reflecting its importance.

[31] The diachronic tax gap (DCG) is achieved by a linear transformation of the compliance gap of several years to make them time consistent with the additional tax collected by tax audits (ARC). In fact, ARC at time t is given by the following equation:

$$ARC^t = \sum_{i=0}^{n} AR_{t-i}^t$$

where "ARC" is the audit yield recorded on a cash basis in the year "t"; AR is the audit yield referred to in each of the "t" tax periods included in ARC, and "n" is the time span needed to complete the audit process. DCG at time t, DCG^t, is the weighted average of the tax gap coherent with the ARC^t, obtained by applying the following formula:

$$DCG^t = \sum_{i=0}^{n} CG_t \times \frac{AR_{t-i}^t}{ARC^t}$$

DCG is called diachronic because it does not refer to a single year but is a "weighted average" of the compliance gap, CG, in multiple years. The number of years included in this average is equal to the time span needed to complete the audit process. See Pisani (2014).

REFERENCES

Alabede, J. O., Z. Z. Ariffin, and K. M. Idris. 2011. "Determinants of Tax Compliance Behaviour: A Proposed Model for Nigeria." *International Research Journal of Finance and Economics* 78 (1): 121–36.

Australian Taxation Office. 2024. "Large Corporate Groups Income Tax Gap: Methodology." https://www.ato.gov.au/about-ato/research-and-statistics/in-detail/tax-gap/large-corporate-groups-income-tax-gap/methodology.

Batrancea, L., A. Nichita, J. Olsen, C. Kogler, E. Kirchler, E. Hoelzl, A. Weiss, and others. 2019. "Trust and Power as Determinants of Tax Compliance across 44 Nations." *Journal of Economic Psychology* 74:102191.

Baum, M. A., M. S. Gupta, E. Kimani, and M. S. J. Tapsoba. 2017. *Corruption, Taxes, and Compliance*. Washington, DC: International Monetary Fund.

Beer, S., M. Kasper, E. Kirchler, and B. Erard. 2019. "Do Audits Deter or Provoke Future Tax Noncompliance? Evidence on Self-employed Taxpayers." IMF Working Paper, WP/19/223 (2019), International Monetary Fund, Washington, DC. https://www.imf.org/en/Publications/WP/Issues/2019/10/11/Do-Audits-Deter-or-Provoke-Future-Tax-Noncompliance-Evidence-on-Self-employed-Taxpayers-48703.

Betts, S. 2022. "Revenue Administration: Compliance Risk Management (CRM): Overarching Framework to Drive Revenue Performance." IMF Technical Notes and Manuals 2022/005, International Monetary Fund, Washington, DC.

Brondolo, J. 2009. "Collecting Taxes during an Economic Crisis: Challenges and Policy Options." IMF Staff Position Note SPN/09/17, International Monetary Fund, Washington, DC.

Carfora, A., S. Dongiovanni, A. Marabucci, and S. Pisani. 2020. "The Impact of Domestic Factors and Spillover Effects on EU Countries VAT Gap." Discussion Topics, Italian Revenue Agency, n. 3, August. Agenzia delle Entrate (Italian Revenue Agency), Rome.

CASE. 2020. "Study and Reports on the VAT Gap in the EU-28 Member States: 2020 Final Report."

D'Agosto, E., M. Marigliani, and S. Pisani. 2014. "Asymmetries in the Territorial VAT Gap." Discussion Topics, Italian Revenue Agency, n. 2 . Agenzia delle Entrate (Italian Revenue Agency), Rome.

Ebrill, L., M. Keen, J. P. Bodin, and V. Summers. 2001. *The Modern VAT*. Washington, DC: IMF.

Hamilton, S. 2015. "Regulatory Compliance, Case Selection and Coverage—Calculating Compliance Gaps." *eJournal of Tax Research 13 (2): 616–37.*

Hutton, E. 2017. "The Revenue Administration—Gap Analysis Program: Model and Methodology for Value-Added Tax Gap Estimation." Technical Notes and Manuals 17/04, International Monetary Fund, Washington, DC, March.

International Monetary Fund (IMF). 2015. *Current Challenges in Revenue Mobilization: Improving Tax Compliance*. Washington, DC.

Kasper, M., and J. Alm. 2022. "Audits, Audit Effectiveness, and Post-Audit Tax Compliance." *Journal of Economic Behavior and Organization* 195:87–102.

Marandu, E. E., C. J. Mbekomize, and A. N. Ifezue. 2015. "Determinants of Tax Compliance: A Review of Factors and Conceptualizations." *International Journal of Economics and Finance* 7 (9): 207–18.

Pisani, S. 2014. "An approach to assess how the activity of Italian Revenue Agency affects compliance.", Discussion Paper of the Italian Revenue Agency, n. 1. Agenzia delle Entrate (Italian Revenue Agency), Rome.

Organisation for Economic Cooperation and Development (OECD). 2004. *Compliance Risk Management: Managing and Improving Tax Compliance.* Paris: OECD Publishing.

TADAT Secretariat. 2015. "Tax Administration Diagnostic Assessment Tool (TADAT) Field Guide." https://www.tadat.org/assets/files/IMF_TADAT-FieldGuide_web.pdf.

Thaler, R., and S. Cass. 2008. *Nudge: Improving Decisions about Health, Wealth, and Happiness*. New Haven, CT: Yale University Press.

Ueda, J. 2017. "The Evolution of Potential VAT Revenues and C-Efficiency in Advanced Economy." IMF Working Paper 17/158, International Monetary Fund, Washington, DC.

PUBLICATIONS

Using Top-Down Compliance Gap Techniques to Supplement the Compliance Risk-Management Framework

TNM 2025/03

ISBN 9798400291555