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The Corporate Income *Tax Gap*

A European approach to measuring losses in corporate tax revenues

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Executive summary

This report presents a detailed analysis of the Corporate Income Tax (CIT) compliance gap across 23 EU Member States, Norway, and Iceland. The CIT compliance gap represents the difference between the tax revenue that should be collected under full compliance with existing tax laws and the amount actually collected. Accurately estimating this gap is an important tool for guiding tax policy, enhancing administrative efficiency, and safeguarding the sustainability of public finances. In light of increasing political and economic attention to tax compliance and fairness, the report aims to provide a robust, scalable, and harmonised methodology for estimating the CIT compliance gap across EU Member States.

Understanding the CIT compliance gap

The report adopts a standard taxonomy decomposing the overall CIT gap into three components:

1. Policy gap – revenue foregone due to tax system design (e.g. deductions, exemptions).
2. Compliance gap – revenue losses due to non-compliance with current laws, including tax evasion (illegal non-reporting or under-reporting) and tax avoidance (legal but aggressive planning).
3. Collection gap – the shortfall between assessed liabilities and the amounts actually collected.

The focus of this report is the CIT compliance gap. While tax evasion is clearly a source of compliance gap, tax avoidance straddles the line between policy and compliance gaps, depending on how it is defined and treated by tax authorities. International tax avoidance and profit shifting are recognised as separate but related challenges; they are not fully captured by standard compliance gap estimation methods and should be assessed using complementary tools.

Existing methodologies: strengths and limitations

Two main methodological traditions underpin the estimation of CIT gaps:

- Bottom-up methods, which use audit or microdata to infer under-reporting and extrapolate to the broader population. These approaches can be highly granular and help uncover the sources of the gap. However, they are data-intensive, costly, and difficult to harmonise across countries. Moreover, they are inherently limited in detecting unregistered or informal activity.
- Top-down methods, which compare aggregate economic measures from national accounts with tax return data to estimate potential undeclared income. While these methods allow for standardised, scalable, and less resource-intensive estimation, they rely on accurate adjustments for the non-observed economy (NOE).

While top-down approaches are well-suited to capturing domestic evasion linked to undeclared activity, they are ill-equipped to capture international profit shifting, which distorts the magnitude of aggregate profits reported in national accounts. Thus, CIT gap estimates produced by top-down methods should be interpreted alongside econometric analyses of base erosion and profit shifting (BEPS), such as those by Wier and Zucman (2022).

Lessons from the application of the IMF top-down method: the case of Spain

As part of this study, we implemented the IMF's Revenue Administration Gap Analysis Program (RA-GAP) top-down method in Spain to assess its feasibility and diagnostic value. Spain presents a strong test case: it is a large EU economy with a representative CIT system and remarkably rich tax return data, allowing for a detailed step-by-step application of the method.

Despite these advantages, our exercise revealed serious practical limitations. Implementing the full sequence of required adjustments – from gross operating surplus (GOS) in national accounts to financial accounting profits and finally to the tax base and liability – proved to be particularly data-intensive and dependent on access to non-public information from both the tax administration and the statistical office. Several conceptual mismatches between national accounts and tax return data also introduced significant uncertainty in interpreting the resulting CIT gap estimates.

Moreover, key steps of the method require assumptions about how the undeclared economy behaves – in terms of income composition, allowable deductions, and loss carry-forwards – for which no direct data exists. The best approximation for these items in the undeclared economy is their observable counterparts in tax returns, but the IMF RA-GAP top-down method prescribes to avoid the use of tax return data. The assumptions required to circumvent this issue, and the pervasive lack of comparability between national and corporate accounting, cast doubt on the reliability of estimates obtained using this method, even in the exceptionally favourable context of availability of highly detailed administrative data and strong coordination between institutions.

Deriving the CIT gap series for Spain using the IMF RA-GAP top-down method was only possible through close cooperation with Spanish authorities and access to granular, often unpublished data. A parallel exercise relying solely on publicly available data led to substantially overestimated gaps, particularly in volatile years like 2020. These findings suggest that, although theoretically robust, the IMF RA-GAP method cannot be readily implemented across most EU Member States under current data conditions.

The JRC's exhaustiveness adjustment-based top-down approach

In response to these challenges, the Joint Research Centre (JRC) proposes a simplified top-down methodology to estimate the CIT compliance gap. This method builds on Eurostat's "Tabular Approach to Exhaustiveness", which provides EU Member States with a framework for the calculation of adjustments for undeclared economic activity for national accounts purposes. By comparing these adjustments (specifically, to gross operating surplus) with declared income, the method produces a transparent, reproducible estimate of the CIT gap.

This simplification avoids the complexities and data requirements of the more elaborate IMF RA-GAP approach, while still adhering to its core logic. It is shown to yield compelling and policy-relevant results, which are consistent with existing estimates of the CIT compliance gap provided by the countries themselves.

Main findings

The results, based on data from publicly available GNI Process Tables, reveal significant cross-country differences in the CIT gap (based on the latest available year for each country):

- The CIT gap was below 3% in high-compliance countries like Denmark, the Netherlands, and Finland.
- In contrast, countries such as Slovakia and Romania showed gaps exceeding 20% and 35%, respectively.
- Larger EU economies such as Germany and France reported moderate gaps of 6–7.5%, while Italy approached 20%.

- The unweighted average CIT gap across the 23 EU countries totalled 10.9%, corresponding to a EUR 38 billion shortfall in tax revenues in 2017.
- Results are broadly consistent with national estimates based on both top-down and bottom-up approaches, particularly in Sweden, Slovakia, Italy, and Slovenia, lending empirical validation to the JRC method.

Industry-level patterns

The analysis extends the CIT gap estimation to the industry level in France, Italy, and the Netherlands, revealing clear sectoral patterns:

- High-gap sectors included construction, accommodation and food services, and wholesale/retail trade, where informality and cash transactions are more prevalent, and third-party reporting is limited.
- Low-gap sectors included financial services, real estate, health care, and public administration, where regulatory oversight and data transparency reduce non-compliance opportunities.
- These patterns were remarkably consistent across countries, suggesting structural features within industries are key determinants of compliance behaviour.

Time dynamics and COVID-19 effects

In terms of temporal evolution, the CIT gap was found to be relatively stable over time in most countries where appropriate data was available. In a focused time-series analysis for Poland, where annual data is available from 2005 onward, the CIT compliance gap fluctuates narrowly around 14–16%, with a modest decline during the COVID-19 pandemic. This decline is plausibly linked to behavioural changes such as reduced cash usage and increased formalisation of employment, as workers sought access to government support schemes.

Policy implications and recommendations

The report underscores that no single method can fully capture the complex reality of CIT non-compliance. In this context, the JRC's simplified top-down method offers several advantages:

- It is operationally feasible, requiring only data that Member States are already using for the compilation of their national accounts (NA) data and obligated to report to Eurostat.
- It is comparable across jurisdictions, facilitating EU-wide benchmarking.
- It is scalable and updatable, making it suitable for regular monitoring of tax compliance.

Nonetheless, the effectiveness of the proposed approach depends critically on the timely and harmonised publication of exhaustiveness adjustment data. Therefore, the report calls on Eurostat and Member States to ensure annual public release of GNI Process Table information, ideally with disaggregated breakdowns at the industry level and by sector of the economy, to enable consistent and high-quality CIT gap estimation across the EU.

In conclusion, the report provides a practical, empirically validated tool for estimating the CIT compliance gap across EU Member States. It complements, rather than replaces, other approaches to measuring tax base erosion and may serve as a foundation for improving tax administration, compliance strategies, and EU-wide coordination in corporate taxation.

1 Introduction

Tax administrations across Europe face ongoing challenges in implementing effective tax compliance and enforcement strategies, which results in gaps in tax revenue collection. Tax gaps, which are defined as the difference in theoretically collectible and actually collected tax revenue, can arise from a range of factors, including tax fraud, evasion, avoidance, omissions, errors of interpretation, and bankruptcies. A thorough understanding of tax gaps is essential for evidence-based policymaking as well as to guide strategic administrative decisions within tax administrations. Therefore, the efficiency and effectiveness of tax collection also depend on the availability of reliable tax gap estimates based on rigorous estimation methodologies. It is therefore not surprising that an increasing number of jurisdictions are engaging in efforts to measure tax gaps (OECD, 2024).

The tax gap can be generally divided into several components. OECD (2024) separates the tax gap into a compliance gap and a policy gap. The compliance gap can be broadly defined as the potential tax revenue loss due to non-compliance under current tax laws. On the other spectrum, the policy gap measures the potential tax revenue loss that follows from the design of the tax system and policy choices, such as tax allowances, deductions and exemptions, commonly summarised as tax expenditures (Hutton, 2017). Depending on the taxonomy, a third component can be included: a collection gap, or payment non-compliance gap, related to the difference between assessed tax liabilities and the amount that is actually collected. Other taxonomies consider it part of the compliance gap, as in OECD (2024).

Despite this relatively simple typology, it is inherently difficult to draw a clear distinction between the different types and the different sources of tax gap. The classification of tax avoidance – as a source of compliance or policy gap – illustrates well the conceptual challenges in delimiting the different components of the tax gap. While tax evasion – i.e. the deliberate under-reporting of tax income – falls clearly within the scope of compliance gap, tax avoidance could be linked to either of the two types of tax gaps.

In principle, if tax avoidance is defined as the actions of taxpayers to reduce their tax liability by taking advantage of certain features of the tax law (including loopholes or the lack of international coordination), it could be classified under the policy gap (OECD, 2024). However, when these actions are challenged by the tax administration, resulting in a re-assessment of the tax liability, tax avoidance can be seen as a source of tax compliance gap. A concrete example in this context is the abuse of transfer prices by multinational enterprises (MNEs) to shift taxable income to a low-tax jurisdiction, which can be seen as non-compliant with current tax laws, specifically the arm's length principle. We elaborate more on these considerations in **Chapter 2**.

Beyond the conceptual considerations in defining the scope and type of tax gap, the practical difficulties in the measurement of the tax gap add another layer of complexity. For instance, measuring the policy gap generally requires defining some reference tax system against which the current policy framework is compared. While this may be well established for some type of taxes, it remains a nontrivial exercise when estimating tax gaps associated with income taxes, in particular the corporate income tax (CIT) ([1]).

Focusing on the compliance gap, the two main approaches to estimate this type of tax gap can be classified under top-down methods and bottom-up methods. Top-down approaches rely on

([1]) See for example the measurement of VAT policy gap in the EU (European Commission et al., 2024).

aggregated macroeconomic data, such as national accounts (NA) statistics, to estimate the size of the tax base and the potential tax liability. The difference between the potential tax liability and the actually collected tax revenues is the estimated tax gap. Conversely, bottom-up approaches use micro-economic data (e.g. tax audit data) to infer non-compliance and estimate the aggregate tax gap. These methods are extensively discussed in **Chapters 3** and **4**.

Both approaches focus on national non-compliance and tend to disregard tax revenue losses due to international tax avoidance and profit shifting. As will be argued in **Chapter 4**, bottom-up approaches that rely on tax audit data may lack the cross-country dimension that is needed to uncover international tax avoidance activities. At the same time, top-down approaches rely on NA data that reports aggregate corporate profits *after* international profit shifting has taken place, making this method unsuitable to measure tax revenue losses associated with this type of tax avoidance. Overall, these insights foreshadow an important conclusion of this report: no single method can provide a full accounting of the CIT revenues foregone. Instead, separate estimates of the extent of international profit shifting should be seen as complementary to CIT compliance gap estimates, as they help capture distinct dimensions of corporate tax base erosion. We will revisit this topic in **Chapter 7**.

Finally, the heterogeneity of tax systems in the EU inevitably implies that different Member State administrations face different issues and constraints. As a result, they have so far chosen different tax gap estimation methods based on their needs and resources as well as administrative goals. According to the OECD (2024), the vast majority (i.e. 14 out of 15) of the surveyed EU Member States use top-down methodologies, while only six of them use bottom-up approaches. As such, interpretations may differ, and tax gap estimates are often not comparable across Member States.

Against this background, the purpose of the study is (i) to review and evaluate the tax gap methodologies available for CIT gap estimation, and (ii) to recommend a common method for the estimation of the CIT gap, that could be implemented in all EU Member States' tax administrations.

After elaborating on the typology and the scope of the CIT gap in **Chapter 2**, **Chapter 3** reviews the existing tax gap methodologies. We provide a preliminary assessment of the different approaches in **Chapter 4**. In the context of this report, whose aim is to evaluate and recommend a method that is feasible and common for all EU Member States, the preliminary assessment leads to the conclusion that it is currently not viable to produce standardised and comparable estimates of the CIT gap across EU Member States using the bottom-up method. Bottom-up methods can estimate precise, firm-level measures of CIT revenues lost, but also face trade-offs. This is particularly true regarding the resources required to conduct tax audits, both in terms of time and financial demands, for tax administrations and taxpayers alike. For this report, the lack of accessible audit-based data imposes an unsolvable constraint to evaluate the bottom-up methods in practice.

We then turn to top-down methods, in particular the IMF's Revenue Administration Gap Analysis Program (RA-GAP) top-down method, and variations of it, as potential candidates for a method that can be applied across the EU. In **Chapter 5**, we evaluate the RA-GAP method in practice taking the Spanish case as an illustrative example. We elaborate on the different steps of the RA-GAP method to point out their effect on the CIT gap estimate and to highlight the main obstacles, difficulties, assumptions, and implications entailed by this method.

In **Chapter 6**, we propose and evaluate a simplified top-down method derived from the RA-GAP method that overcomes some of the restraints of the RA-GAP methodology and which has the distinctive advantage of being potentially applicable to all EU Member States. In particular, our proposed method builds on estimates of the non-observed economy (NOE) available from the EU Member States themselves.

Our results show substantial cross-country variation: the estimated CIT gap ranges from below 3% in countries like Denmark and Finland, to over 35% in Romania, with an unweighted EU average of 10.9%. In monetary terms, this corresponds to an estimated CIT revenue shortfall of approximately EUR 38 billion for the EU in 2017. The method is further validated through close alignment with country-reported estimates from Italy, Slovakia, Sweden, and Slovenia, demonstrating the credibility of our approach.

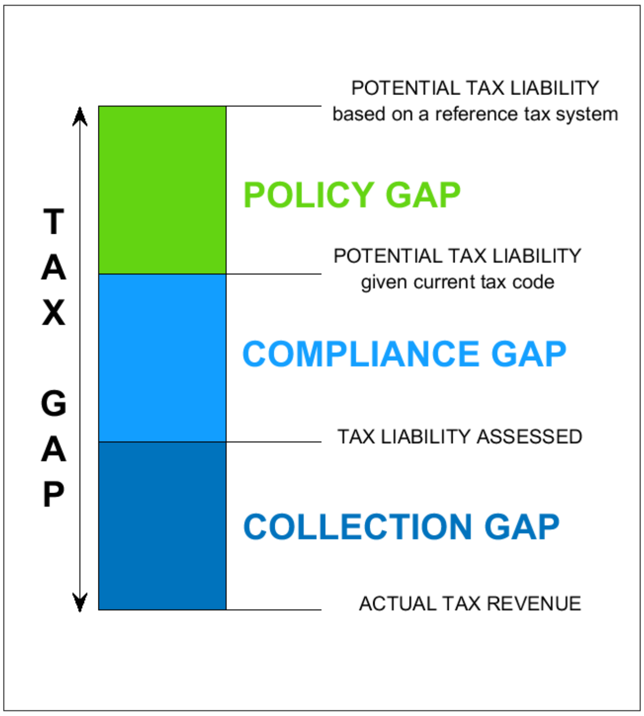
At the industry level, CIT gaps vary systematically, with sectors such as construction, accommodation, and retail exhibiting above-average gaps, while financial services, health, and public administration show significantly lower gaps. Finally, the CIT gap appears broadly stable over time in most countries, with the notable exception of a downward trend that has been observed since the COVID-19 pandemic, and which might potentially be linked to behavioural shifts toward formalisation during the pandemic.

These findings underscore the robustness, scalability, and policy relevance of the proposed top-down methodology for cross-country CIT gap estimation. Importantly, the reliability and comparability of these CIT gap estimates depend critically on the timely and harmonised publication of exhaustiveness adjustments across countries. We therefore strongly advocate for the regular, ideally annual release of this information, which would enable consistent updates of CIT gap estimates and support evidence-based policymaking across the EU.

2 Corporate income tax gap and its components

The CIT gap is generally defined as the difference between the amount of corporate tax revenues "as they should be", i.e. given the state of the law, and "as they are", for a given period of time and a given jurisdiction or region. The tax gap can be broadly divided into three main components, as shown in **Figure 1**: the policy gap, resulting from deliberate policy choices, the compliance gap, resulting from non-compliance of CIT-liable entities, and the collection gap, which relates to administrative challenges in collecting due taxes ([2]). In this Chapter, we describe the three components of the CIT gap and examine their underlying sources. We also discuss the conceptual challenges involved in classifying the sources of revenue loss under a specific tax gap component.

Figure 1. CIT gap: conceptual framework



Source: JRC.

2.1 Components of the gap

The **policy gap** is the difference between the potential CIT liability under the assumption that all corporate income was taxed at the current statutory rate and the potential CIT liability given the current policy framework. Corresponding CIT revenue losses are determined by specific and deliberate choices made in the context of the tax legislation. For example, governments often provide tax incentives, deductions, exemptions, and credits to corporations, which can significantly reduce their tax liability. While these are legal and intentional features of the tax system, they can contribute to the tax gap by lowering the effective tax rate (ETR) for corporations. The magnitude of the policy gap

([2]) Other typologies are possible, see for example OECD (2024).

is affected by two important factors, namely changes in the tax rate structure and changes in the tax base composition.

The **compliance gap** is defined as the difference between the actual CIT tax liability accrued in a given year and the potential revenue that could have been collected within the current tax policy framework and given the extent of economic activity that took place during that year. Whereas tax revenue losses linked to the policy gap can be attributed to intentional or unintentional policy choices, the difference between the actual and potential tax revenues linked to the compliance gap is directly attributable to taxpayers' behaviour. The compliance gap can arise due to a variety of reasons, and its components can be broadly categorised into legal tax avoidance and illegal tax evasion.

Tax avoidance refers to "the arrangement of a taxpayer's affairs that is intended to reduce his tax liability and that although the arrangement could be strictly legal it is usually in contradiction with the intent (or *spirit*) of the law it purports to follow" ([3]). Such practices include the use of transfer pricing, where MNEs may strategically set prices for internal transactions within the company to shift profits to lower-tax jurisdictions. Other examples include the strategic use of debt shifting between subsidiaries or the location of intangible assets in tax-favoured locations, structured only or mainly for taxation reasons ([4]). The existence of so-called "tax loopholes" can add to the tax avoidance practices of corporations. The loopholes can be considered as legal ambiguities or gaps in the national tax law that can be intentionally exploited by corporations to reduce their taxable income, without explicitly breaking the law. Moreover, the lack of coordination in international tax policy, or the non-alignment between the national tax laws of different jurisdictions, can create additional opportunities for tax avoidance. Over time, these loopholes can be closed by new legislation or court rulings, but new ones may emerge or persist.

Beyond tax avoidance, illegal tax fraud and evasion describe another group of activities that fall into the domain of the compliance gap. Such activities are an illegal attempt to escape the payment of taxes, either in part or in total, by deliberately hiding or understating a source of income, overstating expenses or making false claims to tax reliefs. For example, corporations may illegally under-report their income through off-the-books transactions, false invoicing, or other forms of financial misrepresentation. Similarly, businesses may inflate their operational costs, claim deductions for expenses that were not incurred, or fraudulently claim tax credits to which they are not entitled.

Additionally, the complexity of corporate tax law can lead to unintended non-compliance. Corporations may inadvertently underpay taxes due to misinterpretations of the law or complex tax structures. Other factors include unclear legislation, negligent omissions, differences in interpretation, lack of knowledge, and non-deliberate errors leading to differences between the tax liability assessed correctly and the amount actually declared ([5]).

Finally, the **collection gap** describes the difference between the CIT liability due and the actual CIT revenues. The collection gap may be caused by insolvencies, which make it impossible for tax authorities to collect the taxes from bankrupt companies, even though there is an outstanding tax liability. These and other so-called "missing payments" are influenced by factors such as the current

([3]) OECD Glossary of Tax Terms (emphasis added): https://web-archive.oecd.org/2021-02-12/78005-glossaryoftaxterms.htm.

([4]) Beer et al. (2020) provide an extensive review of the empirical literature on the extent of international tax avoidance by multinational corporations and the main channels.

([5]) If taxpayers declare an amount that differs from what the tax authority assesses their tax liability to be, and this is corrected in the return filing process, this is not considered part of the CIT gap.

level of liquidity in the economy, and available tax arrears repayment plans. Additional determinants of the collection gap are related to inadequate enforcement measures on the side of tax authorities. Under-resourced tax authorities may struggle to enforce full compliance, contributing to the tax gap. This includes inadequate staff, outdated technology, and insufficient access to financial information required to assess tax liabilities accurately. For instance, a lack of transparency and information sharing – both domestically and internationally across tax authorities – impedes tracking cross-border transactions and the effective implementation of taxation rights and could further contribute to the collection gap. To calculate the collection gap, it is also important to consider the potential timing mismatches between the assessment of tax liabilities (i.e. tax liabilities accrued during a period) and their settlement.

2.2 Conceptual challenges

While the conceptual difference between the components of the CIT gap – i.e. the policy gap, the compliance gap, and the collection gap – may be clear, the distinction between them is not as clear-cut in practice, especially when only limited information is available. One obvious example is the conflation of the compliance gap and the collection gap. Ideally, to calculate the compliance gap we would like to compare the potential CIT liability with the actual CIT liability; however, it might the case that the magnitude we observe instead are tax revenues effectively collected. Tax revenues may be expressed on a cash flow basis and reflect collections from tax liabilities accrued in different years; while the CIT liability reflects the taxes due on the income of a given period on an accrual basis, but which can be paid over the period of multiple years. These timing mismatches and other differences between taxes due and taxes collected due to missing payments are a feature of almost all CIT systems and are, in general, unavoidable, non-negligible, and hard to correct. This is further discussed in **Box 1**.

Box 1. Timing issues as a potential source of tax collection gaps

In most tax systems, taxes due for a given year of economic activity are usually paid over a period of several years, as firms make advanced payments in the current year, tax returns are filed in the following year, and settlements and reimbursements are made in subsequent years. Put differently, the tax revenues collected by the government in a given year reflect taxes levied on incomes generated in different years. The table below illustrates these timing issues. A_t refers to advanced payments and taxes withheld on the income generated in year t; B_t is the tax liability settled on the tax declaration, which takes place in the following year, $t+1$; and C_t are tax reimbursements, which typically happen even further in the future, say two periods ahead, in $t+2$.

$\boldsymbol{t-2}$	$\boldsymbol{t-1}$	$\boldsymbol{t}$	$\boldsymbol{t+1}$	$\boldsymbol{t+2}$
		A_t	B_t	C_t
	A_{t-1}	B_{t-1}	C_{t-1}	
$\boldsymbol{A_{t-2}}$	B_{t-2}	C_{t-2}		

These timing issues create a gap between the CIT liability $A_t + B_t + C_t$, which is the tax due on the corporate income generated in a given year, expressed in accrual terms, and the CIT revenues $A_t + B_{t-1} + C_{t-2}$, which are the actual cash payments made to and by the tax administration in a given year, in cash-flow terms. Moreover, at times the fiscal year of some corporations does not coincide with the calendar year.

These timing mismatches are a normal feature of the CIT system. However, it is important to take them into account when assessing the data sources used in the estimation of the CIT gap. Ideally, to estimate the compliance gap, the data on tax liabilities used should be on an accrual basis ($A_t + B_t + C_t$). If only cash-flow tax revenues are available, the estimated CIT gap will encompass the collection gap, unless the timing mismatches can be accounted for.

The European System of Accounts, in its Manual on Government Deficit and Debt – Implementation of ESA 2010, establishes that "Time of recording must, as prescribed in national accounts rules, focus on economic substance over legal form, i.e. when the economic activity took place that generated the tax liability. (…) In addition, unpaid taxes must imperatively not be recorded as government revenue and, as a matter of principle; in the long run there must be full convergence between accrued and paid amounts. Taxes accrued (or assessed as due) but unlikely to be collected, for various reasons (such as bankruptcy of companies, lack of efficiency of the tax collecting system, disappearance of individual taxpayers, etc.), shall not be included as government revenue." This implies that tax revenue data in European national accounts is generally on an accrual basis, but net of the collection gap.

Another conceptual challenge regards the classification of tax avoidance. To the extent that tax avoidance practices are legal, it may be reasonable to consider them as a source of policy gap rather than compliance gap ([6]). In particular, the policy gap could be defined to include not only the tax revenue lost from intentional tax expenditures, but also unintentional loss due to loopholes in tax law enabling tax avoidance practices (Hutton, 2017). This is particularly true if one adopts a broad definition of tax avoidance as any attempt to reduce explicit taxes, which does not distinguish between real activities that are tax-favoured, such as accelerated tax depreciation of fixed assets, and avoidance activities specifically undertaken to reduce taxes (Hanlon & Heitzman, 2010).

([6]) See for example OECD (2024).

Conversely, when tax avoidance falls within the letter of the law, but the outcome can be challenged by the tax authorities, tax avoidance can be seen more in line with the concept of compliance gap. For instance, consider the use of transfer prices by MNEs to shift taxable income to low-tax jurisdictions. Most tax laws will mandate transfer prices to follow the arm's length principle, which gives companies some leeway in setting the transfer price. However, if such transfer price is successfully challenged by the tax administration as not in accordance with the arm's length principle, resulting in an (upward) adjustment of a taxpayer's tax liability, it could be argued that the transfer price set by the company was not compliant with the law. In this case, tax avoidance can be well linked to the concept of compliance gap.

Additionally, estimating the compliance gap involves comparing potential tax liability (in a scenario of full compliance) against a benchmark tax liability (in the current scenario of some non-compliance). However, sometimes a benchmark is not directly available and certain policy assumptions must be made, which introduce features of the policy gap into the compliance gap. For example, applying the statutory tax rate to an estimated potential tax base would yield an estimate of the potential tax liability, *under the assumption that all taxable income is subject to the statutory rate*. However, the tax rate structure generally has multiple exceptions that would require a detailed knowledge about which parts of the potential tax base accrue to the firms that are subject to each exception, which is generally not available ([7]). In this sense, applying the flat statutory tax rate to the potential tax base will yield a hybrid estimate of the compliance gap and a policy gap, against the counterfactual policy of no exceptions to the flat rate.

Finally, it is important to understand that the tax gap is the revenue lost due to certain provisions in the tax code or to taxpayer non-compliance, but not the additional revenue that would be collected if the tax provisions were removed or if full compliance were enforced. Estimating the revenue gains from closing the tax gap would require a model to capture the endogenous behavioural responses of economic agents to changes in their ETR and other incentives on the allocation and amount of economic activity. This is a particularly relevant issue when it comes to assessing the policy gap, which aims to capture the changes in tax revenues generated by certain features of the tax system deliberately modified through policy changes. In this sense, the policy gap requires a benchmark counterfactual (the "no policy scenario") that is less reliable if it does not take into account endogenous behavioural responses. But it is also true of the compliance gap. The reason is that economic agents operate optimally under the current setting, including the possibility to misreport some income, but they would probably change their behaviour under other circumstances.

While the policy gap is a matter of policy choices, and the collection gap is generally an unavoidable feature of the CIT system, ideally an efficient CIT system would be equipped to minimise its compliance gap ([8]). To this end, this report focuses on the compliance gap. In addition, while it remains beyond the scope of this report to categorise (cross-border) profit shifting as a source of the CIT policy gap or the CIT compliance gap, profit shifting erodes corporate tax base and results in foregone tax revenues. Therefore, and to help delineate the scope of the different methodologies to estimate the CIT gap, the report reviews also the methodological approaches to estimate profit shifting.

([7]) Examples of this are progressive tax rates, allowances, special rates for SMEs or newly created firms, and special tax regimes for R&D intangible income (e.g. patent boxes), cooperative firms or firms with special concessions to exploit natural resources, which are usually subject to a higher rate.

([8]) In practice, publicly available data does not allow to easily isolate the collection gap.

3 A review of existing methodologies and available evidence

A main challenge in estimating the CIT gap is that the CIT tax base is not a straightforward function of any observable measure of economic activity. On the one hand, multiple provisions in the tax code allow for the partial exemption of different types of income (such as dividends from participations or royalties) and the deduction of different costs (such as depreciation, interest expenditures, foreign taxes paid, or losses) from the taxable base. This precludes the direct application of the statutory tax rate to observable profits to compute the potential tax revenue, which could later be compared to actual tax collections. On the other hand, the observable measures of economic activity themselves are distorted by the presence of arrangements by corporations to reduce their CIT liability.

These difficulties have given rise to a variety of methodologies to quantify the differences between potential and actual tax revenues that differ in approach, scope, the type of data used, and their applicability. In this Chapter, we review the existing methodologies that have been proposed to estimate the CIT gap, including top-down methods – which compare macroeconomic aggregates from national accounts with declared tax data, offering a broad view of undeclared activity – bottom-up methods – which rely on taxpayer audits and administrative data to identify discrepancies at the micro level – and profit-shifting methods – which use econometric techniques based on firm profitability and cross-country tax differentials to estimate international profit shifting by MNEs.

This report analyses the following approaches:

1. Top-down methods
2. Bottom-up methods
    (a) Random audits
    (b) Risk-based audits
3. Methods to estimate profit shifting

After a review of the existing methodologies, the report provides an overview of the available evidence that has been produced so far for EU Member States ([9]).

3.1 Top-down methods

Top-down methods are based on a comparison between the potential tax liability generated by the economic activity observed in NA data, and the actual tax collections reported by the tax administration. The basic assumption underlying these methods is that while tax collections follow from the income declared by taxpayers, national accounts are a broader measure of economic activity that should also cover large parts of the economy that is undeclared to the tax administrations. Thus, a basic requirement for the application of the top-down approach is that NA data is compiled

([9]) A similar and thorough overview can be found in the publications derived from the Fiscalis Tax Gap Project Group (2018; 2025) with a particular focus on the experiences implemented in EU Member States.

independently from tax return data and that it is exhaustive in covering both observed and non-observed activities ([10]) ([11]).

The use of NA data as a proxy for undeclared corporate profits constrains the scope of the top-down methods, since by construction these methods will not capture profits that are not appropriately accounted for in national accounts. Indeed, tax-motivated profit shifting implies that at least some share of the profits booked in low-task jurisdictions should in fact be attributed to other countries. Booking these profits in the jurisdictions where they have been generated would raise the taxable income of these countries ([12]). In any case, a pure top-down method will mostly uncover tax evasion by taxpayers whose activity is covered in national accounts but is undeclared to the tax administration, while it will miss tax avoidance by taxpayers that shift profits abroad, whose economic activity appears distorted in national accounts.

The core task of the top-down approach is to derive a measure of the *potential* CIT liability, i.e. the one that would accrue if all the economic activity recorded in national accounts had been properly declared and taxed. The IMF's Revenue Administration - Gap Analysis Program (RA-GAP) methodology, as explained in Ueda (2018), focuses on the compliance gap of non-financial corporations ([13]). The steps proposed by this method are as follows ([14]):

1. **Deriving taxable income.** Starting from the Gross Operating Surplus (GOS) in national accounts, a series of adjustments must be made to add taxable income that is not included in the GOS (such as capital income and foreign source income), while subtracting exempted income (e.g. pass-through income) and certain expenditures (interest and depreciation) to arrive at a measure of the Financial Accounting Profits (FAP) of corporations.

2. **Defining the tax base.** In this step, one must apply the provisions of the tax code that allow for exemptions, deductions and allowances, and remove them from the FAP to derive its corresponding tax base. This yields the Net Current Tax Base (N-CTB): it is considered "net" because the aggregate measure reflects both profitable and loss-making corporations; and it is "current" because any obligations correspond to the taxable activities of the current year.

([10]) In general, however, tax returns are one of the main data sources used to compile national accounts. More details on this issue are provided in **Chapter 5**.

([11]) The European System of Accounts establishes that national accounts statistics need to cover the non-observed economy through the so-called "exhaustiveness adjustments". More details on this issue are provided in **Chapter 6**.

([12]) Tørsløv et al. (2023) estimate that accounting for tax avoidance increases the profits recorded in national accounts by about 20% in high tax European countries.

([13]) For early applications of the top-down method, see Scope (2011) and Trigueros et al. (2012).

([14]) See **Table A.1** in the **Appendix** for a comprehensive summary of all the adjustments performed in each step.

3. **Treatment of losses.** Losses modify the previous calculations in two ways. On the one hand, the derived aggregate tax base is a net measure that includes both positive tax bases, which yield a positive tax liability, and negative tax bases, which yield no tax liability. We are interested in the *gross* tax base; therefore, negative tax bases have to be added back to the N-CTB calculated in Step 2 ([15]). On the other hand, profitable corporations can decrease their tax base derived from their activity in the current year with negative tax bases carried over from previous periods. Therefore, carried over losses must be subtracted.

4. **Tax rates and tax credits.** After implementing Steps 1 to 3, we arrive at a measure of the Tax Base (TB) to which the statutory tax rate can be applied in order to compute the potential CIT liability. This step must take into account any progressivity in the tax and apply each marginal rate to its corresponding share of the TB. For example, if small and medium-sized enterprises (SMEs) are taxed at a lower rate, then the TB must be split between SMEs and large corporations and apply the different rates to each share accordingly. A final adjustment must be made to subtract any tax credits, e.g. those granted to incentivise research and development (R&D) or to relieve double taxation. This yields the potential CIT liability.

The computations in Steps 1 to 4 impose additional data requirements on the top-down method. Beyond the GOS from national accounts and the tax revenues from the tax administration ([16]), information is needed on:

- taxable income not derived from current operations, and accounting expenditures (Step 1)
- exemptions, deductions, and allowances to compute the tax base (Step 2)
- the split of the tax base between profitable and loss-making corporations, and losses carried forward from previous years (Step 3)
- the shares of the tax base corresponding to different tax rates, plus the amount of granted tax credits (Step 4)

Ideally, the above information should be independent from tax returns. In practice, however, this is unlikely to be the case, particularly for tax deductions and losses in Steps 2 to 4. If tax return information is used for the computation, the CIT gap estimate will be embedded with the assumption that the implicit tax rate (i.e. the ratio of CIT liabilities to GOS) is the same for the observed and the unobserved economy. This implies that the split between current and financial income, the share of expenditures, deductions, allowances and credits, and the distribution of losses and of firm size is assumed to be similar for the observed and the non-observed economy.

Gallucci et al. (2020) propose a mixed assumption to overcome this issue. The authors define Δd as all the actual adjustments made to the declared GOS ($dGOS$) to arrive at the declared CIT liability, and Δp as the equivalent adjustment that would be made if the all the GOS registered in national accounts ($pGOS$) would be properly declared and taxed. Then, they calculate two implicit tax rates:

([15]) Specifically, only the losses of unconsolidated corporations and of tax groups with negative consolidated income should be added back. Firms in consolidated tax groups can and actually do deduct their losses against the profits of other firms in the group. What matters for these taxpayers is the net positive tax base.

([16]) Ideally, the potential CIT liability calculated in Steps 1 to 4 should be compared to the declared CIT liability, which is the amount of tax accrued on the income of a given year, and not the tax collected by the tax administration in a given year. See also **Box 1**.

one assumes that potential and declared adjustments are the same ($\Delta p = \Delta d$), and another assumes that the difference between potential and declared adjustments is proportional to the ratio of potential to declared GOS ($\Delta p = \Delta d \times pGOS \,/\, dGOS$). Their preferred estimate of the CIT gap takes the average of the two gaps, which follow from the two assumptions. In **Chapter 5**, we elaborate more on Gallucci et al. (2020)'s strategy and apply it in our estimate for Spain.

3.2 Bottom-up methods

Bottom-up approaches are based on analysing and quantifying the misreporting of tax liabilities in a sample of actual tax returns and extrapolating these results to the entire population of taxpayers. An important part of the day-to-day activities of tax administrations is the fight against tax fraud, which is conducted through enquiries, audits, and controls of the incomes and expenditures declared by taxpayers when filing their tax returns. While the main purpose of these control activities is the recovery of revenue for the public budget, a wealth of highly detailed and relevant information is generated as a by-product, which can be used for statistical purposes like estimating the CIT gap. Of course, this microdata is usually only available to the tax administrations and making them publicly available could entail potential privacy issues.

The richness of detail contained in the microdata used in bottom-up approaches permits analysis that goes beyond computing a general, overall figure of the CIT gap, like in the top-down approach. Firm-level data can shed light on whether the CIT gap is particularly severe for certain groups of taxpayers, based on firm characteristics like firm size, industry, or asset composition. A thorough audit and analysis of the tax return can uncover not only the final magnitude of the misreported CIT liability, but also the particular provisions of the tax code that contain the largest bulk of irregularities. This can shed light on the ways by which tax liability is avoided, like abuses of the transfer prices for the use of intra-group transactions, or an arrangement of intra-group financial liabilities for the sole purpose of minimising taxes.

In terms of the scope, bottom-up methods are constrained by the pool of entities that are listed in the official public registry of the tax administration, from which the sample of firms to be audited is selected. Therefore, such audits will uncover the tax avoidance produced by irregularities in the tax returns of the entities who have actually filed a tax return and have wrongly done so whether premeditated or unintentional. Since the method will uncover irregularities in the declared CIT liability, a clear advantage is that the method is completely independent from any collection gap derived from timing and other mismatches between liabilities and revenues, which add uncertainty to the top-down method. However, bottom-up methods will miss large parts of the unobserved economy concerned with underground, informal, or illicit activities undertaken by firms whose tax evasion is under the radar of the tax administration.

An additional issue with the scope of bottom-up methods is that auditing a small or a large taxpayer is a very different task. While tax avoidance by SMEs comes mostly from the omission of income or an overstatement of expenses, large corporations also abuse other, more complex provisions of the tax code, such as depreciation, treatment of losses, or company debt, to reduce their CIT liability (Barra et al., 2023). SMEs tend to have a simple corporate arrangement that is similar across firms, and a set of trained auditors can apply the same standardised procedure to uncover potential irregularities. Instead, large corporations have complex, firm-specific structures, often involving other jurisdictions, and their audits are significantly more costly for tax administrations. Moreover, sampling large corporations is not straightforward, as each firm is a non-negligible share of the overall population. For this reason, some bottom-up methods tend to exclude large taxpayers from the sample of audited firms, or apply simplified heuristics based on targeted audits to account for the CIT gap generated by these large taxpayers.

There are two basic types of bottom-up methods, which differ in the way they compose the sample of firms to be audited – either randomly or targeting certain taxpayers who are deemed more likely to avoid tax. Obviously, the two sample selection methods yield a different sample representativeness, which then determines the subsequent procedure to apply to extrapolate the results to the entire population.

3.2.1 Random audits

Samples based on audits performed on a randomly selected set of firms should be in principle representative of the entire population of taxpayers. In this sense, extrapolating the obtained results is relatively straightforward and requires multiplying by a weighting factor constructed from a set of firm characteristics, such as the number of employees, firm age, turnover, industry, location, etc., with minor corrections accounting for dropouts in attrition or potential outliers.

The report of the FISCALIS tax gap group 2018 (Fiscalis, 2018) reviews the implementation of this method in two European countries, Denmark and Sweden. In the Danish case, a sample of 1,074 corporations was randomly drawn from a population of approximately 232,000 corporations (0.46%), while the Swedish sample of audited firms contains 650 sole traders and unincorporated economic associations ([17]). Both samples exclude larger taxpayers, who are partially covered by separate procedures combining a random and a risk-based audit in the Danish case, and a risk-based audit in the Swedish case. In both cases, a subsample of the audited returns was re-examined with a backstop audit to detect any potential errors in the auditing process.

Bottom-up methods based on random samples of firms are considered a gold standard, because they minimise uncertainty and bias in the estimation of the CIT gap. However, they do not come without cost to the tax administration implementing them. First, they require properly trained auditors and time: the Danish survey required about 150 auditors for a period of over 3 years, while the Swedish Tax Agency devotes 60 to 70 auditors every year for this purpose. Second, the choice between selecting the sample randomly or targeting riskier firms involves an opportunity cost, since by definition a share of the random audits will not involve any misreporting and will yield no additional tax liability (for instance, 38% of the audits in the 2017 Danish sample had no errors). This issue is particularly relevant when large taxpayers, who account for most of the CIT revenues (and, as a consequence, of the tax gap), are unlikely to be included in the sample (Guyton et al., 2021).

3.2.2 Risk-based audits

Risk-based or operational audits are conducted on certain taxpayers that are deemed to be “riskier”, in the sense of having certain characteristics historically associated with a higher likelihood of engaging in misreporting. This implies that the set of audited returns that constitute the sample for this bottom-up approach is not representative of the whole population of firms, and if results were to be extrapolated this would result in an overstated estimate of the CIT gap. Therefore, this bias must be corrected in the extrapolation of results.

([17]) Data for 2017, reported in Fiscalis (2018).

Frequently used bias correction methods that account for the non-randomness of the samples based on operational audits include Heckman (1979)'s selection correction model, Feinstein (1990)'s detection-controlled estimation or the post-stratification approach. The main idea behind these bias correction methods is to adjust the aggregation weights by accounting for the probability that a misreporting firm is selected into the sample. In this sense, there are multiple uncertainties involved, regarding the probability of a certain taxpayer committing fraud, the probability of (not) auditing that particular taxpayer, and the probability of auditing a fraudulent taxpayer but underestimating the extent of their fraud. None of these probabilities are observed, so they must be estimated, which increases the uncertainty around the estimation of the CIT gap.

Fiscalis (2018) reviews the implementation of this method in two European countries, Czechia and Slovakia ([18]). Both countries have been conducting top-down estimations of the CIT gap for several years and have recently decided to complement and improve their findings with a bottom-up risk-based method. In the case of Czechia, the development of the bottom-up methodology is still in progress, but no relevant or detailed information is currently publicly available.

It is worth pointing out that it is not uncommon for countries to apply separate methodologies for different subsets of corporations, reflecting differences in data availability. For example, the estimation of the CIT gap in the United States (US) is based on separately analysing small and mid-sized/large corporations. The estimation of the compliance gap for small corporations, i.e. those with reported assets of less than $10 million, is based on operational audit data. Since the results on non-compliance identified through these audits cannot be directly extrapolated to the universe of small firms, the Internal Revenue Service (IRS), the federal agency responsible for tax collection and compliance, applies Heckman (1979)'s methodology to minimise the sample selection bias. Concretely, their reweighting approach is based on the probability of a CIT return being audited and the probability of detecting under-reported CIT conditional on an audit, among other criteria (IRS, 2022).

According to these IRS calculations, most of the CIT gap in the US is driven by under-reporting of the tax liability by the very large corporations, defined as those with reported assets of $250 million or more (who also account for most corporate taxes paid). As is the case for smaller corporations, the current estimated tax gap for large corporations is also based on operational (i.e. non-random) audit data. However, the relatively small number of audited corporations and the high degree of heterogeneity among the very large corporations make the application of reweighting methods impractical.

Instead, the magnitude of non-compliance is assumed to decrease exponentially as one moves down the ranks of corporations from the most to the least non-compliant. Based on the ranking of audited large corporations and the amount of federal tax adjustments identified from a thorough audit, a simple regression analysis is then used to extrapolate tax non-compliance to the rest of the large corporate population in order to obtain an estimate of the whole CIT gap for large corporations. Obviously, the accuracy of the approach depends crucially on having identified the highest value adjustments (the "extreme value") for large businesses in the first place, which is a strong assumption when audit identification of non-compliance can never be 100% effective. See **Box 2** for a more technical discussion of the methodology and the assumptions underpinning it.

([18]) Results for Slovakia come from Chudy et al. (2020).

Box 2. Extrapolation of non-compliance in large corporations

The Extreme Values Technique

The approach for the largest corporations, as it is applied by the IRS in the US, rests on the hypothesis that the magnitude of non-compliance at the firm-level follows a Pareto distribution at the top. More concretely, this approach assumes that the logarithm of the known non-compliance at the firm-level is inversely related to the logarithm of the rank of the non-compliance amount and can be described by a linear curve. Put differently, the firm with the highest audit adjustment is ranked first, the firm with the second-highest audit adjustment is ranked second, and so on. Then, by fitting a linear curve through the observed (logarithm of) audit adjustments of audited businesses, the method allows to quickly infer tax gaps for the population of non-audited business on the basis of the negative relationship between the rank and the audit adjustment by means of a simple extrapolation.

The methodology is based on two critical assumptions. First, the magnitude of the tax gap should be well described by a Pareto distribution. This assumption is based on empirical findings, which document that business income is reasonably well described by a Pareto distribution for the higher-income entities. Then, if all large businesses under-report a certain fixed fraction of their income, the average under-reported amount will also tend to follow a Pareto distribution. Second, the effective application of the methodology requires the largest audit adjustment (the “extreme value”) to be identified in the first place. On the contrary, not having identified the largest audit adjustment would effectively lead to an underestimation of the tax gaps for all other non-audited firms.

3.3 Methods to estimate profit shifting

A wide body of the academic literature estimates the scale of international tax avoidance and the amount of CIT revenues that are lost as a result. Within the international tax framework, MNEs employ a range of strategies to shift profits among affiliated entities to minimise their overall CIT liability (Beer et al., 2020). In response, numerous studies have employed diverse econometric and other empirical estimation methods to gauge the magnitude of base erosion and profit shifting (BEPS).

While top-down and bottom-up methods put an emphasis on accounting and measurement discrepancies, profit shifting studies stand out as they typically use econometric regressions and economic theory to estimate shifted profits. This body of research primarily utilises two methodological approaches: (i) measuring profit shifting through tax-rate differentials, and (ii) measuring profit shifting through differences in profitability.

A broad strand of literature exploits corporate tax rate differentials across jurisdictions to proxy the incentives for MNEs to shift profits internationally and investigates empirically whether these explain systematic differences in reported profits that cannot be accounted for by real factors. Specifically, this literature is based on estimating the semi-elasticity of reported profits to tax rate differences. A measure of profit shifting and missing CIT revenue can be then derived from the estimated parameter, as explained in more detail in **Box 3** below.

Box 3. Measuring profit shifting through tax-rate differentials

The now standard methodology was initially proposed by Hines and Rice (1994), later developed by Huizinga and Laeven (2008), and established as the benchmark in OECD (2015). The methodology posits that the profits reported by a MNE in a jurisdiction reflect both real factors and profit shifting. Real or true profits are the sum of reported profits and shifted profits:

$$\pi_{it} = \pi_{it}^{r} + s_{it}$$

where π_{it} are true profits, π_{it}^r are reported profits, and s_{it} are shifted profits, in jurisdiction i at time t. A negative s_{it} reflects inward profit shifting (e.g. reported profits are higher than true profits in that jurisdiction), and a positive s_{it} reflects outward profit shifting (e.g. reported profits are lower than true profits in that jurisdiction). We would expect low tax countries to have negative s_{it}, while high-tax countries to have a positive s_{it}.

The MNE chooses the optimal profit shifting flows s_{it} for all the $i = 1, \dots, N$ jurisdictions where it operates, to maximise total after-tax profits, subject to the constraint that all inward and outward flows cancel out, $\sum s_{it} = 0$. However, shifting profits may be costly, particularly since countries are implementing measures to counteract BEPS through a variety of regulations. Assume that the optimal amount of profit shifting into jurisdiction i is a proportion γ of true profits in that jurisdiction times a tax incentive:

$$s_{it} = \gamma \pi_{it} g(\tau)$$

where the tax incentive $g(\tau)$ is a function of the marginal tax rates that the MNE faces in all the countries where it operates, $\{\tau\}_{i=1}^{N}$. From this, reported profits can be expressed as:

$$\pi_{it}^r = \pi_{it} - s_{it} = \pi_{it}(1 - \gamma\, g(\tau))$$

Obviously, available data will contain the profits that firms report, π_{it}^r, but not true profits π_{it} (those that would obtain without profit shifting). This method proposes to approximate π_{it} controlling for the factors of production. Suppose that the MNE produces output y_{it} combining capital and labour inputs, and total firm revenue is allocated between profits and the compensation of employees:

$$y_{it} = F(K_{it}, L_{it}) = \pi_{it} + w_{it} L_{it}$$

where K_{it} is the capital input, L_{it} is the labour input, and w_{it} is the average wage. Further assume that the production technology $F(K_{it}, L_{it})$ is Cobb-Douglas and that output prices and wages are settled in a competitive market, such that the wage rate equals the marginal product of labour. True profits are the capital share of output, which can be expressed as:

$$\pi_{it} = y_{it} - w_{it} L_{it} = \alpha F(K_{it}, L_{it}) = \alpha A_{it} K_{it}^{\alpha} L_{it}^{1-\alpha}$$

where α is the production coefficient of capital and A_{it} is a technology parameter. Plugging the capital share equation into the expression for reported profits and log-linearising yields the equation:

$$\log(\pi_{it}^r) = \alpha + a_{it} + \alpha k_{it} + (1-\alpha) l_{it} - \gamma\, g(\tau)$$

where lower case letters represent the natural logs of the corresponding upper-case variables and $\log\big(1 - \gamma\, g(\tau)\big) \approx -\gamma\, g(\tau)$. The equation above can be estimated using standard econometric techniques applied to data on reported profits, the factors of production and tax rates. The technology parameter a_{it} is usually approximated with GDP per capita and/or a measure of the market size.

The key parameter in the equation is γ, the semi-elasticity of reported profits to changes in the tax incentive. When the tax incentive $g(\tau)$ increases (decreases) by one percentage point, reported profits in jurisdiction i decrease (increase) γ%**.** From the estimate of the semi-elasticity, $\hat{\gamma}$, we can recover the amount of shifted profits:

$$s_{it} = \frac{\hat{\gamma} \pi_{it}^r g(\tau)}{1 - \hat{\gamma}\, g(\tau)}$$

If π_{it}^r are pre-tax profits, then s_{it} is a direct measure of the absolute CIT “base” gap, and $\tau_{it} s_{it}$ would be the absolute CIT gap, where τ_{it} is jurisdiction i’s statutory tax rate in year t.

Studies that exploit tax rate differentials across jurisdictions show robust evidence of profit shifting across a broad range of empirical settings. Heckemeyer and Overesch (2017)’s meta-analysis reports a consensus estimate for the semi-elasticity of reported profits to tax rate differential of 0.8.

However, important differences are found depending on the data and the specifics of the equation used for the estimation. Notably, studies show significantly different estimates of the semi-elasticity depending on whether they employ firm-level microdata or aggregate data. Beer at al. (2020)'s meta-analysis shows an average consensus semi-elasticity of 2.29 for studies employing macro data (e.g. Hines and Rice, 1994; Clausing, 2016), and an average consensus semi-elasticity of 1 for studies employing microdata (e.g. Huizinga and Laeven, 2008; OECD, 2015) ([19]).

Moreover, empirical studies vary in the measurement of reported profits and the tax incentive stemming from cross-country tax rate differentials. Most studies use pre-tax profits as the dependent variable, while some opt for "pre-finance" profits to isolate non-financial profit shifting ([20]). For the tax incentive variable, studies use either statutory or effective tax rates. ETRs better reflect marginal tax costs due to tax code provisions and avoidance strategies but are endogenous to activity size and may lead to biased profit shifting estimates. Moreover, the tax rate of one country is arguably of little importance in itself – what matters is its level in relation to other countries' tax rates ([21]). Lastly, studies vary also in estimating equations, especially regarding non-linearities and fixed effects. The inclusion of non-linear effects in particular results in greater responsiveness of reported profits to tax policy changes in low-tax jurisdictions ([22]).

Another strand of the literature relies on economic theory and the observed differences in profitability to infer the magnitude of shifted profits. This approach builds on the idea behind Pissarides and Weber (1989), who propose a "traces-of-true-income" model to identify income under-reporting. The authors note that self-employed workers tend to have a much higher propensity to consume than equally earning hired employees. Meanwhile economic theory would suggest otherwise given the uncertain and fluctuating nature of their income. In short, economic theory and evidence predict that income has a stable relation with expenditures like consumption, and that those taxpayers with large discrepancies in this relation must be misreporting their income.

The equivalent "traces-of-true-income" approach in the case of firms postulates that corporate income should have a stable relation with firms' current expenditures, like labour costs, and that firms with outliers in this relation are likely to be shifting their profits. In this case, the theoretical relation is the production function. Under profit-maximising assumptions, the ratio of profits to production factor costs such as labour should be a stable function of technological parameters and mark-ups. If these technological parameters and mark-ups are similar across subsidiaries of the same MNE

([19]) An exception is Delis et al. (2024), who find a large semi-elasticity of reported profits to tax rate differentials using non-parametric techniques on microdata.

([20]) See for example Heckemeyer & Overesch (2017).

([21]) Some studies proxy the incentive variable with the difference in the tax rate of a parent entity's residence country and that of the jurisdiction where its subsidiary is located, focusing only on profit shifting from parents to subsidiaries. However, Huizinga and Laeven (2008) argue that the incentive variable must reflect all the tax rates that the MNE faces in the multiple jurisdictions where it operates. They propose an incentive variable that is a sum of the tax differentials between the jurisdiction where the profits are reported, and each of the jurisdictions where the MNE owns a subsidiary, weighted by the size of the activity in those jurisdictions. The advantage of this tax variable is that it captures all the incentives of the MNE to shift profits across jurisdictions, whether between parent and subsidiary or between subsidiaries. The disadvantage is that it is particularly demanding in terms of data, and especially when using financial microdata, the lack of known profits in tax-haven jurisdictions produces a tax incentive variable that ignores some of the most important locations where the MNEs shift profits.

([22]) See for example Hines and Rice (1994) and Dowd et al. (2017).

(Guvenen et al., 2022), or across domestic and foreign firms (Tørsløv et al., 2023) in the same country, then any discrepancy in the profits-to-factor-costs ratio must be driven by misreporting of profits ([23]).

Profits shifted abroad are measured using data that comprises the global operations of MNEs and detail where these corporations, including both parents and affiliates, book profits, own assets, hire labour, or pay taxes, in a country-by-country fashion. Guvenen et al. (2022) use firm-level tax microdata, but access to such data is typically only available to tax administrations, except if MNEs voluntarily make their country-by-country reports available to the public ([24]) ([25]).

Finally, since the CIT gap is usually interpreted to be the lost revenue in the source country, once the shifted profits are quantified in the destination country, computing the CIT gap requires attributing these profits back to where they were generated. This is not a trivial exercise, particularly for an increasingly digital economy where value comes from intangible assets characterised by large economies of scale. In this context, Tørsløv et al. (2023) propose two different ways of re-attributing the profits that rely on bilateral balance of payments data (such as data on service trade flows) and foreign direct investment (FDI) income.

Irrespective of the methodological approach, profit shifting studies may not fully capture the various ways in which BEPS impacts tax revenues. For instance, Clausing (2015) highlights the negative effect of BEPS on tax collection and its implication in complicating governments' ability to forecast corporate tax revenues. Tax avoidance shifts the tax burden to less mobile entities, potentially disadvantaging smaller firms, households (Dyreng & Markle, 2016), or specific industries (Barrios & d'Andria, 2020) that cannot effectively exploit international tax schemes. Sorbe and Johansson (2017) further demonstrate how profit shifting skews competition, resulting in increased market dominance and profit margins for companies engaging in strategic tax planning. **Box 4** illustrates a more holistic approach to measuring the fiscal and economic impact of BEPS.

Box 4. Base erosion and profit shifting: a general equilibrium perspective

Álvarez-Martínez et al. (2022) propose a holistic analysis that takes into account the various ways BEPS influences the economy, taxation, employment, and welfare. Such an assessment should particularly consider the complex interactions between corporate tax avoidance, investment, and overall economic activity. The international tax system involves interactions among all countries and requires sophisticated modelling.

To address these complexities, the authors argue that employing a computable general equilibrium (CGE) model is appropriate. The Joint Research Centre's (JRC) in-house CORTAX model, a CGE designed for EU member states, the UK, the USA, Japan, and a tax haven, is particularly focused on corporate taxation. This model simulates the effects of corporate tax changes, accounting for interactions throughout the economy and placing emphasis on different types of firms – domestic, multinational headquarters, and subsidiaries. It also considers households, government, and foreign sectors, with countries linked by international trade and multinational investments.

([23]) These factor costs are exclusively labour costs in Tørsløv et al. (2023) and a weighted average of the returns to labour, physical capital, and intangible assets in Guvenen et al. (2022).

([24]) See for instance https://www.repsol.com/content/dam/repsol-corporate/en_gb/sostenibilidad/responsible-tax-policy/2021-country-by-country-tax-report.pdf.

([25]) Note that financial institutions operating in the EU have been subject to public Country-by-Country Reporting (CbCR) since 2014 and similar reporting requirement will eventually be extended to large non-financial MNE from 2025 onwards. See in particular Credit Requirement Directive (CRD) IV, Article 89 for financial institutions and Directive (EU) 2021/2101 amending Directive 2013/34/EU for non-financial firms.

These multinational entities are designed to optimise their profits on a global scale, which includes the potential for engaging in profit-shifting practices. Such activities are represented within the model through transfer pricing mechanisms, whereby multinational firms may manipulate the prices of intermediate goods to reallocate profits to more favourable tax jurisdictions, including tax havens. Additionally, the model accounts for the administrative burdens of profit-shifting, such as compliance with diverse legal and accounting systems, by incorporating these costs in a non-linear relationship with the volume of profits shifted overseas.

The author's findings, based on the CORTAX model, suggest that the EU (including the UK by the time of these estimates were produced), loses approximately EUR 36 billion in corporate tax revenues due to profit shifting annually, with a range of potential losses between EUR 9.7 billion and EUR 71.7 billion, depending on the profit shifting elasticities used. The USA is estimated to lose EUR 100.8 billion, and Japan EUR 24.0 billion in tax revenues, with most of these losses attributed to profit shifting to tax havens. These findings align with those of Tørsløv et al. (2023), who estimate global tax revenue losses due to profit shifting at USD 187 billion annually. The analysis also considers welfare losses and the impact of eliminating profit shifting, indicating that while profit shifting may initially reduce capital costs and boost investment and GDP, it ultimately results in a significant negative effect on welfare – for the EU, approximately 0.2% of GDP, and for Japan and the USA, around 0.4% each. Eliminating BEPS would benefit domestic firms by levelling the playing field, increase labour income relative to capital income, and lead to a significant boost in consumption.

3.4 Estimation methods and the available evidence

The different methods introduced in this Chapter use different data and estimation strategies. As a result, they are likely to capture different sources of tax revenue foregone. For example, tax avoidance practices that reduce taxpayers' tax liabilities without affecting a country's measure of gross profits can be detectable through top-down methods based on macroeconomic aggregates or bottom-up methods based on audits of individual taxpayers. In contrast, international tax avoidance, such as profit shifting via transfer pricing, reduces both firms' tax liabilities and national measures of profits. Hence, top-down methods will fail to capture it because the macroeconomic aggregate is already distorted. At the same time, bottom-up methods will often lack sufficient cross-border information to detect it reliably. Conversely, tax evasion – such as under-reporting of income or inflating of expenses – directly lowers both declared tax liabilities and aggregate profits. While difficult to identify through audits alone, top-down methods are better equipped to capture this source of the gap, as they rely on national accounts that include adjustments for hidden or unreported economic activity.

Ultimately, each method provides only a partial view, and the choice of methodology significantly shapes the resulting estimate of the CIT (compliance) gap. This is important to bear in mind when comparing available estimates. To put this into perspective, we compare the available evidence for Italy, Slovakia and Sweden. **Table 1** compiles the estimates generated by top-down and bottom-up approaches and profit shifting estimates ([26]).

In the case of Italy, estimates are available from Gallucci et al. (2020)'s top-down estimate and Wier and Zucman (2022)'s profit-shifting estimate ([27]). Both methods yield very similar figures, of about 20% of the CIT revenues, for the years 2015 to 2019. Yet, the similarity in these figures does not

([26]) We deliberately focus on Italy, Slovakia, and Sweden, as they represent a mix of different estimation methods. CIT gap estimates are also available for a few other countries, though they are not included in this table.

([27]) To maintain conceptual coherence in the comparison, we report only the compliance gap in the top-down method, and we leave out the collection gap, which is also estimated and is smaller in magnitude.

suggest that there is an overlap in the unreported CIT liabilities that the two methods capture. Rather, the true CIT gap may be closer to the sum of both numbers.

In the case of Slovakia, estimates for all three different methods exist. In particular, CIT gap estimates derived using the top-down and bottom-up methods come from Chudy et al. (2020). Although the two methods report similar estimates for 2015, the evidence available for 2014 and 2016 suggests a different magnitude of the compliance gap, likely reflecting the different scope of the two methods. Furthermore, estimates from the top-down method show a significant downward trend, potentially due to a change in the legislation affecting exempted micro-enterprises. To the contrary, estimates from the bottom-up approach indicate a stable CIT gap of around 25%. In turn, the available evidence from Wier and Zucman (2022) suggests that revenue losses from international profit shifting are substantially smaller in magnitude, around 6%.

For Sweden, Barra et al. (2023) reports a CIT gap of 3.4%, on average, between 2014 and 2018, derived using the bottom-up approach. While Sweden's bottom-up approach mostly focuses on small and domestic enterprises, the CIT gap figure for large enterprises only was 6.3% on average between 2014 and 2018 (Barra et al, 2023). Revenue losses from profit shifting, as estimated by Wier and Zucman (2022), are an order of magnitude larger, in the range of 13% to 18%.

Taken together, the available evidence on the CIT gap derived from different estimation methods suggests that the different source of foregone tax revenues contribute to a varying degree to the overall CIT gap in the respective countries. In both Italy and Slovakia, the available evidence suggests that domestic tax avoidance and tax evasion are the main channels of the CIT gap. In contrast, international base erosion and profit shifting seems to be the main source of CIT revenue losses in Sweden.

Table 1. Available estimates of the CIT gap as a percentage of CIT revenues

	ITALY		**SLOVAKIA**			**SWEDEN**	
	Top-down	**Profit shifting**	**Top-down**	**Bottom-up**	**Profit shifting**	**Bottom-up**	**Profit shifting**
2014	25.8%		42%	26%			
2015	19.2%	19%	23%	24%	5%	3.4% (average for 2014 to 2018)	13%
2016	22.7%	19%	16%	24%	6%		16%
2017	19.6%	15%	11%		6%		17%
2018	17.2%	20%			7%		18%
2019	18.3%	18%			7%		17%

Source: The figures for the compliance gap in Italy come from the top-down method computed by Gallucci et al. (2020). The figures top-down method and bottom-up methods in Slovakia are from Chudy et al. (2020). The figures for bottom-up approach in Sweden is the 2014-2018 average reported in Barra et al. (2023). The figures for profit shifting are from Wier and Zucman (2022).

Traditionally, estimates of CIT gap have been focusing on the domestic source of compliance gap, i.e. domestic tax avoidance and tax evasion. Existing studies employ top-down and bottom-up approaches, described in **Chapters 3.1** and **3.2,** to measure the CIT compliance gap associated with illegal tax evasion and (domestic) tax avoidance, respectively. In general, as the choice of method will depend on the availability of data and on the purpose of the estimation, the use of these methods in practice lacks a sufficient degree of harmonisation. At the same time, methods to estimate international profit shifting have been discussed extensively in the academic literature, resulting in ample empirical evidence.

Against this background, the remainder of this report focuses on an assessment of the top-down and bottom-up approaches to estimating the CIT gap, with the goal to recommend a common approach for the EU. In the next Chapters, we discuss the two methods in detail and evaluate their feasibility for the EU. Then, we focus on the application of top-down methods, with an illustrative case study for Spain. Building on these methods, we suggest a simplified approach to estimate the CIT gap that overcomes some of the limitations of more elaborate methodologies.

4 A comparison and preliminary assessment of the existing methodologies

The two main approaches surveyed – top-down and bottom-up – differ significantly in methodology, scope, data requirements, and applicability. Each method used to estimate the CIT compliance gap has its respective strengths and limitations. All require assumptions to bridge data gaps. Crucially, the nature of the underlying data shapes the specific aspects of the CIT gap each method reveals: top-down approaches are more effective in identifying tax evasion, while bottom-up methods are better suited to detect tax avoidance. Additionally, the two approaches tend to focus on different taxpayer segments: top-down and random audit methods typically address small and medium-sized firms, whereas risk-based audits are mainly directed at larger firms. **Table 2** summarises these methodologies and highlights relevant examples from the literature.

Table 2. Overview of the methodologies to estimate the CIT gap

	Top-down methods	**Bottom-up methods**
Based on	Comparing the potential tax liability derived from aggregate measures of profit reported in NA data against the actual tax liabilities declared to the tax administration	Auditing and quantifying the misreporting of CIT liabilities in a sample of tax returns, and extrapolating these results to the entire population of taxpayers (potentially with correction)
Scope	Uncover mostly tax evasion and produce an economy-wide figure	Uncover mostly tax avoidance and target multiple parts of the gap
Data used	Aggregate data on profits, losses, and tax expenditures, and actually declared profits, losses, tax expenditures, and tax liabilities	Microdata on tax returns from control operations of the tax administration, like random or targeted audits, and information on their representativeness
Data requirements	(1) Independence of NA data from tax return data (2) Exhaustiveness of NA data to cover the non-observed economy (3) Detailed data on tax expenditures, losses, and the timing of payments	(1) A carefully designed set of audits that are of high quality and comparable (2) For random audits, the representativeness of the sample is key (3) For targeted audits, the method and assumptions to extrapolate the results are crucial
Examples	Ueda (2018) Gallucci et al. (2020)	Internal Revenue Service (2022) Chudy et al. (2020)

Source: JRC.

4.1 Scope: what do the methods capture, and what don't they?

As previously discussed, the compliance gap can result from a range of factors, broadly grouped into legal tax avoidance – which, while legal, often contravenes the spirit of the law – and tax evasion, which is explicitly illegal. For the purposes of this report, it is also useful to distinguish between domestic and international tax avoidance, or more generally, between domestic and international sources of tax revenue foregone.

Domestic tax avoidance includes all arrangements by which a taxpayer reduces their tax liability without altering the GOS of a country. Examples include: a domestic firm misclassifying income to benefit from lower marginal tax rates when different rates apply to various income sources; a sole proprietor reallocating income between corporate and personal taxes by adjusting salary; or a domestic group of firms manipulating transfer prices to benefit from lower marginal tax rates. In all these cases, while the taxpayer's liability is reduced, the total GOS of the firm, the group, or the firm-owner combination remains unchanged. Yet, these arrangements can often be challenged during audits by tax inspectors.

When it comes to measuring domestic tax avoidance, top-down approaches are not well equipped to identify its sources. By contrast, micro-based bottom-up methods, which rely on audits of individual tax returns, are more effective in uncovering and quantifying such activities.

In contrast, international tax avoidance refers to arrangements that reduce a taxpayer's liability while directly impacting a country's GOS. A typical example involves profit shifting by large MNEs through transfer pricing. Consider a scenario where a subsidiary in a high-tax country pays a fee for the use of intellectual property (IP) or a trademark held by an affiliated company in a low-tax jurisdiction. In theory, this fee should reflect an arm's length price. However, by inflating the price, the MNE can book higher tax-deductible expenses in the high-tax country and higher taxable income in the low-tax country, effectively shifting profits and reducing overall tax liability. This practice not only decreases the MNE's tax burden but also lowers the GOS in the high-tax jurisdiction.

However, neither top-down nor bottom-up methodologies are well suited to measure the full extent of international tax avoidance. As previously discussed, international tax avoidance distorts NA data because the profits that are shifted abroad are not recorded as such in the aggregate statistics of the jurisdiction out of which those profits have been shifted. In other words, NA data reflects macroeconomic outcomes *after* profit shifting has already occurred. As a result, top-down methods, which rely on NA data to derive a theoretical tax base or a theoretical tax liability – explored before in **Chapter 3.1** – are unable to capture this dimension of the CIT gap.

Bottom-up approaches – discussed in **Chapter 3.2** – could potentially detect some of the profits shifted abroad, for example through transfer pricing adjustments identified during an audit. However, in practice, auditors within tax administrations typically have limited information on the foreign operations of the corporation (Guyton et al., 2021). Moreover, transfer pricing assessments, particularly when they involve intangible assets such as IP, are inherently difficult due to the lack of comparable transactions.

Consequently, neither top-down nor bottom-up methodologies are particularly well suited to uncover and quantify international profit shifting in the context of tax gap estimation. In this regard, separate estimates of the extent of international profit shifting should be seen as complementary to CIT compliance gap estimates, as they help capture distinct dimensions of corporate tax base erosion.

Tax evasion, conceptually distinct from both domestic and international avoidance, manifests in both the micro-accounts of individual taxpayers and national aggregate statistics. Typical examples include under-reporting taxable income or overstating deductible expenses. These practices directly impact a firm's financial statements and tax returns, and at the macro-level, contribute to a lower GOS.

In terms of measuring tax evasion, micro-based approaches that rely on audits struggle to fully capture this aspect of non-compliance, as fraudulent behaviour is often invisible without additional external information. Thus, bottom-up methods generally do not provide a complete picture of tax evasion. Audit data – whether from operational or random audits – tends to focus on registered economic activity and fail to detect hidden or unreported income. Addressing this blind spot requires alternative data collection techniques, such as targeted surveys and direct inquiries. While these may improve upon existing audit data, they still fall short of capturing the full extent of concealment. Consequently, extrapolation using bottom-up data remains inherently limited.

Conversely, top-down methodologies are better positioned to address this issue. As will be detailed in **Chapter 6.2**, national governments are expected to produce comprehensive national accounts that include adjustments for unobserved, hidden, or illegal economic activity. Whereas tax collection figures are based on declared income, national accounts offer a broader measure of economic activity, including undeclared income. This makes top-down methods particularly useful for estimating the portion of the compliance gap attributable to tax evasion. These insights lead to an important conclusion: no single method can provide a full accounting of the CIT (compliance) gap. Depending on the data and methodology, each approach typically captures different aspects – be it domestic tax avoidance, international profit shifting, or (part of) tax evasion (see **Table 3**).

Table 3. Measuring the compliance gap: tax avoidance channels

	Compliance Gap	
Method to estimate compliance gap / Source of compliance gap	**Top-Down Approaches**	**Bottom-Up Approaches**
Domestic Tax Avoidance	Generally not included: domestic tax avoidance does not materialise in NA data	Included: tax audits allow to uncover domestic tax avoidance activities
International Tax Avoidance	Not included: aggregate profits are reported *after* profit shifting (except if NA data has been corrected)	Rather not included: international tax avoidance will generally remain unobservable in a tax audit
Tax Evasion	Included: governments are expected to provide exhaustive NA statistics, inclusive adjustments for illegal, unobservable, or hidden economic activity	Partially included: hidden or unreported income will generally remain unobservable in a tax audit

Source: JRC.

4.2 Advantages and disadvantages of top-down and bottom-up methods

Having established that top-down and bottom-up approaches each capture different dimensions of the CIT compliance gap – ranging from tax evasion to domestic (and international) tax avoidance – we now turn to the question of their practical feasibility. To do so, we assess each method against a set of predefined evaluation criteria. Inevitably, choosing a preferred method involves a trade-off between comprehensiveness and practical feasibility, especially in terms of timeliness and applicability across a critical mass of Member States.

The evaluation criteria examine whether a method is actionable and informative for tax administrations. Consideration is given to whether the methodology uses relatively timely input data to produce up-to-date results that can inform the public and guide policy decisions. Methods that deliver results with delays of many years offer limited utility for current policymaking. Furthermore, outputs should be comparable across a critical mass of the EU27 Member States and cover a sufficiently long time series to enable trend analysis, cross-country comparisons, and tracking of the impact of tax policy reforms. Ideally, methods should also be cost-effective: affordable and practical to implement in a reasonable timeframe.

Additionally, the accuracy and reliability of estimates is crucial. Methods must be robust and not overly sensitive to the choice of modelling parameters or assumptions. They should also align conceptually with the definition of the CIT gap. This means clearly isolating the gap's various components and minimising ambiguity stemming from data scope or timing. Examples of such ambiguity include the inclusion of non-CIT-liable entities that cannot be easily excluded from datasets, or reliance on data compiled on a cash-flow rather than accrual basis.

Top-down methods have a notable advantage: they depend primarily on NA data, which is generally available with relatively short delays – preliminary estimates often arrive within nine months – and span long time periods. These datasets are also accessible from public sources like Eurostat, covering all EU27 Member States. However, implementations of top-down methods, such as the IMF RA-GAP approach described in Ueda (2018), also require supplementary microdata that may not be accessible to all authorities. Another drawback is that NA data is not always independent of tax return data and may be downwardly biased due to corporate tax avoidance, potentially resulting in systematic underestimation of the CIT gap.

The top-down method starts with the GOS in national accounts, derived as a residual from comprehensive measures of value added minus labour costs. National accounts balance data from three different approaches – production, income, and expenditure – and any inconsistencies are absorbed into a residual, which in the income approach is the GOS. This means that GOS reflects not just corporate profits (declared or hidden), but also statistical discrepancies or imbalances.

Another challenge is that NA data is not always disaggregated by economic sector or legal form. In this context, sectoral disaggregation helps distinguish between public, financial and non-financial corporations. In turn, legal form affects the applicable income tax regime, for example corporations liable to CIT versus partnerships liable to personal income tax (PIT). The inability to isolate CIT-liable non-financial corporations (sector S.11) from non-liable entities introduces uncertainty into the estimates and necessitates further assumptions. **Box 5** provides evidence of this mismatch using the case of Germany.

Box 5. CIT and PIT in Sector S.11 in Germany

The comparability of the taxpayers between national accounts and tax return data is crucial for the accurate estimation of the CIT gap using a top-down approach. Ideally, this would mean that the scope of Sector S.11 in national accounts perfectly matches the population of CIT-liable entities covered in the tax files. However, Sector S.11 in national accounts, representing "non-financial corporations", includes a diverse set of entities, including partnerships, which are typically not liable for CIT. Similarly, some CIT-liable entities may be classified outside of S.11. Thus, it is important to explore the scope of S.11 in relation to CIT and PIT liabilities.

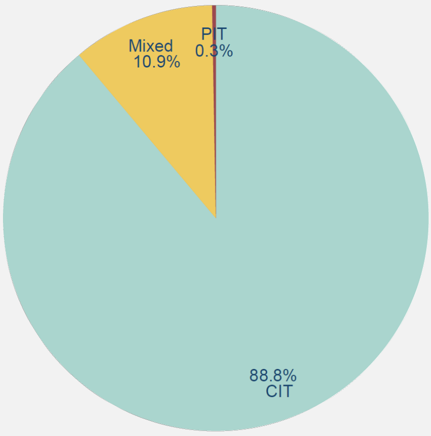
In Germany, business profits are subject to two different taxes. At the national level, profits are taxed either under the PIT or under the CIT, depending on the legal form of the firm. Profits of incorporated firms are subject to the national CIT (Körperschaftsteuer). Profits of non-incorporated firms are subject to the progressive PIT (Einkommensteuer). In addition, both corporate and non-corporate firms are subject to the local business tax (LBT, Gewerbesteuer) at the municipality level.

To assess the share of PIT taxpayers in S.11, we conduct an analysis using microdata from the business tax statistics in Germany for the year 2019. As the corporate tax and the personal income tax, the LBT is a federal tax. For this reason, tax base and liability criteria of the LBT are set at the federal level. The tax rate, in turn, falls under the discretion of the municipalities, which decide autonomously on a scaling factor that is then multiplied with a uniform basic tax rate. This dataset covers the entire universe of entities subject to LBT, covering all legal structures such as corporations, partnerships, sole proprietorships, and individual entrepreneurs. In line with the methodologies used in determining S.11 in national accounts, the dataset includes foreign permanent establishments taxable in Germany, while permanent establishments abroad owned by German firms are excluded. The dataset also provides financial details, including the LBT base for each entity.

In order to isolate entities that fall into NA sector S.11, we exclude those which belong to different sectors – namely, private and public banks and insurance companies (S.12), public services (S.13), and individual entrepreneurs (S.14) – based on their legal classification.

Subsequently, we categorise each entity according to their type of tax liability as either CIT, PIT, or a hybrid category. In Germany, corporations like "GmbH" (limited liability company) or "AG" (public stock corporation) are subject to CIT, while the business profits of partnerships, such as "OHG", are subject to PIT. We also recognise a third category to account for legal forms with a dual tax treatment, such as "GmbH & Co. KG" or "GbR", where some part of the tax base is subject to CIT and other parts subject to PIT.

The figure below illustrates the distribution of the total tax base within sector S.11 for the case of Germany across each of the three tax categories (CIT, PIT, or ambiguous):



Source: RDC of the Federal Statistical Office and Statistical Offices of the Federal States, DOI: 10.21242/73511.2019.00.00.1.1.0, own calculations.

As the diagram illustrates, an overwhelming majority (88.8%) of the tax base within NA sector S.11 is unambiguously subject to CIT, while only a minimal fraction (0.3%) of the tax base is unambiguously subject to PIT, which suggests that the presence of PIT payers in S.11 has a limited impact on the comparability of national accounts and tax returns data. There remains a non-negligible share (10.9%) of the tax base within S.11 which is subject either to PIT or to CIT.

At the industry level, we find particularly large shares of almost 100% CIT-liability for the manufacturing (NACE Rev. 2, Section C) and Information & Communication (NACE Rev. 2, Section J) industries, which together contribute almost 70% of the total LBT tax base.

Bottom-up methods are valuable for their ability to reveal heterogeneity in both the size and causes of the CIT gap across firm types and industries. They are largely unaffected by issues related to conflating different gap components, as they rely on misreporting in actual tax returns. As such, they capture the difference between expected and declared tax liabilities under the current policy regime, uncontaminated by enforcement or policy effectiveness.

In practice, tax administrations mainly rely on risk-based audit data, which are typically generated from standard audit procedures. These audits tend to focus on firms with characteristics linked to higher non-compliance risk – such as firm size or sector. However, a full CIT gap estimate requires coverage of all firms, including smaller ones, ideally via a truly random audit sample. Coordinating such an effort across Member States, with harmonised criteria for firm selection and audit timing, would be exceptionally resource-intensive and time-consuming.

Comprehensive audits, especially for large multinational firms, are particularly costly due to the complexity of these businesses. One major drawback of bottom-up methods is the significant time lag associated with their results. Audits cannot commence until tax returns are filed, and the audit process itself can take several years. **Table 4** summarises the primary advantages and disadvantages of each method.

Table 4. Preliminary assessment of the methodologies to estimate the CIT gap

	Top-down methods	**Bottom-up methods**
Advantages	(1) Necessary data usually publicly available with short time lag (2) Method does not require sophisticated modelling and/or econometric techniques	(1) Highly detailed data allow to unmask heterogeneity in CIT gap and inspection of the sources of the gap (2) In principle, risk-based tax audits are a by-product of the operations of the tax administration and could be available for CIT gap estimation (at least internally)
Disadvantages	(1) Discrepancies between the scope and timing of economic activity and national accounts/tax collection data introduce uncertainty and require further assumptions (2) NA data is distorted by tax avoidance (3) Uncertain distinction between the compliance, the policy and the collection gap	(1) Necessary audit-based data is usually not publicly available (2) Audit data is only available with significant time delay (3) Random tax audits would be desirable for CIT gap estimation, but are particularly costly for tax administrations (4) Samples of random tax audits usually do not include very large corporations given the complexity of the tax audit for those firms

Source: JRC.

Given these considerations, the preliminary assessment in this Chapter concludes that it is currently not feasible to produce harmonised and comparable CIT gap estimates across EU Member States using bottom-up methodologies. While these methods provide precise firm-level insights into lost revenues, their implementation is hindered by high costs, lengthy timelines, and data unavailability. Specifically, the absence of publicly available random audit data is a critical constraint. Even risk-based audit data – though available in principle to national authorities – lacks cross-country harmonisation, particularly in firm selection.

Against this backdrop, we now turn our attention to top-down approaches, particularly the RA-GAP method and its variations, as viable options for EU-wide application. In the next Chapter, we assess the RA-GAP method using Spain as an illustrative case, due to the availability of comprehensive public data. We then propose a simplified version of the RA-GAP approach, which mitigates several of its limitations and offers the advantage of broader applicability across all EU Member States.

5 Top-down method in practice: a Spanish case study

As part of our quantitative evaluation of the existing methods to calculate the CIT gap, we implement the top-down approach in a country of choice, following the IMF procedure as closely as possible. The goal of this exercise is not only to produce an estimate of the CIT gap according to the IMF method, but also to highlight the assumptions, implications, obstacles and difficulties, entailed by this method in practice.

Spain is a particularly suitable case for this exercise. It is a large European country, accounting for 9% of corporate profits and 6% of CIT tax revenues in the EU in 2019 ([28]). Its CIT rate (25%) is broadly representative of the European average, while the pervasive presence of informal activities suggests that the CIT gap may be potentially sizeable ([29]). Most importantly, the Spanish tax administration publishes a wealth of data based on corporate tax returns, offering a level of detail rarely available in other Member States. The Spanish tax return is designed to be exceptionally comprehensive, requiring firms to report detailed balance sheet and profit and loss information, along with the full set of calculations used to determine the tax base and liability ([30]). This allows for a precise quantification of the steps needed to derive the tax base from current profits within the declared economy ([31]).

5.1 The Spanish CIT system

The Spanish tax on business profits is governed by Law 27/2014 on the Corporate Income Tax and Royal Decree Law 634/2015 on the implementation of the Corporate Income Tax and is levied on all companies and entities with commercial purpose, having legal personality or not, operating in Spain. The general rate is 25%.

In practice, there are multiple exceptions to the general rule. In terms of the scope, certain entities are either partially exempt (NGOs, institutions, political parties; professional, business and workers' associations; chambers of commerce, job-promoting funds and state ports) or totally exempt (public administration, state agencies, or the Bank of Spain) from paying CIT.

Additionally, the law establishes special regimes for certain types of entities. On the one hand, many types of entities benefit from lower statutory rates: Real Estate Investment Trusts (REITs, or *SOCIMIs* in Spanish) are subject to a 0% CIT rate if they meet certain requirements; investment funds are subject to a 1% rate; NGOs, 10%; newly created entities, 15% during their first tax period; and workers' cooperatives, 20%. Moreover, starting in tax year 2023, entities with turnover below EUR 10 million benefit from a reduced rate that is expected to progressively decrease to reach 20% in 2029, with entities with turnover below EUR 1 million having a 3-percentage points discount on their first

([28]) At the time of writing this report, 2019 appears as the most reliable reference year for the analysis, as in the period 2020-2022 the data is highly affected by the COVID pandemic, and for the subsequent years (e.g. 2023) the information is still not yet publicly available or is likely to undergo further revisions.

([29]) Pappadà & Rogoff (2023) report three different estimates of the size of the informal economy in Spain that range between 19% and 24%.

([30]) Additionally, we have benefited from invaluable cooperation of both the Spanish Tax Administration (Servicio de Estudios Tributarios y Estadísticas de la AEAT) and the Spanish National Statistics Institute (INE) in writing this Chapter.

([31]) See https://sede.agenciatributaria.gob.es/Sede/estadisticas.html.

EUR 50,000 of taxable profits. On the other hand, entities like oil companies and financial institutions are subject to a higher rate of 30%.

For the application of the top-down method, this implies that applying the general statutory rate of 25% to a derived measure of the potential tax base will never be exact. However, if we focus on non-financial corporations (institutional sector S.11 in national accounts) and exclude investment vehicles and financial institutions, the average tax rate (e.g. sum of the full tax liability over the tax base) on the declared side is very close to the statutory rate, since the share of profits from entities subject to special regimes is low. In particular, 94.8% of non-financial corporations and 98.4% of the tax base are subject to the statutory rate of 25% ([32]).

Other characteristics of the Spanish CIT system are very similar to those of other corporate tax regimes in Europe. To name the most important ones, there are exemptions for double taxation for foreign income of permanent establishments subject to at least a 10% CIT rate in the source country, and for dividends and capital gains if the participation is at least 5% of equity. Additionally, Spain, like many other countries, allows for tax group profit and loss consolidation, as well as loss carry-forward, which we can observe in aggregate data from tax returns and will be exploited in our analysis. Finally, there are multiple tax incentives, among others to R&D, cultural activities, job creation for vulnerable workers, income from intangible assets, or investment in certain regions. Some of these apply to the tax base and some are applied in the form of tax credits, further reducing the ETR on profits.

5.2 Issues of scope

The first important issue to consider when implementing the top-down approach is that if the comparison of data from national accounts and tax returns is to give an accurate measure of the CIT gap, then they must refer to the same population of taxpayers. In this sense, the institutional sector S.11, which refers to non-financial corporations, is mostly composed of public and private limited companies subject to CIT. However, in NA, values for the institutional sector S.11 might also include so-called quasi-corporations, which are market producers that operate like a company and have separate accounting books but are not incorporated. This is the case of some partnerships or sole proprietorships, which are not subject to CIT but to the PIT of their owners.

In Spain, quasi-corporations that are not legal entities are classified under S.14 (the Household sector), while the single shareholder public and private limited companies that are classified in S.11 are legal entities subject to CIT (Banco de España, 2017). Moreover, most partially exempted entities are classified under S.15 (Non-Profit Institutions Serving Households). While some NGOs and other institutions, like sports federations, fall into S.11, they are generally non-profit entities with a low profit margin, if any, and consequently, represent a negligible share of the GOS. This fact, together

([32]) Averages calculated for 2017-2021 from tax return micro-data. The second most common rate in terms of the number of firms is 15%, which applies to 3.2% of non-financial corporations, but they only account for 0.4% of the tax base.

with the evidence collected for Germany (see **Box 5**), suggest that the scope issues derived from quasi-corporations classified into S.11 are much less important in Europe than in the USA ([33]) ([34]).

Tax return data may also be the source of issues of scope. In particular, some public corporations such as public utility providers, hospitals, the public mail service, train operators, transportation hubs like airports, ports and similar, are also subject to the CIT. The tax liabilities from these entities would be included in the aggregate data from tax returns, but in national accounts they would be classified into S.13 (the Government sector). In Spain, the CIT payments attributed to these entities account for about EUR 600 million annually, which is less than 3% of the total tax liability. In our calculations below, we use tax return data net of these entities, which was made available to us by the Spanish tax administration.

Finally, a scope issue that is specific to Spain concerns fiscal decentralisation. Two regions, the Basque country and Navarre, are not part of the common fiscal territory and have their own tax agencies. Moreover, these regional tax agencies publish very little information. This implies that the profits of some CIT payers in the GOS of NA, which covers all Spain, will not show up in the tax return data published by the Spanish tax agency. Nonetheless, this issue should not be overstated: entities operating in the rest of Spain, as well as entities with profits above a certain threshold must fill in their tax returns with the Spanish tax agency and report *all* of their corporate profits, including those derived from activities in the Basque country and Navarre ([35]).

In sum, while the scope issues may not be quantitatively big, particularly for countries like Spain with a potentially large CIT gap, they add to the uncertainty with which the gap is estimated using the top-down method.

5.3 National accounts vs tax returns

All the above issues considered, the starting point for applying the top-down method is the GOS of S.11. In national accounts, GOS is defined as gross value added (GVA) minus compensation of employees (CoE), where GVA is production at basic prices minus intermediate consumption at purchasers' prices minus taxes on production and imports. As stated earlier, the Spanish tax returns contain the profit and loss statement of corporations, so that firms' earnings before interest, taxes, depreciation, and amortisation (EBITDA), the equivalent of value added minus CoE and taxes on production and imports in firms' accounting, is available in the aggregate tax return data.

([33]) This is likely because the marginal PIT rate is high in Europe compared to the CIT rate leading to a stronger incentive to incorporate at lower values of company profits. See, for example, Fuest & Weichenrieder (2002).

([34]) In the primary income allocation account, all income produced domestically is attributed to domestic institutional sectors S.11 to S.15, including income that accrues to the rest of the world. Specifically, the GOS of S.11 also includes flows accruing to non-financial non-resident persons, both legal (e.g. Spanish subsidiaries of foreign businesses) and natural persons, which are treated as a notional quasi-corporation. This implies that the rental value of owner-occupied dwellings belonging to non-resident natural persons is included in the GOS of S.11. These flows are potentially large in Spain. One key adjustment in the IMF method is to subtract untaxable income, in this case, "D.422 - Withdrawals from the income of quasi-corporations". This adjustment ensures that when deriving the FAP from the GOS, corrections are made not only for conceptual differences in their definitions but also for differences in scope. When we use the GOS, we adjust it for these flows, which were made available to us by the Spanish National Statistics Institute (INE).

([35]) The scope issues between national accounts and tax returns are thus circumscribed to Basque and Navarra firms with a turnover under EUR 10 million for which more than 25% of their business activity takes place in those territories.

Importantly, while the compilation of NA data is largely based on information from tax returns, the Spanish National Statistics Institute (INE) performs additional adjustments. Regarding production, INE corrects for non-market production, like production for own use or consumption, inventory changes, financial intermediation services indirectly imputed (FISIM), and exhaustiveness adjustments for the non-observed economy. Regarding the CoE, INE corrects for compensations in kind, tips, wages in the non-observed and non-registered enterprises, and only accounts for wages and salaries, removing net social contributions or other employer contributions to employee funds, and non-wage transfers to workers, such as maternity and paternity leaves or severance payments. In terms of intermediate consumption, INE corrects for FISIM and the non-observed economy and deducts R&D expenses ([36]). Finally, adjustments in the production, income and expenditure approach to compute GDP are equilibrated to make them internally consistent.

Many of these adjustments to national accounts help ensure, to a certain extent, their independence from tax return data – an essential requirement for the application of the top-down method. Moreover, the exhaustiveness adjustments for the NOE, such as non-registered businesses or under-reported income, closely align with the concept of the CIT gap, as will be further discussed in the next Chapter. However, some other adjustments reflect conceptual differences between national and corporate accounting that hinder the comparability between the two data sources. Some of these differences are considered by the IMF top-down method, including adjustments for inventory changes, social contributions or R&D expenses, which are recorded differently in corporate and national accounting.

Nevertheless, significant conceptual differences between GOS and EBITDA remain and it is not certain that these are addressed by the top-down method. For example, in Spain, production and intermediate consumption are not defined in the same way in tax returns and in national accounts. In tax returns, production is defined as net revenue or turnover (in Spanish, *importe neto de la cifra de negocios*), plus inventory changes, plus other operating income. In turn, turnover is the revenue from the sales of goods and services plus certain income of a financial nature (the income from the subsidiaries of corporate groups). Conversely, INE uses tax return information only on the sales of goods and services, not turnover, as input data for their production estimate, thus excluding the income from subsidiaries ([37]). These differences yield a value for production and intermediate consumption that is higher in tax returns than in national accounts. However, since the differences in production are smaller than the differences in intermediate consumption, GVA is higher in national accounts than in tax returns. This gap carries over to the difference between GOS and EBITDA ([38]).

([36]) The change in the treatment of R&D expenditures was one of the main innovations in the introduction of ESA 2010 and it was the main driver behind the revisions of GDP. This item was considered earlier as "intermediate consumption", but it was re-classified as "gross fixed capital formation", because it creates a form of capital, i.e. Intellectual Property Products. See:

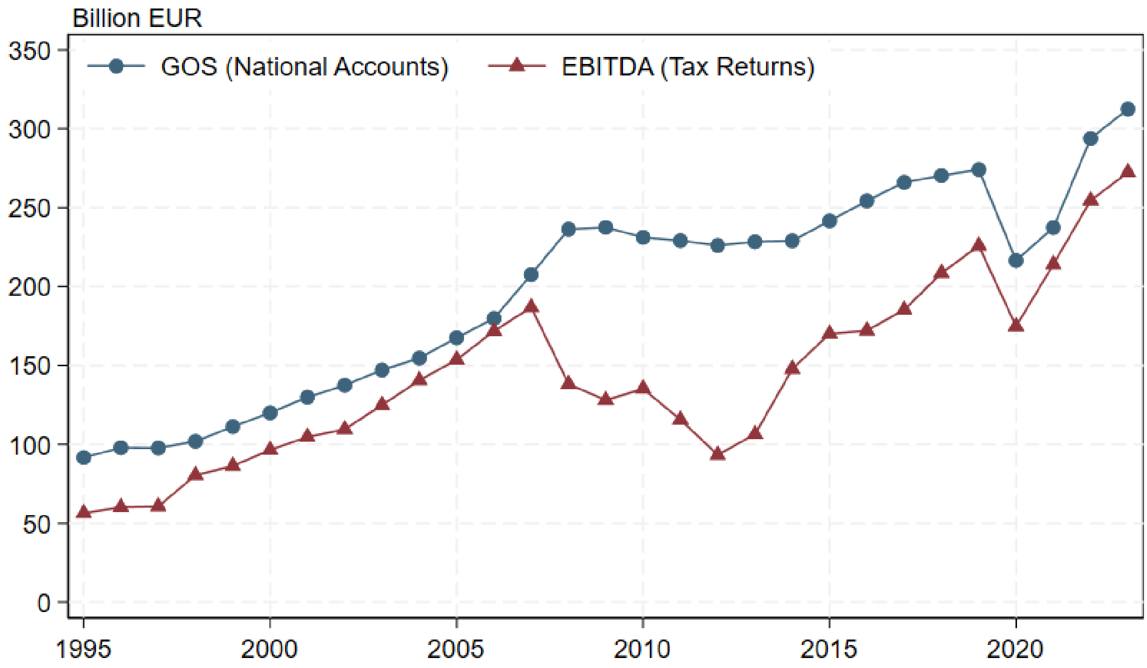
https://eur-lex.europa.eu/resource.html?uri=cellar:cb11eb82-663b-4358-89ff-032ea811d2b4.0001.01/DOC_1&format=PDF.

([37]) Differences in intermediate consumption concern the changes in input commodities and the variation in the stock of raw materials employed for production. For more details on this, see https://sede.agenciatributaria.gob.es/static_files/Sede/Tema/Estadisticas/Observatorio_margenes_empresariales/Metodologia_OME_VF.pdf.

([38]) Note that if the difference between GOS and EBTIDA was only due to the income from subsidiaries, this would imply that subsidiaries consistently make losses, since GOS, which excludes this income, is larger than EBTIDA. However, the data shows that this flow is consistently positive. Additionally, this conceptual difference could be corrected for in one

This fact suggests that the larger magnitude of GOS vis-à-vis EBITDA is largely not due to GOS encompassing unreported corporate income that constitutes a CIT gap, but to the conceptual differences underlined above. It also implies that even after applying the significant and data-demanding steps of the top-down method, deriving a potential tax base from the national accounts that can be comparable to the declared tax base in tax returns to derive an estimate of the CIT gap is not guaranteed. To underline the significance of these differences in concept and scope, it is informative to compare the evolution of the GOS in national accounts and the aggregate EBITDA for firms in tax returns.

Figure 2. Current corporate profits in National Accounts vs tax returns, Spain 1995-2023



Source: authors' elaboration. Data for GOS in national accounts is taken from INE, Cuentas anuales no financieras de los sectores institucionales, cuentas corrientes detalladas, variable B.2g - Excedente Bruto de Explotación of S.11, Non-Financial Corporations. Data for EBITDA is taken from the Administración Estatal de la Agencia Tributaria (AEAT), Informe Anual de Recaudación Tributaria, Tabla 8.4 - Cuenta de Pérdidas y Ganancias de las Sociedades No Financieras, variable Resultado Bruto de Explotación.

Figure 2 shows the evolution of these two magnitudes for Spain between 1995 and 2022. As stated, GOS is always higher than EBITDA, but the gap between both varies significantly throughout the period. In particular, their difference seems to be strongly counter-cyclical. During the years of strong growth in Spain since the end of the 20th century, the gap between GOS and EBITDA narrowed significantly, with GOS only between 5% and 10% larger than EBITDA in the 4 years prior to the Great Financial Crisis. However, at the onset of the crisis, the two variables diverge significantly. While GOS continues to grow until 2009, and then suffers a mild decline, EBITDA falls drastically. Their difference

of the steps of the top-down method, in particular, when the item D.42 - Distributed income of corporations in national accounts is added to GOS. However, the difference between the net financial income in national accounts and in tax returns correlates little with the income from subsidiaries.

reaches 143% of EBITDA in 2012, one of the worst years for Spain during the Eurozone Debt Crisis. Since then, EBTIDA has recovered fast and the gap between the two variables is narrowing again. The GOS-EBITDA difference was 15% of EBITDA in the last year of available data, 2023.

Some of this cyclical behaviour in the GOS-EBITDA difference might reflect a CIT gap, for instance, if firms are more aggressively miss-reporting as a hedge against falling profits during a crisis ([39]). However, the shocks to economic activity may also affect the items that are part of the conceptual differences between GOS and EBITDA in a structural way. In particular, the subsidiary income of corporate groups, which is included in EBITDA but excluded from GOS is likely to be counter-cyclical as well. In any case, GOS and EBITDA are not the basis of the comparison suggested by the top-down method. This subchapter is only meant to illustrate that even if all the steps of the top-down method can be correctly implemented, national accounts and tax return data are of a very different nature, and it is important to understand how both are compiled and defined to better interpret their comparison. Moreover, since it is likely that not all the steps can be correctly implemented, the gap estimates will be polluted by these conceptual differences.

5.4 Step 1: deriving financial accounting profits

Step 1 of the top-down method entails adjusting the GOS to derive a measure of potential financial accounting profits (FAP) that accounts for these conceptual differences ([40]). As explained above, GOS is defined as output minus intermediate costs, while FAP are revenues minus expenses. To derive FAP, the difference between revenues and output must be added to GOS, while the difference between costs and expenses must be subtracted. The differences between revenues and output are essentially the financial income (interest, dividends, rents, and capital gains), the foreign source income, as well as inventory valuation adjustments. The differences between costs and expenses are financial expenses (i.e. interest payments and rents), current and capital transfers (such as social security contributions and subsidies), accounting depreciation, capital losses, and R&D expenditures.

The most important adjustments from GOS to FAP are flows that are directly observed in national accounts, particularly those related to financial income and expenses, and to current and capital transfers. Other adjustments, some potentially very large, lack an equivalent in national accounts and must be inferred. In our calculations, certain adjustments (inventory valuation, R&D expenditure, and depreciation) have been accounted for using information provided by INE that is not publicly available ([41]). In some cases, including the adjustments for profits of foreign branches, realised capital gains, provisions for allowances and reserves, and stock options to employees, there was no choice but to use the information from tax returns.

For example, profits of foreign branches were estimated from the double-tax exemptions for foreign permanent establishment income (Article 22 of the Spanish CIT Law), as suggested in Ueda (2018). Stock options to employees were taken from tax return microdata (not publicly available). When tax return data has been used, the value of the adjustment has been estimated as the declared value times GOS over EBITDA. Finally, there are some adjustments (e.g. cost of trading and issuing

([39]) The empirical literature consistently finds the size of the informal economy to be countercyclical, a stylised fact dubbed “The Hugo Effect” (Pappadà & Rogoff, 2023).

([40]) See **Chapter 3.1** and especially **Table A.1** in the **Appendix** for an overview of the steps.

([41]) For accounting depreciation, we used the Consumption of Fixed Capital (P.51c) at historical cost.

securities) for which no data could be found, although these are expected to be relatively small for Spain. The reversal of allowances and reserves is a provision in the Spanish tax code and is adjusted for in Step 2.

The schematic formula in **Figure 3** is adapted from Ueda (2018), with a reference to the ESA2010 code when the magnitude is available in national accounts, and the source of the data used when a national account equivalent is not available.

Figure 3. Derivation of Financial Accounting Profits (FAP)

Gross Operating Surplus	**B.2g**
+ Interest income (received)	D.41g
+ Distributed income of corporations (received)	D.42
+ Realized profits of foreign branches (received)	TR
+ Other investment income (received),	D.44
- except investment income of insurance policy holders	D.441
+ Rents (received)	D.45
+ Net social contributions	D.61
+ Other current transfers (received)	D.7
+ Capital transfers (received)	D.9
+ Inventory valuation adjustment (holding) gains	INE
+ Realized capital gains	TR
+ Cost of trading and issuing securities	-
+ Reversal of allowances and reserves	-
- Interest income (paid)	D.41g
- Rents (paid)	D.45
- Social benefits other than social transfers in kind and other current transfers, like nonlife insurance net premiums, fines and penalties, and donations (paid)	D.62
- Other current transfers (paid)	D.7
- Capital transfers (paid)	D.9
- Inventory valuation adjustment (holding) losses	INE
- R&D expenditure and software	INE
- Accounting depreciation	INE
- Provisions of allowances and reserves	TR
- Stock options to employees	TR
= Financial Accounting Profits	

Source: Ueda (2018), JRC application to Spain.

5.5 Observed adjustments in the tax returns

Financial accounting profits (FAP) are the starting point of the tax return. From here, the tax code allows firms to apply exemptions, deductions, and allowances, while including non-deductible items, to derive the tax base. Step 2 of the top-down method replicates these adjustments from FAP to the tax base. In fact, Step 2 implies that some of the items added in Step 1 to derive FAP have to be (partially) subtracted, since they are mostly tax exempt. An example of this are foreign profits and dividend income. Thus, deriving FAP as an intermediate step puts a heavy strain in terms of data demands on the top-down method, when eventually several adjustments from GOS to FAP cancel out with adjustments from FAP to the tax base. Once the tax base is calculated, Step 3 accounts for losses, since only entities with positive tax bases are liable for CIT in the current period, and tax groups can deduct the negative tax bases from loss-making subsidiaries against the group's profits. Finally, Step 4 applies the statutory tax rate and deals with tax credits.

In practice, the best and often only source of information for the adjustments in Steps 2-4 are, of course, tax returns. However, using tax return data implicitly entails the assumption that the undeclared economy follows a pattern similar to the declared economy. In order to formalise this assumption, we follow Gallucci et al. (2020) and derive a measure of the Spanish CIT gap averaging over certain adjustments based on tax return data. Before that, however, we will examine in depth the rich information available from the Spanish tax agency.

As explained above, the reporting requirements of Spanish firms to their tax administration are very comprehensive. In addition to the information necessary to calculate their tax liability, firms must fill in financial statements with balance sheet and profit and loss information for the period, in what is known as *Modelo 200* ([42]). Tax groups are also required to fill in another document, *Modelo 220*, in which they provide additional information on the calculation of the consolidated tax base, credits, and liabilities. For many of these entries, the Spanish tax administration publishes the aggregate equivalents. Aggregate equivalents are available either at the unconsolidated level, spanning the entire universe of firms, or at the consolidated level, reported separately for tax groups and standalone entities ([43]) ([44]).

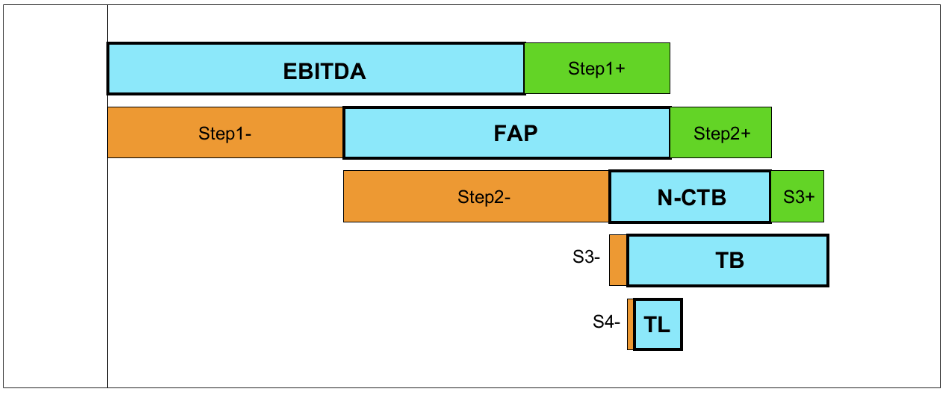
All this information allows us to derive Steps 1 to 4 for the declared part of the economy. While some of these steps differ when applied to the unobserved part (particularly Step 1, which must account as well for the differences between GOS and EBITDA), this exercise provides interesting insights on the relative importance of these adjustments. **Figure 4** shows the steps of the top-down method from EBITDA to the Tax Liability (TL) for the observed part of the economy using 2019 Spanish tax returns. Steps 1 and 2 are quite large, while Steps 3 and 4 are relatively small.

([42]) All the information about the Spanish CIT return can be found in the Spanish Tax Administration (AEAT) website, https://sede.agenciatributaria.gob.es/Sede/procedimientoini/GE04.shtml.

([43]) Unfortunately, the business population in the Unconsolidated Accounts is not the same as in the Consolidated Accounts, as the latter are net of entities subject to special tax regimes, such as investment funds subject to 0% and 1% CIT rate. However, their share of the tax base is small.

([44]) Moreover, tabulations of these aggregates are provided by NACE Rev. 2 industry and by firm size (not used here).

Figure 4. Top-down method adjustments on the tax returns in Spain, 2019



Source: authors' elaboration, data taken from the Administración Estatal de la Agencia Tributaria (AEAT), Cuentas no consolidadas y Cuentas consolidadas del Impuesto de Sociedades para las Sociedades no financieras, 2019.

Table A.2 in the **Appendix** provides the actual numbers on which **Figure 4** is based. A close inspection of the table allows us to draw several conclusions. For example, the most important items for each of the steps:

— In **Step 1**, the largest positive adjustments (Step1+) are financial income and capital gains, while the largest negative adjustments (Step1-) are accounting depreciation and capital expenses.

— In **Step 2**, the largest positive adjustments (Step2+) are provisions for losses, while the largest negative adjustments (Step2-) are exemptions for double taxation.

— In **Step 3**, positive adjustments (Step3+) are the losses of standalone entities or tax groups making a loss in the current period. Recall that these are added back because aggregate EBITDA is a net concept that sums up positive and negative tax bases, while we are only interested in positive tax bases that lead to positive tax liability. Negative adjustments (Step3-) are loss carry-forwards and provisions for capital reserves.

— In **Step 4**, tax credits are subtracted from the full tax liability that is derived by applying the statutory rate to the tax base.

Table A.2 in the **Appendix** also shows the consolidated accounts separately for tax groups and standalone entities. Interestingly, all the adjustments from EBITDA to the tax base for standalone entities leave the magnitude barely unchanged (from EUR 65.3 to EUR 65.0 billion). On the other hand, tax groups, which are also composed of the largest Spanish firms, are able to take advantage of the provisions in the tax code more extensively and reduce their tax base to EUR 36.8 billion from an EBITDA of EUR 119.7 billion. For standalone entities, loss carry-forwards are sizeable (EUR 12.8 billion), while for tax groups, within group consolidation of losses (EUR 8 billion) is double the size of loss carry-forwards (EUR 4 billion). Finally, the ETR on the tax base is very close to the statutory rate (24.4% for standalone entities and 24.9% for tax groups), despite the multiple special tax regimes.

5.6 Steps 2-4 based on Gallucci et al. (2020)'s method

As explained above, implementing Steps 2-4 of the IMF top-down method is unfeasible without relying on information from tax returns. Using tax return data imprints certain assumptions on the characteristics of the undeclared economy for which no alternative or independent estimate exists.

Broadly speaking, we lack information on the extent of income exemptions (Step 2) and of losses (Step 3) that would accrue to the undeclared economy, to estimate the share of potential FAP that actually constitutes the potential tax base. We also do not know whether the undeclared economy would benefit from additional tax credits after applying the tax statutory rate (Step 4). Against these data limitations, we follow the strategy proposed by the Italian Tax Administration, which exploits the information in the tax returns to derive a potential tax base under certain assumptions (Gallucci et al., 2020).

The top-down estimate of the Spanish CIT gap is the product of the undeclared tax base times an ETR. The undeclared tax base (TB_{ud}) is the difference between the potential tax base (TB_p) and the declared tax base (TB_d). Define the additional adjustments from GOS to TB_p as Δp (for potential adjustments) and from EBITDA to TB_d as Δd (for declared adjustments):

$$TB_p = GOS + \Delta p \quad (1)$$

$$TB_d = EBTIDA + \Delta d \quad (2)$$

Define the difference between GOS and EBITDA as the undeclared GOS (GOS_{ud}). The undeclared tax base (TB_{ud}) can thus be expressed as the undeclared GOS (GOS_{ud}) plus the difference between potential and declared adjustments:

$$TB_{ud} = TB_p - TB_d = GOS + \Delta p - (EBITDA + \Delta d) = GOS_{ud} + (\Delta p - \Delta d) \quad (3)$$

The ETR is the ratio of the declared tax liability (TL_d) over the declared tax base (TB_d) calculated using tax returns:

$$ETR = \frac{TL_d}{TB_d} \quad (4)$$

The general formula for the CIT gap is:

$$CIT\ gap = [GOS_{ud} + (\Delta p - \Delta d)] \times \frac{TL_d}{GOS_d + \Delta d} \quad (5)$$

Moreover, we split the adjustments from GOS to TB_p and from EBITDA to TB_d in two categories, such that $\Delta p = \Delta p_1 + \Delta p_2$ and $\Delta d = \Delta d_1 + \Delta d_2$. Define Δp_1 as de difference between GOS and the potential FAP ($pFAP$) that has been derived in Step 1, described in **Chapter 5.4** and **Figure 3**. Δd_1 is the equivalent variable observed in the tax returns (declared FAP or profit and loss before tax). Δp_2 and Δd_2 are the adjustments in Steps 2-4 on the potential and declared side respectively.

Following Gallucci et al. (2020), we calculate three different top-down estimates:

— **Hypothesis 1**: A first, naïve estimate assumes that the adjustments from GOS to TB_p are proportional to the ones observed in tax returns, e.g. $\Delta p = \Delta d \times (GOS/EBITDA)$. This yields an estimate of the CIT gap that is equal to the undeclared over the declared GOS, e.g. $CIT\ gap = GOS_{ud}/GOS_d$. This estimate assumes that the undeclared economy has the same proportion of exempt income, of deductions and allowances, and of losses and tax credits than the declared economy. While overly simplistic, this first estimate serves as a useful benchmark. Moreover, taking into account the conceptual differences between GOS and EBTIDA discussed in **Chapter 5.3**, this estimate is a reference on the extent to which more refined estimates are still polluted by the strong patterns in the GOS-EBITDA difference.

— **Hypothesis 2**: The second tax gap estimate implements Step 1 of the top-down method and then assumes that the unobserved economy is not able to claim any additional adjustments from FAP to the TB, e.g. $\Delta p_2 = \Delta d_2$. On the one hand, this estimate assumes that undeclared activities would be taxed under the full rate without additional deductions (Step 2). At the same time, it also assumes that losses are not likely to be unreported (Step 3). While Step 2 implies a decrease from FAP, Step 3 implies an increase, since we go from net to gross aggregate profits. This estimate ultimately implies that Steps 2 and 3 largely cancel out. It also assumes that the undeclared economy claims no additional tax credits (Step 4).

— **Hypothesis 3**: The third tax gap implements Step 1 of the top-down method and then assumes that the rest of the deductions would be proportional to the ones observed in the tax return, e.g. $\Delta p_2 = \Delta d_2 \times \left(FAP_p / FAP_d\right)$ ([45]). This yields an estimate of the CIT gap that is equal to the undeclared over the declared FAP, e.g. $CIT\ gap = FAP_{ud}/FAP_d$.

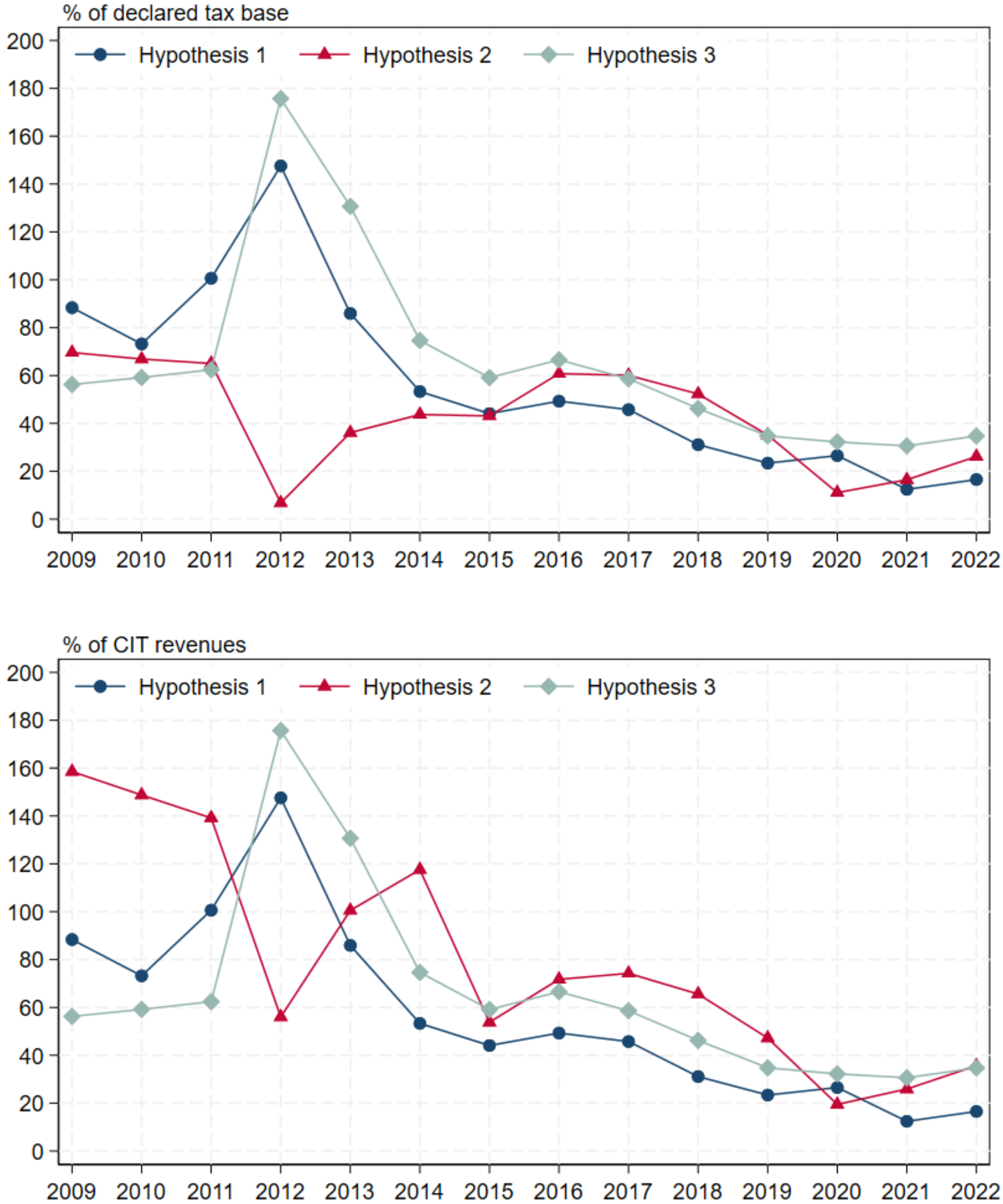
5.7 A top-down estimate of the Spanish CIT gap

Figure 5 shows the three estimates of the Spanish CIT gap following the hypotheses laid out in the previous paragraph for the years 2009 to 2022 ([46]). The top panel shows the Tax Base gap, and the bottom panel shows the Tax Liability gap.

([45]) While in Hypothesis 2 we proxy potential depreciation using the national accounts item P.51c - Consumption of Fixed Capital at historical cost (provided by INE), in Hypothesis 3 we follow Gallucci et al. (2020) and include depreciation in Δp_2 rather than Δp_1, in order to prevent extreme values.

([46]) Consolidated tax returns for non-financial corporations are publicly available since 2016. Data from 2009 has been provided by the Spanish tax administration (AEAT).

Figure 5. Three top-down estimates of the Spanish CIT gap

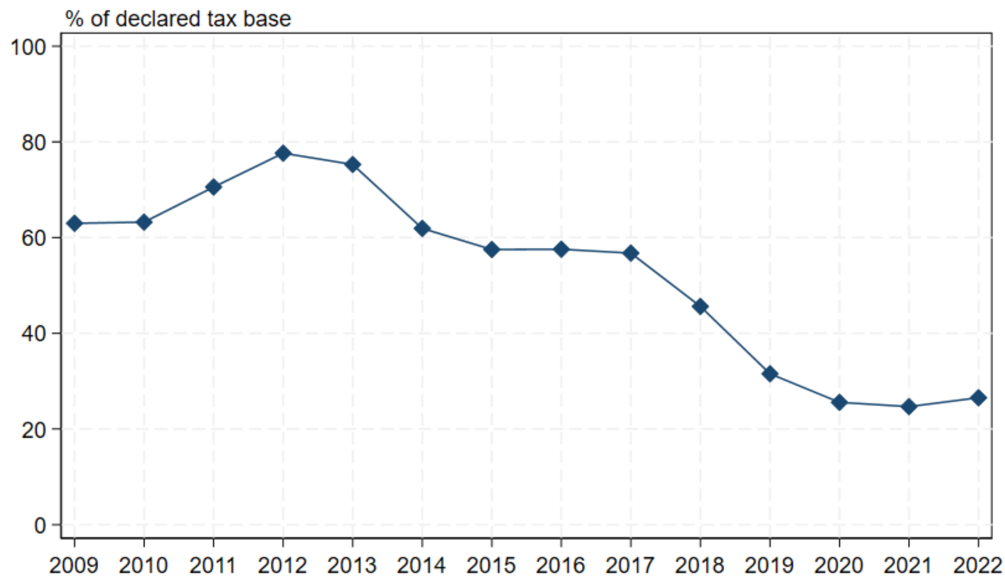


Notes: The figure compares CIT gap estimates for Spain derived following the top-down method under three alternative hypotheses. Hypothesis 1 approximates the gap as the difference between GOS and EBTIDA. Hypothesis 2 implements Step 1 of the top-down method and then assumes that the undeclared economy claims no additional deductions. Hypothesis 3 applies Step 1 of the top-down method and then assumes that the potential deductions for the undeclared economy are proportional to the ones in the declared economy. Source: authors' elaboration. NA data is taken from INE, Cuentas anuales no financieras de los sectores institucionales, cuentas corrientes detalladas. Data on Tax Returns are taken from the Administración Estatal de la Agencia Tributaria (AEAT), Informe Anual de Recaudación Tributaria, Tabla 8.4 - Cuenta de Pérdidas y Ganancias de las Sociedades No Financieras, and "Cuentas Consolidadas de las Sociedades No Financieras". INE kindly provided additional data on inventory valuation adjustments, R&D expenditures, Consumption of Fixed Capital at historical cost, and imputed rents of non-resident homeowners, which are not publicly available. AEAT kindly provided financial statement and tax return aggregates only for the corporations that are classified under S.11.

As we can see, both panels follow a general downward trend, with the exception of the years 2011-2013, in which Spain suffered a very severe economic crisis. In fact, in 2012, the peak of the recession, aggregate financial accounting profits are negative, causing extreme values in the estimates. While the tax gap's downward trend surely captures the efforts of the Spanish tax administration to reduce non-compliance, it also closely mirrors the convergence between GOS and EBITDA after the Great Financial Crisis, analysed in **Figure 2** in **Chapter 5.3**, and represented by the line labelled Hypothesis 1. This fact raises suspicions that despite all the efforts in the adjustments, the CIT estimate may still be affected by conceptual differences between GOS and EBTIDA and their weak comparability.

To better analyse the CIT gap dynamics in Spain, we refine the estimate by taking the mean between Hypothesis 2 and 3 and smoothing the series with a 3-period moving average filter, which is shown in **Figure 6**. The estimate shows a somewhat stable value above 60% at the beginning of the period, that slightly increases and falls during the worst years of the Great Recession in Spain. It stabilises under 60% in 2015-2017, and then follows a markedly downward trend, that stabilises again slightly above 20% from 2020 onward.

Figure 6. Spanish CIT gap estimate

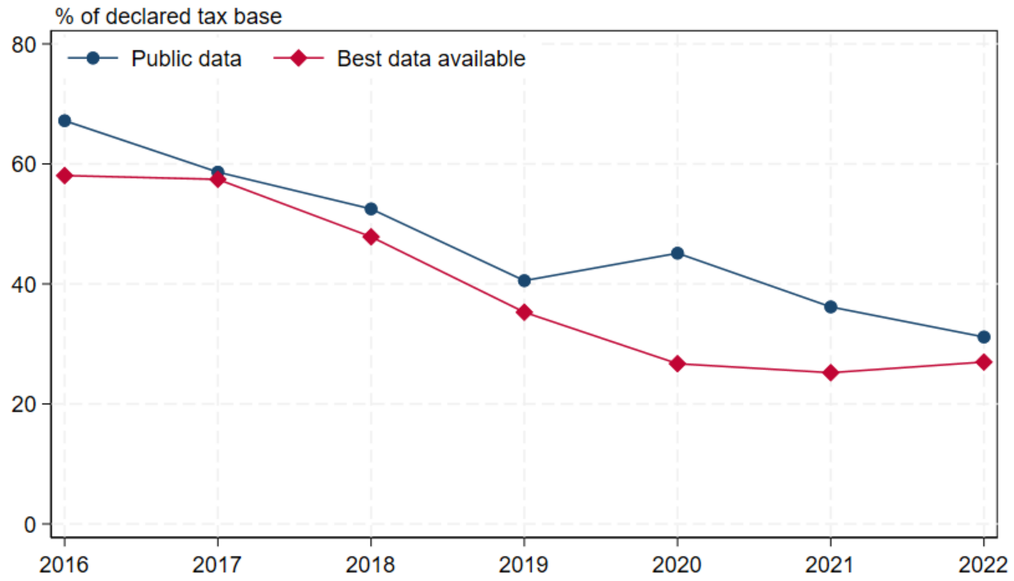


Notes: The figure shows the Spanish CIT gap estimate according to the IMF top-down method, for the period 2009-2022. Source: authors' elaboration, calculated as the average between Hypothesis 2 and 3 and smoothed with an asymmetric 3-period moving average.

5.8 Conclusions

The application of the top-down method for Spain laid out in this Chapter highlights the importance of understanding how NA data is elaborated, especially regarding the adjustments that statistical agencies perform to the data they receive from tax administrations. Without the collaboration of the statistical agencies shedding light in how these estimates are produced and sharing the data for certain adjustments, it is unlikely that the top-down method can be successfully applied without considerable uncertainty. Thanks to the close collaboration of the Spanish tax administration and INE, we have been able to use the best data to produce our estimates, although much of it is not publicly accessible. In this sense, it is informative to compare our estimate with one derived solely from publicly available sources. This comparison, illustrated in **Figure 7**, underscores the additional uncertainty involved in implementing the top-down method with severe data limitations.

Figure 7. Spanish CIT gap estimate using public vs the best available data



Notes: The figure shows the Spanish CIT gap estimate according to the IMF top-down method, for the period 2016-2022. Source: authors' elaboration, calculated as the mean between Hypothesis 2 and 3 and smoothed with an asymmetric 3-period moving average.

It is interesting to note that for 2020, the year of the COVID-19 pandemic shock, having accurate data was crucial. Relying solely on publicly available data would have predicted a gap more than 50% larger than our best estimate. The COVID-19 pandemic posed a significant challenge in the compilation of aggregate data, with a surge in non-market activities replacing market activities. At the same time, the massive public transfers programmes implemented by governments may have curved tax evasion by giving underground activities a higher incentive to declare.

As we have argued, even with the best available data, the top-down estimates are likely to be significantly affected by any lack of comparability between national accounts and tax returns data. While the top-down method rightly targets the national accounts' broader span that encompasses undeclared activities, the significant uncertainty involved in the implementation casts doubt on whether it is successful in isolating them. However, there is a unique data source that details how NA data is compiled and quantifies the adjustments made to account for the undeclared economy: the GNI Reports. In the next Chapter, we propose a methodology that abstracts from all the data-demanding adjustments of the top-down method and instead goes at the source of what is behind the differences in information between national accounts and tax returns.

6 A top-down method proposed by the JRC

The objective of this report is to develop and implement a method that yields a robust CIT gap estimate and is feasible and common for all EU Member States, while minimising demands on data availability. To this end, the chosen method should be implementable using the "least common denominator" across Member States, in particular with respect to the availability of necessary input data. Moreover, the observed variables should follow a common conceptual framework to allow for comparisons across countries. Against this background, we propose a simplified top-down approach based on disentangling the part of aggregate corporate profits that correspond to the undeclared economy.

6.1 Conceptual framework

The top-down method to estimate the CIT gap relies on aggregate measures of corporate profits (e.g. the GOS) to derive an estimate of the potential tax liability, i.e. the taxes that should be collected given the size of the economy as reported in NA data. This estimate of the potential tax liability, TL_p, can be compared to the taxes actually paid by corporations according to the tax returns, TL_d, for an estimate of the CIT gap. More formally, we can define the CIT gap as the ratio of tax liabilities in the non-observed economy (NOE), which is the difference between the potential and the declared tax liability, over the tax liabilities in the observed economy:

$$CIT\ Gap = \frac{TL_p}{TL_d} - 1 = \frac{TL_{ud}}{TL_d} \tag{6}$$

Deriving a potential tax liability (TL_p) from GOS requires making certain adjustments that mimic the calculations in a tax return, such as applying exemptions and deductions, as well as accounting for conceptual differences between firm accounting and national accounts. The first step of the top-down method calculates Financial Accounting Profits (FAP) by including all potentially taxable income of corporations. The second step applies exemptions and deductions to derive the net current tax base ($N\text{-}CTB$). The third step accounts for losses and derives the current tax base (TB). In step 4, an effective tax rate (ETR) is applied to the estimated tax base (TB) to arrive at an estimate of the tax liability (*TL*). **Eq. (7)** reflects this calculation of the tax liability:

$$TL_i = GOS_i \times \frac{FAP_i}{GOS_i} \times \frac{C - NTB_i}{FAP_i} \times \frac{TB_i}{C - NTB_i} \times\ ETR_i \tag{7}$$

where $ETR = TL/TB$ and $i = \{ud, d\}$, as the decomposition is applicable to both the observed and the non-observed economy. Each of the ratios in the right-hand side of **Eq. (7)** corresponds to a step in the IMF top-down method. However, we can collapse all the top-down steps in one single step and define:

$$TL_i = GOS_i \times \frac{TL_i}{GOS_i} = \ GOS_i\ \times\ ITR_i \tag{8}$$

where *ITR* is an implicit tax rate that serves as a comprehensive metric mapping a country's GOS into actually collected tax revenues. It encapsulates a variety of relevant components, including the statutory tax rate, applicable tax deductions, and depreciation allowances, among others. The *ITR* also takes into account the collection gap faced by tax administrations, acknowledging that not all taxes assessed and due are ultimately collected. Since the denominator of **Eq. (6)** represents the actually collected tax payments, the CIT gap is thereby expressed as a fraction of these collected taxes ([47]).

The IMF top-down method can estimate the CIT gap insofar as national accounts capture all economic activity, including that unreported to tax authorities. Specifically, the IMF top-down method requires NA data to be independent from tax returns and exhaustive in capturing the NOE. As explained in Fiscalis (2018), starting in 2016 all EU Member States apply Eurostat's "Tabular Approach to Exhaustiveness", such that their NA data capture all productive activity, including underground, informal, and illegal activities, as well as activities omitted due to deficiencies in data collection ([48]). In practice, tax data typically inform the compilation of national accounts for the declared part of the economy. To guarantee exhaustiveness, national statistical offices take tax return input data and adjust it to capture activities in the hidden, undeclared part of the economy ([49]).

Therefore, estimating undeclared corporate profits requires reversing the adjustments that Member States apply to their tax-informed national accounts. While the IMF top-down approach involves multiple complex steps and significant data requirements, the JRC proposes a more straight-forward alternative: directly using these exhaustiveness adjustments as a benchmark to estimate the size of the unobserved economy and the potential CIT gap. Once the declared and undeclared components of GOS are obtained, an implicit tax rate (*ITR*) is applied to both the numerator and the denominator that translate GOS in the undeclared and the declared parts of the economy into actual corporate tax revenues:

$$CIT\ Gap = \frac{ITR_{ud} \times GOS_{ud}}{ITR_d \times GOS_d} \tag{9}$$

In the formula used to compute the CIT gap, we would ideally want to use the GOS of a country because of its proximity to the actual aggregate tax base of corporations. However, most countries only report the exhaustiveness adjustments that they perform on GVA or GDP, without breaking down the adjustments corresponding to GOS from those corresponding to other aggregate components of GDP, such as intermediate consumption or the compensation of employees. Therefore, to maximise data comparability we complement the GOS-based estimation in **Eq. (9)** by GVA-based and GDP-based ones, depending on data availability. In such cases, the new implicit tax rate would be a multiple of the original implicit tax rate, as outlined in **Eq. (9)** above, adjusted by the ratio of GOS to GDP or GOS to GVA, in both numerator and denominator.

The proposed method is akin to a stylised top-down approach. Ideally, the top-down method requires that starting from GOS in national accounts, data independent from tax returns is used to perform each of the steps. In practice, certain information can only be found in tax returns, as underlined in **Chapter 5**. If tax data is used, a reasonable assumption is that the adjustment in each step is of the same magnitude for the observed and the non-observed economy. In particular, it seems reasonable

([47]) We acknowledge the imprecision arising from timing differences, where taxes related to gross operating surpluses in period t are most likely paid in a future period, typically $t+1$, and may also be influenced by loss offsets accumulated in the past. However, by adopting a longer-term perspective, we expect these imprecisions to eventually be neutralised.

([48]) The calculations of both the GVA, in the production side of GDP, and the CoE, in the income side, apply these exhaustiveness adjustments. The GOS is then determined as the residual of GVA minus CoE.

([49]) This is closely related to the ongoing discussion about the independence of NA data from tax return data, which is the primary requirement for the top-down method. While anecdotal evidence suggests that in practice, tax return data is always used as an input to compile NA data, it is the adjustments for undeclared or under-reported activities that guarantee both the exhaustiveness and independence of NA data.

to assume that $ETR_{ud} = ETR_d$, implying that the distribution of firms subject to different statutory tax rates, and that the amount of tax credits is identical in the observed and the non-observed economy.

For a baseline estimate of the CIT gap, our method proposes to take this assumption further and assume that it is the *ITRs* that are identical in the observed and the non-observed economy, such that the CIT gap is determined essentially by the gap between undeclared and declared GOS (or any other measure of economic activity). Our assumption is identical to that in Gallucci et al. (2020)'s hypothesis 1 that we have used in **Chapter 5**, where the adjustments in each step are proportional to the ratio of observed and unobserved GOS. To see this, we can break down Gallucci et al. (2020)'s hypothesis 1 from the lens of our decomposition:

$$TL_{ud} = TL_d \times \frac{GOS_{ud}}{GOS_d} = GOS_{ud} \times \frac{TL_{ud}}{GOS_{ud}} \tag{10}$$

After some manipulation, we can see that Gallucci et al. (2020)'s hypothesis 1 implies:

$$\frac{TL_d}{TL_{ud}} = \frac{GOS_d}{GOS_{ud}} \leftrightarrow ITR_d = ITR_{ud} \tag{11}$$

6.2 Adjustments to GNI figures for non-observable activity

The "GNI Regulation" (Regulation (EU) 2019/516) foresees annual data transmission of gross national income (GNI) aggregates and their components (called "GNI Questionnaire") together with a report on the quality of the submitted GNI data by each Member State to Eurostat. The "GNI Inventory" is a detailed description of the sources and methods used to produce GNI aggregates and their components in accordance with ESA 2010. It is a supportive document used for verification of data sources and methods within a multiannual cycle based on Commission Implementing Regulation (EU) 2020/1546.

For Eurostat's multiannual verification cycle of the GNI own resource data, countries are obliged to provide numerical information contained in so-called "Process Tables" for the reference year of their GNI Inventories. These Process Tables foresee, inter alia, that countries provide detailed information on how they implement Eurostat's "Tabular Approach to Exhaustiveness" (in the following, "exhaustiveness adjustments"), together with further breakdowns by NACE Rev. 2 Section for output, intermediate consumption and GVA ([50]). The reference years of the Process Tables and GNI Inventories are not harmonised across countries. Process Tables for the exhaustiveness adjustments, as submitted to Eurostat by Member States, are expected to be updated for each multiannual evaluation cycle, i.e. every five years, or in case of major revisions to data and methods underpinning the adjustments. For the years between two benchmark revisions, countries are expected to use appropriate extrapolation indicators capturing quantity and price developments or use annually available data/estimates.

Table 5 summarises the different categories of exhaustiveness adjustments, which are reported in monetary terms in the Process Tables and provides concrete examples for each of them.

([50]) There is, however, no breakdown by institutional sector within the Process Tables for every country, which would allow a focus on non-financial firms only (sector S.11 in national accounts).

Table 5. Exhaustiveness adjustments in National Accounts

N1	Producer should have registered (underground producer)	— The producer fails to register in order to avoid tax and social security obligations. Typically, these are small producers with turnover exceeding the threshold above which they should register their income. — Producers that fail to register because they are involved in illegal activities that fall under N2, rather than N1. — Type N1 does not include all underground activities, some of which are associated with type N6.
N2	Illegal producer that fails to register	— N2 covers activities of producers that avoid registration entirely. — N2 excludes illegal activities by registered legal entities or entrepreneurs that report (or misreport) their activities under legal activity codes.
N3	Producer is not obliged to register	— The producer is not required to register because it has no market output. Typically, these are non-market household producers involved in: (a) production of goods for own consumption or for own fixed capital formation, and (b) construction of and repairs to dwellings. — The producer has some market output but it is below the level at which the producer is expected to register as an entrepreneur.
N4	Registered legal person is not included in available statistics	— The legal person may not be included in the available statistics for a variety of reasons: e.g. the business register is out of date or updating procedures are inadequate; the classification data (activity, size or geographic codes) is incorrect; the legal person is excluded from the survey frame because its size is below a certain threshold.
N5	Registered entrepreneur is not included in available statistics	— A registered entrepreneur may not be included in the statistics for various reasons: e.g. the administrative source with lists of registered entrepreneurs may not always be complete or up to date. — Even if there is a regular flow of accurate and comprehensive information from the administrative source to the statistical office, the registered entrepreneur may not be included in the business register for several reasons (see those given under N4).
N6	Misreporting by the producer	— Misreporting unambiguously means that gross output is under-reported and/or intermediate consumption is over-reported in order to deliberately evade (or reduce) income taxes, value added taxes or social security contributions. — Misreporting often involves the maintenance of two sets of books; payments of envelope salaries which are recorded as intermediate consumption; payments in cash without receipts; and non-collected VAT due to fraud and insolvency.

N7	Statistical deficiencies in the data	— Adjustment type N7 is sub-divided into N7a – data that is incomplete, not collected or not directly collectable, and N7b – data that is incorrectly handled, processed or compiled by statisticians. This distinction is useful because it helps to better understand the origins of statistical deficiencies. However, in practice, N7a and N7b cannot always be easily separated. — Statistical deficiencies: the following list is not comprehensive, but these topics should be investigated for non-exhaustiveness: • Handling of non-response; • Production for own final use by market producers; • Tips; • Wages and salaries in kind; • Secondary activities — Clearly, not all statistical deficiencies result in the under-estimation of GDP. (The focus here has been to identify and target those areas, which are likely to lead to non-exhaustiveness in the NA.)

Source: JRC, based on United Nations (2008).

In principle, the common reporting standards provided by Eurostat to the Member States for the compilation of GNI Inventories and Process Tables guarantee a high level of comparability of adjustments N1 to N7 across Member States. Various recommendations of the GNI Committee/GNI Expert Group (e.g. recommendations for the recording of illegal activities) and Eurostat's verification activities further aim at ensuring comparable approaches to exhaustiveness; nevertheless, these exhaustiveness adjustments are calculated in different ways across countries, due to differences in available data sources, like surveys or audits (Fiscalis, 2018). For example, certain activities in some countries are legal whereas they are illegal in other countries (e.g. prostitution, trade of certain "light" drugs etc.). Thus, it is reasonable to assume that there exists more reliable, complete and timely data (for example from regular tax files and business account data) for legal activities than for illegal activities. Estimating the extent of the latter requires specialised studies, results from tax audits, expertise and reports of the police and specialised governmental and non-governmental organisation. To illustrate, **Box 6** below provides more details on the methods applied to estimate the extent of economic activity in the NOE for Denmark's GNI Inventory.

In theory, it is possible that some of the activities that count towards the non-observed part of the economy have already been covered in the NAs estimates *before* the exhaustiveness adjustments. This could happen, for example, if illegal activities, such as trafficking of drugs, were covered by a smoke screen of legal business, for instance a bar or a restaurant ([51]). Therefore, the measurement of the NOE could in theory result both in an underestimation but also, although to a smaller extent as in the case of smoke screen businesses, in double-counting of the income generated by these activities.

([51]) Information based on technical exchanges with Eurostat.

Box 6. Measures of economic activity in the non-observed economy

Member States have some discretion in choosing the methods and data sources they use for the exhaustiveness adjustments, as long as they adhere to the overarching principles and goals of the ESA 2010. They aim to use the best available data and methods that reflect their unique economic contexts and statistical systems.

For instance, some countries may use surveys, tax data, or administrative records to estimate the size of the underground economy, while others might use indirect methods such as the discrepancy method or the currency demand approach. Similarly, for illegal activities, estimates could be based on police or judicial data, expert assessments, or specific surveys. In seminal work, Schneider and Enste (2003) estimate the size of the informal economy across 76 countries using methods including currency demand, electricity consumption, and structural modelling. Their findings show that in the 1990s, the shadow economy averaged 12% of GDP in OECD countries, 23% in transition economies, and 39% in developing countries. The authors detect an increase in the size of the shadow economy, possibly related to factors such as high taxation, increased regulation, and declining tax morale, and advocate for institutional reforms to strengthen the formal economy.

Despite the flexibility in methods, Eurostat works with Member States to improve the comparability of national accounts. Eurostat provides guidance, organises training and workshops, and facilitates the exchange of best practices among Member States. This collaborative approach helps to ensure that while the specific methods of exhaustiveness adjustments may differ, the overall quality and comparability of NA data across the EU are maintained.

As an illustrative example, this Box reviews the specific case of Denmark. With a tailored set of methods and data, Denmark's strategies for incorporating the full scope of economic activity – including the underground economy, informal transactions, and illegal activities – into its national accounts offer some interesting insights. The following sections detail how Denmark calculates exhaustiveness adjustments and the particular data sources that inform these estimates, thus providing a concrete demonstration of the EU framework in action at the Member State level.

Interestingly, Denmark does not utilise tax audit information when calculating exhaustiveness adjustments. Although this option was considered during the development of the estimation approach for the underground economy, it was concluded that the available information was neither sufficiently representative nor systematic for such use. Instead, Denmark has chosen to rely on survey data to inform their exhaustiveness adjustments and has consistently adhered to this approach.

Adjustment N1, titled "Producer should have registered" and coupled with adjustment N6, "Misreporting by the producer," account for economic activity that is deliberately hidden from public authorities to evade taxes, with both the seller and the buyer typically aware of the non-reporting. The adjustment also includes under-reporting and associated VAT fraud that companies exploit, where buyers may not know that the production is not properly declared. Several methods are used to estimate the corresponding adjustment for N1, most importantly telephone interviews. These adjustments are based on benchmark estimates from 2004, extrapolated using annual information from supplementary questions about hours worked in the shadow economy in the Danish Labour Force survey. The benchmark estimates of hidden work were derived from over 10,000 telephone interviews carried out in the first two quarters of 2004.

Other approaches to estimating N1 and N6 are the "Discrepancy Method" and the "Indicator Method". The "Discrepancy Method" compares information from the supply side with information from the demand side, operating on the assumption that while income/production is not always registered, expenditure usually is. Therefore, discrepancies where demand side figures exceed supply side figures may indicate unregistered production. For example, this method is used to make an annual estimate for under-reporting and associated VAT fraud in Danish hairdressing salons and part of the hidden production of cleaning services for private households. The "Indicator Method" also estimates the value of under-reporting using "statistical fingerprints" of the non-observed economy, such as electricity consumption. This method is particularly used for estimating under-reporting and associated VAT fraud in restaurants and retail trade of food, where under-reporting and undeclared tips are believed to be the dominant form of shadow activity.

Adjustment N2, labelled “Illegal activity,” includes illegal activities such as smuggling, drug trafficking, and prostitution. Unlike the shadow economy, where the activities may be legal if properly declared and taxed, the activities in N2 are inherently illegal. One method applied in this context is estimating value added from illegal activities by multiplying estimated prices by approximated volumes. This method is used for various types of illegal activities, including smuggling of alcohol, tobacco, soft drinks, and sweets, as well as prostitution. For example, the supply side estimate for prostitution is based on the number of women in prostitution, multiplied by prices and the average number of contacts per woman. The number of women in prostitution is informed by a report from the Danish Centre for Research on Social Vulnerability, with corresponding prices based on advertisements from newspapers and the internet. In other activities, demand side estimates are considered more reliable: for drugs, the estimation is based on average quantities consumed per drug user, multiplied by the number of drug users, and then by observed import and retail prices to calculate the trade margin, which equals the value added. Specifically, the total number of drug users comprises “hard” users and recreational users. Information on the number of hard users comes from a report by the National Board of Health, and assumptions about the number of recreational users are based on police reports on organised crime in Denmark and assumptions about average consumption by recreational users. For import prices of drugs, so-called “wholesale prices” are used, and for drug retail prices, “street prices” are employed.

Adjustment N3 considers the case when a “Producer is not obliged to register,” which includes the production of output for own final use. This type of production is common in sectors like agriculture, where farmers may produce goods such as eggs, milk, or livestock for their own consumption. These activities are not registered in the same way as commercial production because they are for personal use rather than for sale in the market. To estimate the corresponding adjustment for N3, Denmark uses agricultural statistics. The method involves estimating the value of own consumption of agricultural products, assumed to cover the underground farm-economy. The values are based on agricultural selling prices for the products concerned. These adjustments are made at a highly disaggregated level using supply-use tables. The obtained values are then extrapolated to calculate the adjustments for the entire agricultural sector.

Adjustment N5 concerns “Registered entrepreneur not included in statistics.” This adjustment accounts for economic activity by enterprises that fall below the statistical threshold for reporting in the Accounts Statistics. Put differently, it addresses the value added by small-scale entrepreneurs who are registered but not captured in the usual statistical sources due to their size or the economic significance of their activity. Adjustments in Denmark are based on applying industry-specific scaling-up factors to the turnover figures of registered entrepreneurs.

Finally, adjustment N7 covers “Statistical deficiencies,” which includes, in particular, wages and salaries in kind (also known as “fringe benefits”) and the production of capital goods for own final use. These are areas where the necessary data for proper accounting may not be systematically collected or reported, and thus adjustments are needed to account for these elements in the national accounts. The methods applied to estimate the corresponding adjustment for N7 include, in particular, imputations for payments in kind. The corresponding adjustments for CoE are imputed for various payments in kind, covering a range of benefits such as free cars, telephones, canteen food, housing, health insurance, newspapers, PCs, and employee stock options. The impact of these benefits is estimated based on various sources, including tax values, surveys, and other data, to adjust the CoE, output, and intermediate consumption accordingly. For example, the taxable value of free cars is calculated as a percentage of the car’s price, and this value is then used in national accounts.

6.3 The JRC methodology for estimating the CIT gap

At the outset, the approach proposed in **Chapter 6.1** requires using the implicit tax rate applicable to the undeclared part of the economy, i.e. ITR_{ud}. In practice, however, the rate cannot simply be estimated empirically as the corporate tax revenues in the undeclared part of the economy are, by definition, not observed. Therefore, in our baseline scenario, we assume the implicit tax rate to be the same for both the declared and the undeclared part of the economy, i.e. $ITR_{ud} = ITR_d$. Obviously, the estimate of the CIT gap would rely on the critical assumption that the tax-related characteristics of the declared and the undeclared GOS are identical. Concretely, the approach assumes that the share of GOS that is subject to CIT (as opposed to share of GOS that is exempt or taxed in PIT), and the distribution of firms in terms of size, industry or financial structure that give rise to allowances, are the same ([52]).

In this specific case, as the two implicit tax rates cancel each other out in **Eq. (9)** above, the CIT gap is simply the ratio of the exhaustiveness adjustments over the declared part of the GOS, both reported in the "GNI Process Tables", which we have obtained for 23 EU Member States, Norway, and Iceland ([53]). In the baseline scenario, we assume the implicit tax rate to be the same for both the declared and the undeclared part of the economy**.** We will revisit the appropriateness of this assumption in **Chapter 6.4** below.

The results of this exercise are shown in **Figure 8**, with the underlying numbers reported in **Table A.3** in the **Appendix**. For each country, we obtain an estimate of the CIT gap based on the total sum of exhaustiveness adjustments made to GOS, GDP and GVA. The year in brackets behind each country's name refers to the respective baseline year in the Process Tables.

In general, all 25 countries in our sample have both GDP- and GVA-based estimates available ([54]). GOS-based estimates of the CIT gap are available for 11 countries. While GDP- and GVA-based estimates are typically closely aligned, GOS-based estimates can diverge significantly. In cases where GOS-based estimates are noticeably lower than those based on GDP or GVA (as observed for Sweden, Croatia, and Czechia) this is primarily due to incomplete exhaustiveness adjustments in the GOS data, resulting in a lower-bound estimate of the CIT gap. Conversely, when GOS-based estimates exceed those derived from GDP or GVA, as seen for Austria and Cyprus, the discrepancy stems from countries generally applying the same exhaustiveness adjustments across GDP, GVA, and GOS. Since GOS is usually considerably smaller than GDP or GVA, this leads to relatively larger CIT gap estimates when using the GOS-based method. Given these inconsistencies and the limited availability of GOS-based estimates across countries, we focus our analysis on the more stable and complete GDP- and GVA-based estimates.

In general, the estimate of the CIT gap varies considerably across countries. For example, the CIT gap is estimated to be well below 3% in the cases of Norway, Denmark, the Netherlands, and Finland, while it is above 20% in the case of Slovakia and above 35% for Romania. Among the larger EU Member States, estimates for France and Germany point towards CIT gaps of around 6% and 7.5%, respectively. The estimate for Italy suggests a higher CIT gap of slightly below 20% ([55]). Across all 23 Member States for which we have information from the Process Tables on the extent of exhaustiveness adjustments, the unweighted average of the CIT gap, based on the extent of the

([52]) Moreover, if **Eq. (9)** is applied using GDP instead of GOS, it would require the additional assumption that $^{GDP_{ud}/GOS_{ud}}/_{GDP_d/GOS_d} = 1$. An analogous assumption is needed if GVA is used in place of GOS.

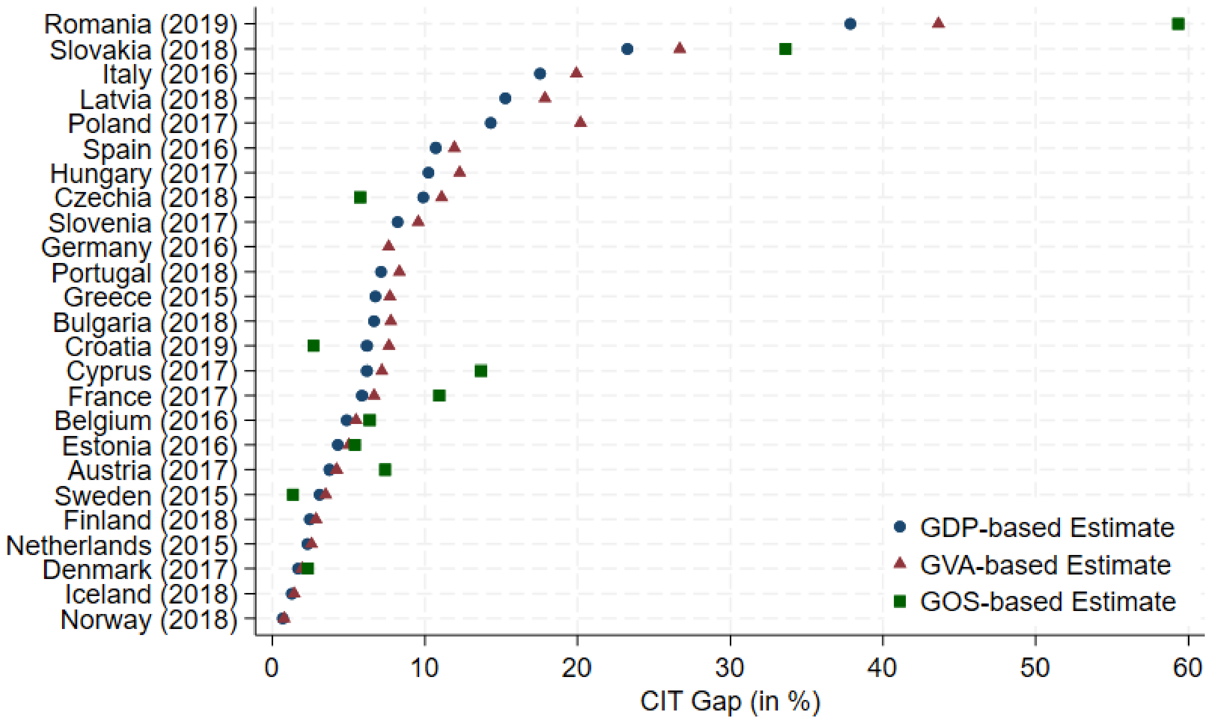
([53]) Information for Ireland, Lithuania, Luxembourg, and Malta cannot be published.

([54]) Germany is the only exception, with only a GVA-based estimate available.

([55]) Estonia levies a CIT on a company's distributed profits. To the extent that the characteristics of distributed profits in the declared and the undeclared part of the economy are identical, the simplified version of **Eq. (9)** still applies.

exhaustiveness adjustments made to GVA, is equal to 10.9%. Applying this percentage to total collected taxes from profits in the EU-27 in 2017, the year in which most countries in our sample refer to in their Process Tables, yields a CIT gap estimate of about EUR 38 billion for the EU as a whole in absolute numbers.

Figure 8. Simplified CIT gap estimates based on the JRC top-down method



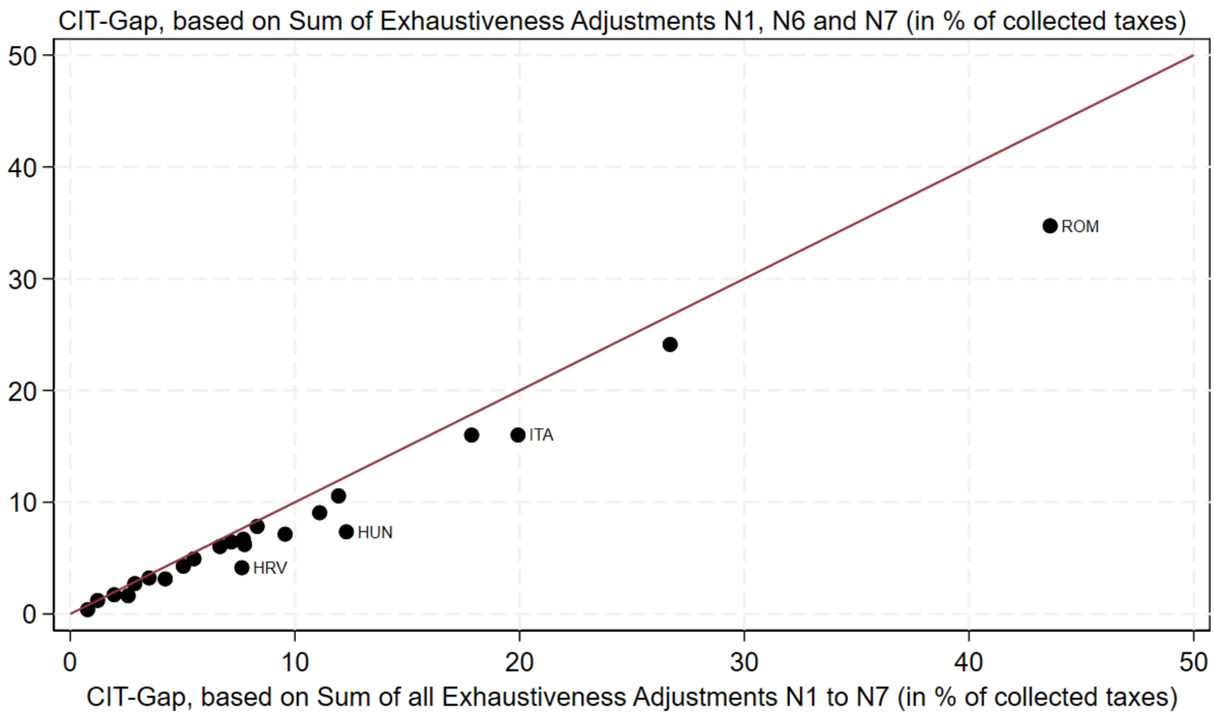
Notes: The figure shows for each country the share of adjustments made to Gross Domestic Product (GDP), to Gross Value Added (GVA) and to Gross Operating Surplus (GOS) in order to account for non-observed activity as part of the GNI adjustments. Source: GNI Process Tables of the respective countries. In the case of Poland, we obtain relevant information from the annual publication "National Accounts by institutional sectors and sub-sectors" (Statistics Poland), and not from the Process Tables. Underlying numbers are reported in ***Table A.3*** *in the* ***Appendix****.*

In our analysis of the CIT gap, we identify three categories of exhaustiveness adjustments as particularly pertinent: N1, N6, and N7. These categories encompass activities that, if properly registered and reported, would be most likely subject to corporate income taxes. N1 addresses the deliberate non-registering of producers, capturing businesses that operate outside the formal economy to evade tax liabilities. N6 involves the deliberate under-reporting of taxable profits, reflecting intentional efforts by businesses to minimise tax obligations. N7 includes non-reporting of tips, wages in kind, and similar income, which are all relevant for accurate CIT calculations. Conversely, other categories, such as N3, are not necessarily subject to CIT if reported. For instance, N3 involves producers not obliged to register, like non-market household producers engaged in self-consumption, which generally fall outside the scope of CIT. Therefore, focusing on N1, N6, and N7 provides a more precise measure of the CIT gap by addressing the activities directly impacting corporate tax revenues.

While we would like to focus solely on the exhaustiveness adjustments N1, N6, and N7 due to their direct link to the CIT gap, not all the countries report a detailed breakdown of the seven different types of exhaustiveness adjustments. Therefore, in order to maximise country coverage, we use the sum of all adjustments N1 to N7. This approach allows us to include comparable estimates for all 25 countries in our analysis, rather than limiting it to the 21 that report disaggregated numbers.

To assess the sensitivity of our CIT gap estimate to the selection of specific exhaustiveness adjustment categories, we compare the results derived from using the sum of *all* exhaustiveness adjustments with those obtained from focusing on a subset of them, specifically N1, N6, and N7, for the countries for which the breakdown is available. In **Figure 9**, we compare the resulting GVA-based CIT gap measure, based again on the simplifying assumption that the implicit tax rate is identical in the declared and the undeclared part of the economy, when using all adjustments N1 to N7 on the horizontal axis, and when using only the three before-mentioned categories of adjustments on the vertical axis. As N6 is typically the largest of all categories, usually accounting for more than 50% of the sum of exhaustiveness adjustments, it is not surprising that the CIT gap estimate based on a restricted set of exhaustiveness adjustments is, in general, only marginally smaller than the one based on all adjustments. Our analysis reveals that only a few countries in the reduced sample have a CIT gap estimate based on a reduced set of exhaustiveness adjustments that is more than 20% smaller than the estimate derived from using all adjustments (Croatia, Hungary, Italy, and Romania, all of which are indicated in the figure). In conclusion, we do not find evidence that our approach, which utilises the full set of exhaustiveness adjustments, significantly deviates from estimates based on a narrower set of adjustments.

Figure 9. Comparison of CIT gap measures depending on selected exhaustiveness adjustments



Notes: The figure shows for each country the GVA-based estimate of the CIT gap based on all exhaustiveness adjustments on the horizontal axis and the CIT gap estimate based on only exhaustiveness adjustments N1, N6, and N7 on the vertical axis. The 45-degree line is indicated in red. The figure is based on 21 country observations, for which a breakdown of individual exhaustiveness adjustments is available. Source: GNI Process Tables of the respective countries.

6.4 Comparison of CIT gap estimates across approaches

The assumption of the same implicit tax rate for the declared and the undeclared part of the economy may appear to be a crude approximation and an over-simplification. However, a comparison of our estimates against CIT gap estimates from more elaborated top-down and bottom-up methods, provided by the respective countries themselves, suggests that the JRC approach to measuring the CIT gap yields plausible estimates. **Figure 10** provides a comparison of the GVA-based CIT gap estimated according to the simplified JRC method as outlined above and own estimates provided by Italy, Slovakia, Sweden, and Slovenia, respectively. For instance, Gallucci et al. (2020) estimate the Italian CIT gap in 2016 at 22.7%. For the same year, the ratio of adjustments to declared income in the Italian GNI Inventory report is 23.5% for the case of institutional sector S.11 (note that the values in **Figure 8** refer to the economy as a whole and not only the subset of non-financial firms in sector S.11).

Similarly, in the cases of Slovakia and Sweden, the estimates derived from the simplified JRC approach are particularly close to each country's own estimate obtained from bottom-up approaches.

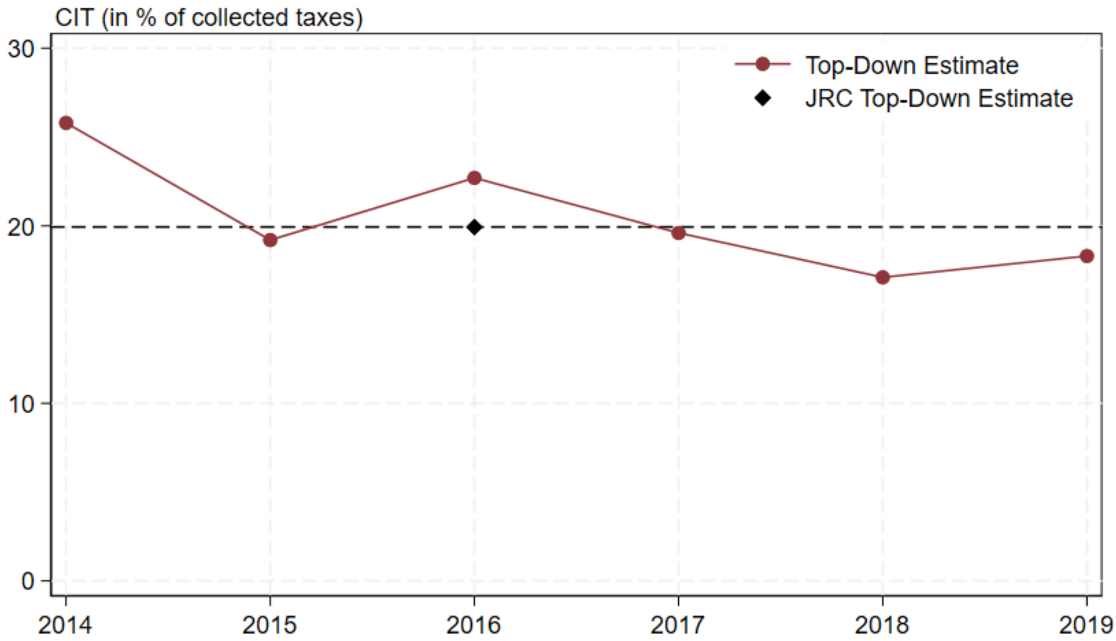
Moreover, the case of Sweden is especially interesting. The own-country estimate of the CIT gap – derived from the bottom-up method based on tax audit data – is nearly identical to the JRC estimate of the CIT gap, which is derived from an application of the "simplified" top-down method. The reason behind this is that tax audit data is one of the main sources to inform the exhaustiveness adjustments in national accounts. In turn, these exhaustiveness adjustments underpin the estimate of the CIT gap in top-down methods. Several conclusions can be drawn from this.

First, the typology of the CIT gap and its components discussed in **Chapter 2** may be even less clear cut. If tax audit data is used to inform the exhaustiveness adjustments in national accounts, then these exhaustiveness adjustments will reflect a mix of tax avoidance and tax evasion practices. Thus, while top-down approaches measure generally CIT gap linked to tax evasion, it would be too simplistic to argue that they cover only tax evasion. Conversely, while tax audits concern typically (domestic) tax avoidance practices, they can also detect tax evasion schemes and profit shifting strategies, especially when additional information is available. This brings a certain level of nuance into the typology discussed in this report.

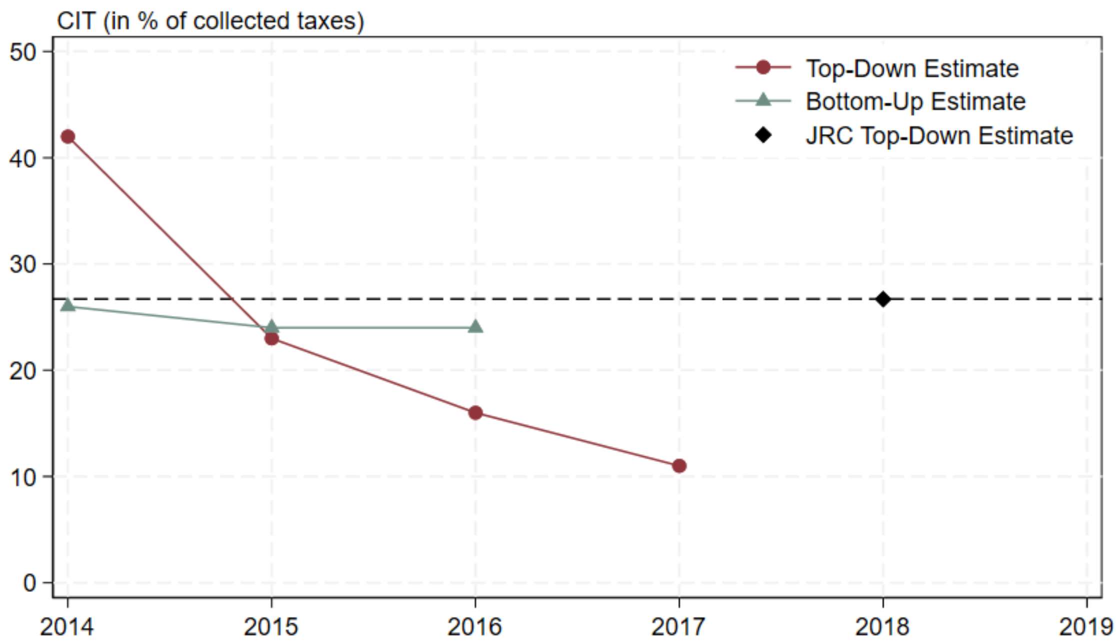
We estimate a CIT gap for Slovenia that is nearly 10 percentage points lower than the IMF's published figure (Hutton, 2023). However, the IMF's own estimate is subject to considerable uncertainty, suggesting that such gaps should be interpreted with caution.

Figure 10. Comparison of simplified CIT gap estimates with own-country estimates

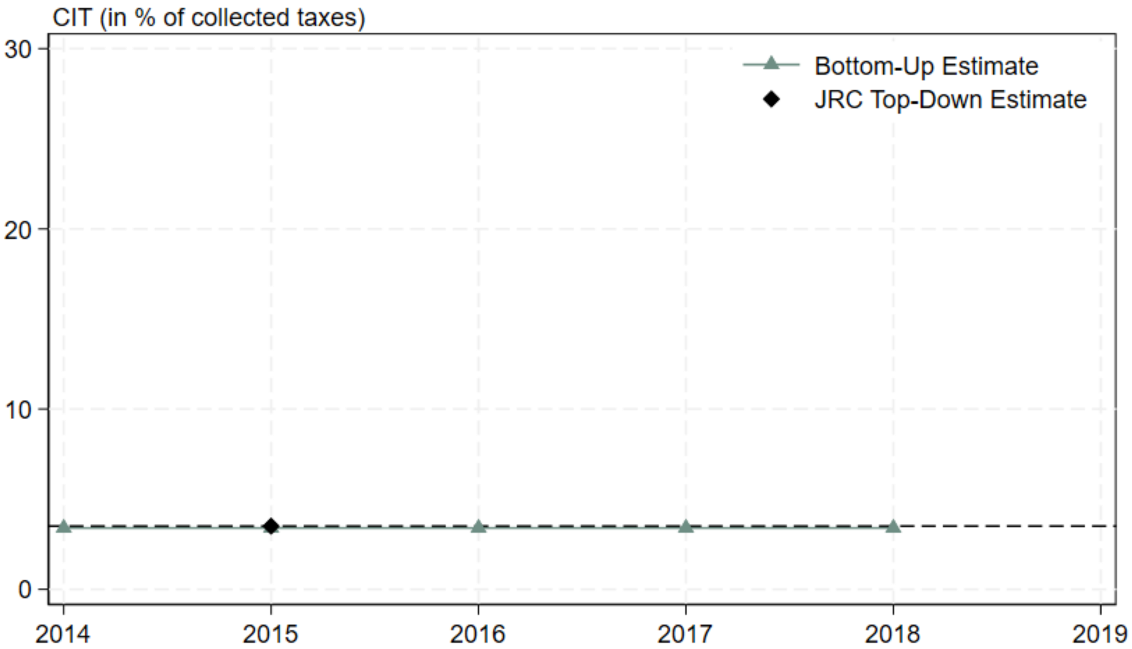
(A) Italy



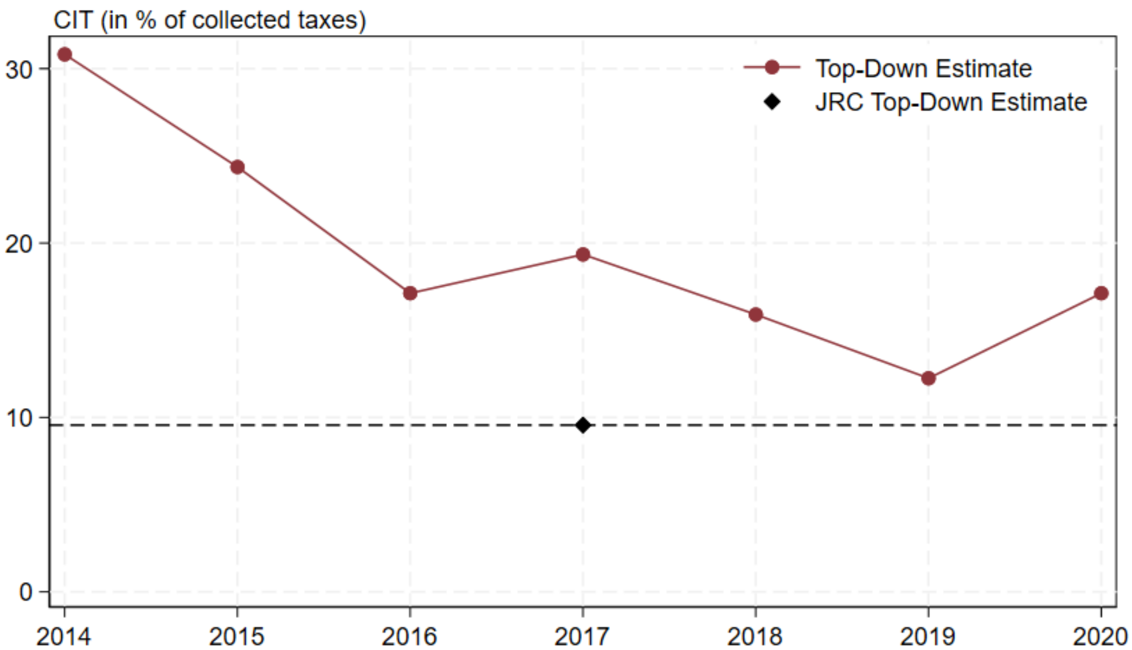
(B) Slovakia



(C) Sweden



(D) Slovenia



Notes: The figure compares GVA-based CIT gap estimates derived using the top-down method (in red) for Italy (2014-2019), Slovakia (2014-2017), and Slovenia (2014-2020) and using the bottom-up method (in green) for Slovakia (2014-2016) and Sweden (2014-2018) against CIT gap estimates derived using the JRC method proposed in this report (dashed line). Note that JRC method estimates the CIT gap in Italy for 2016, in Slovakia for 2018, and in Sweden for 2015. Source: JRC, Fiscalis (2018) and Hutton (2023).

The fact that the adjustment-to-declared income ratio, i.e. the basis of the JRC's exhaustiveness adjustment-based top-down approach, and other top-down approaches yield similar estimates is perhaps not surprising. As explained in **Chapter 6.1**, both approaches crucially rely on the difference between national accounts and tax data, and if national accounts are largely based on tax data "plus some adjustments" for the undeclared economy, then the CIT gap estimates obtained from other top-down approaches are just as good as the adjustments themselves. Obviously, if the exhaustiveness adjustments are not a good approximation of the undeclared economy, then the JRC's CIT gap estimates will not be accurate; but this is a limitation shared by more elaborated top-down methods as well.

The key theoretical difference between the adjustments-to-declared-income ratio and the IMF top-down method is that the latter improves on the ITR by estimating the deductions from taxable income that are necessary to derive the tax base. In that regard, the approach allows for a more explicit control of the relevant adjustments to the tax base and, ultimately, of the ITR. However, since the deductions that would apply if the undeclared income was declared cannot be observed, the best guide is to take the deductions actually observed and impose assumptions concerning their applicability to the undeclared part of the economy. As noted before, Gallucci et al. (2020) assume different hypotheses in this context. One hypothesis states that there would be no additional deductions to taxable income, such that the ITR is higher for the undeclared GOS. Another estimate assumes that deductions on the undeclared income are proportional to the ratio of potential GOS over declared GOS, such that the ITR would be the same.

The following subchapters offer additional insights on specific aspects of the CIT gap obtained through the JRC's exhaustiveness adjustment-based top-down approach. In particular, **Chapter 6.5** estimates the CIT gap at the industry level for three EU MS, including the Netherlands, France, and Italy. **Chapter 6.6** revisits the assumption of identical ITR across the declared and undeclared, or unobserved, segment of the economy. Finally, **Chapter 6.7** presents evidence on the dynamics of CIT gap over time.

6.5 CIT gap estimates at the industry level

The analysis of the CIT gap can be effectively extended to the industry level. This expansion is particularly interesting as it exposes the varying degrees to which different industries are exposed to under-reporting and other non-compliant behaviour that contributes to a CIT gap. One reason for varying CIT gaps at the industry level could be the extent of third-party reporting, which refers to the use of independent information sources – such as financial institutions, suppliers, or customers – to verify income or transactions, thereby increasing transparency and reducing opportunities for under-reporting. For example, industries with robust third-party reporting mechanisms, such as financial services or large retail sectors, often have more accurate and transparent income reporting, potentially leading to a smaller CIT gap. Conversely, industries with limited third-party oversight, like small-scale construction or certain service sectors, may experience a larger CIT gap due to increased opportunities for income under-reporting or misreporting.

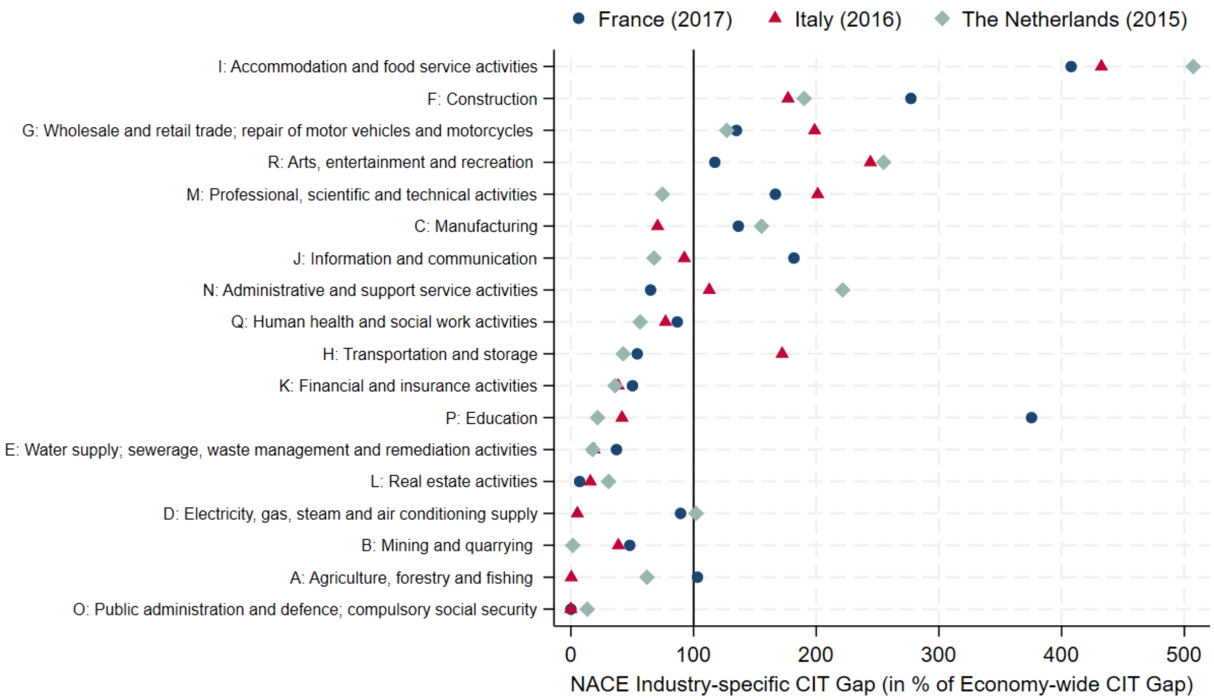
To quantify these differences, we use the same approach that we previously applied to determine the CIT gap for the entire economy. Specifically, we compare the magnitude of NOE adjustments made to the GVA within each industry against the declared GVA for that same industry. For consistency, we maintain the assumption that the ITR is identical in the declared and the undeclared part of the economy, which simplifies the calculations by eliminating it from the equation.

The analysis focuses on three European countries with significant differences in CIT gap at the country-level: the Netherlands, France, and Italy. The disparities at the national level among these countries present an opportunity to examine insightful variations, and to detect regularities at the industry level across countries. To facilitate comparison across countries, we standardise the industry-specific CIT gap within each country. This is done by dividing the CIT gap for each industry by the national average CIT gap, which allows us to compare the figures across different countries. The result of this calculation indicates whether the industry-specific CIT gap is above or below the national average. A percentage value of 100% would suggest that the industry-specific gap aligns precisely with the economy-wide average. For each industry, we obtain three estimates corresponding to the three different countries.

The results of this exercise are shown in **Figure 11**. The different industries are shown on the vertical axis, ordered by the smallest industry-specific CIT gap estimate within that industry across the three different countries under investigation. Our analysis shows substantial variation in the CIT gap across industries, highlighting distinct sector-specific patterns. More concretely, our findings suggest that within the NACE Rev. 2 classification of industries, section O ("Public administration and defence; compulsory social security"), B ("Mining and quarrying"), L ("Real estate activities"), E ("Water supply; sewerage, waste management and remediation activities"), K ("Financial and insurance activities"), and Q ("Human health and social work activities") typically have a CIT gap that is lower than the country average. Conversely, industries R ("Arts, entertainment and recreation"), G ("Wholesale and retail trade; repair of motor vehicles and motorcycles"), F ("Construction"), and I ("Accommodation and food service activities") are observed to have a higher-than-average CIT gap across all three countries under study. The fact that the industry-specific deviations from the average economy-wide gap correlate significantly across the three countries highlights the extent to which the CIT gap is influenced by industry-specific factors ([56]).

([56]) It is beyond the scope of this study to identify the concrete determinants that contribute to variations in CIT gap at the industry level.

Figure 11. Industry-specific CIT gap estimates



Notes: The figure shows for each NACE Rev. 2 industry the values that we obtain by standardising industry-specific GVA-based CIT gap estimates from three countries (the Netherlands, France, and Italy) by the respective CIT gap estimate at the country-level. Values below 100% indicate that industry-specific estimates are below the country-average, while values above 100% indicate the opposite. Source: GNI Process Tables of the respective countries.

6.6 Implicit tax rates for the declared and the undeclared economy

So far, we operated under the assumption that the ITRs are identical across both the declared economy and the unobserved, or undeclared, economy. This assumption significantly streamlined the process of calculating the CIT gap by sidestepping the complexities that might arise from varying implicit tax rates.

Accepting this assumption implies that the tax-relevant characteristics are uniform across the entire economy. Nonetheless, it is not hard to conceptualise scenarios where this assumption may be violated. For instance, we could hypothesise that the NOE may be disproportionately concentrated in certain sectors, such as construction. This would imply that the ITR in the construction sector should have a larger weight in the overall ITR of the undeclared economy than in that of the declared economy, resulting in distinct ITRs between the two sectors of the economy.

To validate the reliability of the assumption of identical ITRs, we employ industry-specific information on the exhaustiveness adjustments from the Process Tables. These adjustments provide insight into the distribution of economic activity among different NACE Rev. 2 industries within the NOE. By employing the respective relative distributions of both the NOE and OE, we estimate a weighted average of the implicit tax rates for both the undeclared (ITR_{ud}) and declared (ITR_d) parts of the economy. Specifically, we multiply the relative industry weights by the corresponding ITR at the industry level. This ITR is defined as the ratio of collected tax revenues to declared GVA and is presumed to be identical in both the observed and unobserved parts of the economy. While industry-specific ITRs are assumed to be identical in both the observed and unobserved parts of the economy, the economy-wide ITRs may differ due to varying industry weights.

In the following, we focus on Italy as a concrete case study. The exhaustiveness adjustments applied to the GVA in each NACE Rev. 2 industry from the Process Tables and the corresponding relative share of economic activity within the NOE of Italy are shown in column 1 of **Table 6**. By subtracting the extent of the NOE adjustments from each industry's total GVA, we can derive the size of the observed economy and its distribution (presented in column 2).

We then calculate an industry-specific ITR by dividing the actual CIT payments by the declared GVA for each industry. In the case of Italy, these rates vary significantly, with NACE Rev. 2 industries such as O ("Public administration and defence; compulsory social security"), P ("Education"), and T ("Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use") having rates close to 0%, while others like G ("Wholesale and retail trade; repair of motor vehicles and motorcycles") and D ("Electricity, gas, steam and air conditioning supply") experience much higher rates of 5% and 6%, respectively.

By applying the NOE distribution weights (from column 1), we compute a weighted average ITR of 2.9% for the economy-wide NOE. In contrast, the OE's weighted average ITR comes in slightly lower at 2.6%, using the OE distribution weights (from column 2). Crucially, when we consider the ratio of these two averages, which is essential for computing the CIT gap in application of **Eq. (9)**, we arrive at a value of 1.1. This suggests that for Italy, only a minor upward adjustment is necessary when applying the simplified CIT gap measure. Concretely, the Italian CIT gap would slightly increase from 19.9%, as derived under the simplifying assumption of equal ITRs, to 21.9% when accounting for different ITRs.

Applying the same analytical process to Portugal results in a ratio of implicit tax rates of almost exactly 1. From these findings in the two country cases, we can tentatively conclude that the original assumption of equal ITRs between the declared and undeclared parts of the economy is generally plausible ([57]).

([57]) As of the time this report was written, only Italy and Portugal provided detailed information on collected CIT revenues across all 20 NACE Rev. 2 industries. This data is essential for the analysis conducted in this exercise. For other countries, such data was either unavailable or presented in a different industry breakdown.

Table 6. Sectoral distribution undeclared & declared economy and implicit CIT rates (Italy, 2018)

NACE Rev. 2 Section		(1)		(2)		(3)
		Exhaustiveness Adjustments (in m EUR)	Share of total NOE (in %)	Declared GVA (in m EUR)	Share of total OE (in %)	Implicit CIT Rate (= Collected CIT Revenues / Declared GVA, in %)
A	Agriculture, forestry and fishing	22	0.01	32679	2.57	0.29
B	Mining and quarrying	261	0.10	3390	0.27	1.39
C	Manufacturing	30961	12.24	219863	17.32	4.93
D	Electricity, gas, steam and air conditioning supply	248	0.10	23723	1.87	6.36
E	Water supply; sewerage, waste management and remediation activities	578	0.23	15361	1.21	3.28
F	Construction	17058	6.74	48368	3.81	3.23
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	50645	20.02	127949	10.08	5.17
H	Transportation and storage	21666	8.56	63156	4.97	2.62
I	Accommodation and food service activities	26509	10.48	30762	2.42	1.72
J	Information and communication	8949	3.54	48577	3.83	3.55

Table 6. Sectoral distribution undeclared & declared economy and implicit CIT rates (Italy, 2018), continued

		(1)		(2)		(3)
NACE Rev. 2 Section		**Exhaustiveness Adjustments (in m EUR)**	**Share of total NOE (in %)**	**Declared GVA (in m EUR)**	**Share of total OE (in %)**	**Implicit CIT Rate (= Collected CIT Revenues / Declared GVA, in %)**
K	Financial and insurance activities	5777	2.28	75215	5.92	4.98
L	Real estate activities	6338	2.50	201033	15.83	0.78
M	Professional, scientific and technical activities	27879	11.02	69533	5.48	1.45
N	Administrative and support services	8833	3.49	39302	3.10	2.58
O	Public administration and defence; compulsory social security	0	0.00	101336	7.98	0.06
P	Education	4814	1.90	58046	4.57	0.10
Q	Human health and social work	12161	4.81	79126	6.23	0.44
R	Arts, entertainment and recreation	5778	2.28	11879	0.94	2.41
S	Other service activities	13990	5.53	12550	0.99	0.73
T	Activities of households as employers	10565	4.18	7875	0.62	0.00
Total		**253032**	**100**	**1269723**	**100**	

Notes: The exhaustiveness adjustments to GVA and the declared GVA (both in million EUR) in columns (1) and (2), respectively, are directly obtained from the GNI Process Table for Italy (base year 2018). The relative industry composition of the observed and the unobserved economy follow immediately as each industry's share of the total in both cases. The implicit tax rate for each industry in column (3) is defined as the ratio of collected CIT revenues over declared GVA. Source: GNI Process Table for Italy and ISTAT.

6.7 Dynamics of CIT gap over time

To gain a deeper understanding of the CIT gap and its evolution, it is crucial to examine the dynamics of this estimate over time. Tracking increases or decreases in the CIT gap can provide valuable insights for the evaluation and refinement of policy instruments and measures.

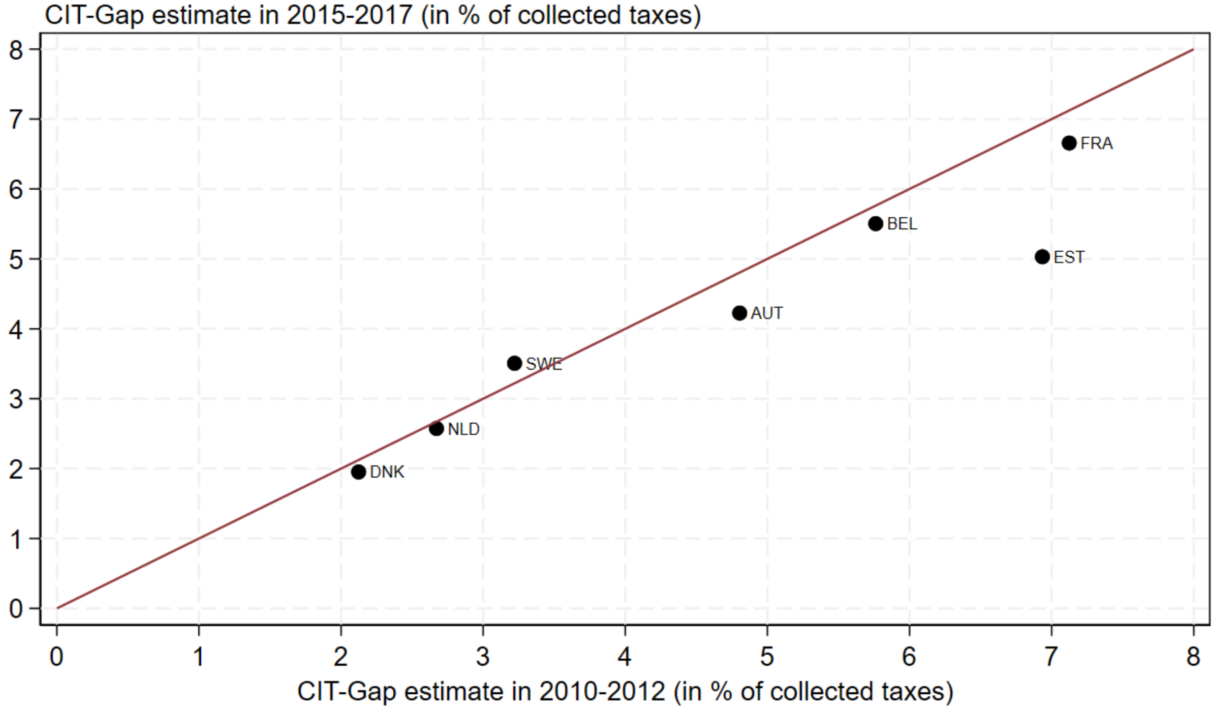
To this end, we have computed the CIT gap using an older wave of Process Tables from the years 2010 to 2012. For seven EU Member States, we were able to compare the older CIT gap figures with more recent ones. The comparison is illustrated in **Figure 12**, which plots the CIT gaps for the period between 2010 to 2012 on the horizontal axis against the CIT gap for the period between 2015 to 2017 on the vertical axis. The close alignment of these observations with the 45-degree line suggests that the CIT gap is largely stable over a period of approximately five to six years.

Focusing on the specific case of Poland, we obtained detailed information on the exhaustiveness adjustments annually, enabling us to calculate the GDP-based CIT gap estimate yearly, starting from 2005, as shown in **Figure 13** ([58]).

Our findings indicate that Poland's CIT gap has been relatively stable, fluctuating at around 14% to 16% of collected CIT revenues, with annual changes usually not surpassing 1.5 percentage points. However, we noted a significant downward trend beginning with the onset of the COVID-pandemic. The decline in CIT gap during this period can be attributed to a couple of factors: the reduced use of cash due to pandemic-related hygiene measures and a growing preference for formal employment contracts. The latter trend emerged as workers recognised that staying off the books could mean forfeiting access to furlough payments and support schemes during lockdowns, highlighting a shift in behaviour due to the pandemic's economic impact.

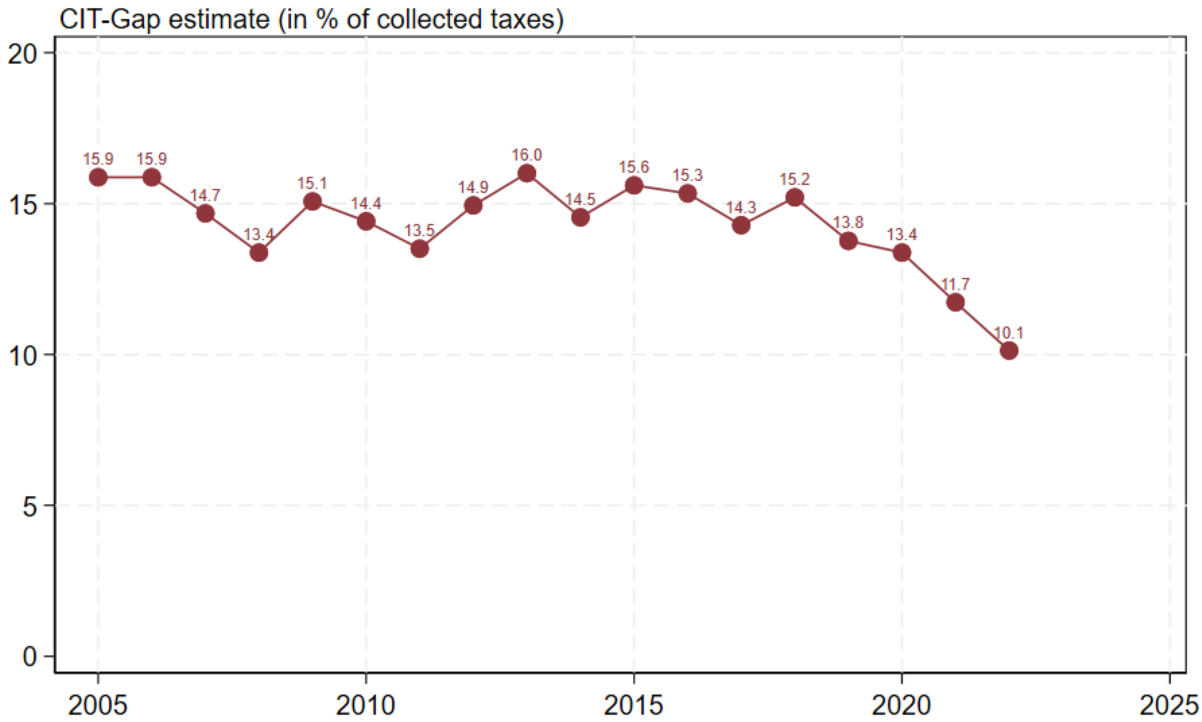
([58]) The estimates for Poland's non-observed economy are constructed from several sources, including assumptions about the average productivity of registered workers, labour market studies that estimate the scale of unregistered employment by natural persons, and assessments of activities tied to the magnitude of illegal sexual services.

Figure 12. Comparison of CIT gap estimates over time



Notes: The figure shows the JRC GVA-based CIT gap estimate for a set of seven countries, for which it was possible to compute a CIT gap from GNI Process Tables at different points in time. The horizontal axis indicates the CIT gap estimate in the time period between 2010 and 2012, while the vertical axis indicates the CIT gap estimate in the period from 2015 to 2017. The 45-degree line is indicated in red. Source: GNI Process Tables of the respective countries.

Figure 13. CIT gap in Poland between 2005 and 2021



Notes: The figure shows the JRC GDP-based CIT gap estimate for Poland between 2005 and 2022. The estimate is derived under the simplifying assumption of the identical implicit CIT rates in the declared and the undeclared part of the economy and expresses the size of the non-observed economy to the size of the observed economy in percent. Source: The relevant information is obtained from the annual publication "National Accounts by institutional sectors and sub-sectors" (Statistics Poland), and not from the Process Tables.

7 Conclusions and recommendations

A tax gap can be decomposed into three components: the policy gap, the compliance gap, and the collection gap. This report focuses mostly on the CIT compliance gap. The CIT compliance gap can arise from multiple sources, broadly categorised into tax avoidance and tax evasion. On one hand, tax avoidance refers to actions that result in an excessive reduction of tax liability for a given amount of correctly reported income. While technically legal, such actions go against the spirit of the law. On the other hand, tax evasion involves the deliberate misreporting of taxable income or deductible items to reduce or entirely circumvent tax liabilities.

While tax evasion is clearly a source of compliance gap, tax avoidance straddles the line between policy and compliance gaps, depending on how it is defined and treated by tax authorities. Additionally, international tax avoidance and profit shifting are recognised as separate but related challenges. Specifically, separate estimates of the extent of international profit shifting should be seen as complementary to CIT compliance gap estimates, as they help capture distinct dimensions of corporate tax base erosion. A wide body of the academic literature estimates the scale of international tax avoidance and the amount of CIT revenues that are lost as a result. The report provides a brief review of that literature, but its primary focus is on methods for estimating domestic CIT gaps.

Two main approaches exist for estimating the domestic CIT gap: top-down and bottom-up methods. Top-down methods compare NA data, which serves as a proxy for theoretical taxable activity in an economy, against tax return data, which reflects declared activity. The IMF RA-GAP framework is the most comprehensive description of this method and is currently being implemented in multiple jurisdictions. In contrast, bottom-up methods rely on firm-level data derived from tax administration audits. These audits can be conducted on randomly selected firms or targeted at firms suspected of misreporting. If data originates from such risk-based audits, post-stratification and econometric techniques are necessary to extrapolate findings to the broader economy.

The suitability of a particular method depends on a number of factors, notably on how tax-reducing activities affect the nature and compilation of economic data. For instance, top-down methods may miss some aspects of international tax avoidance, as profit shifting distorts NA data by understating domestic measures of economic activity, such as GOS. Bottom-up methods have the advantage of capturing both domestic and, to a limited extent, international tax avoidance, given that tax authorities can audit firms' full activities. However, these methods cannot account for illegally operating firms, whose undeclared activities contribute to the CIT gap but remain outside the scope of the audited sample. Moreover, bottom-up approaches are potentially challenging to harmonise across jurisdictions and difficult to operationalise for standardised, timely CIT gap estimates.

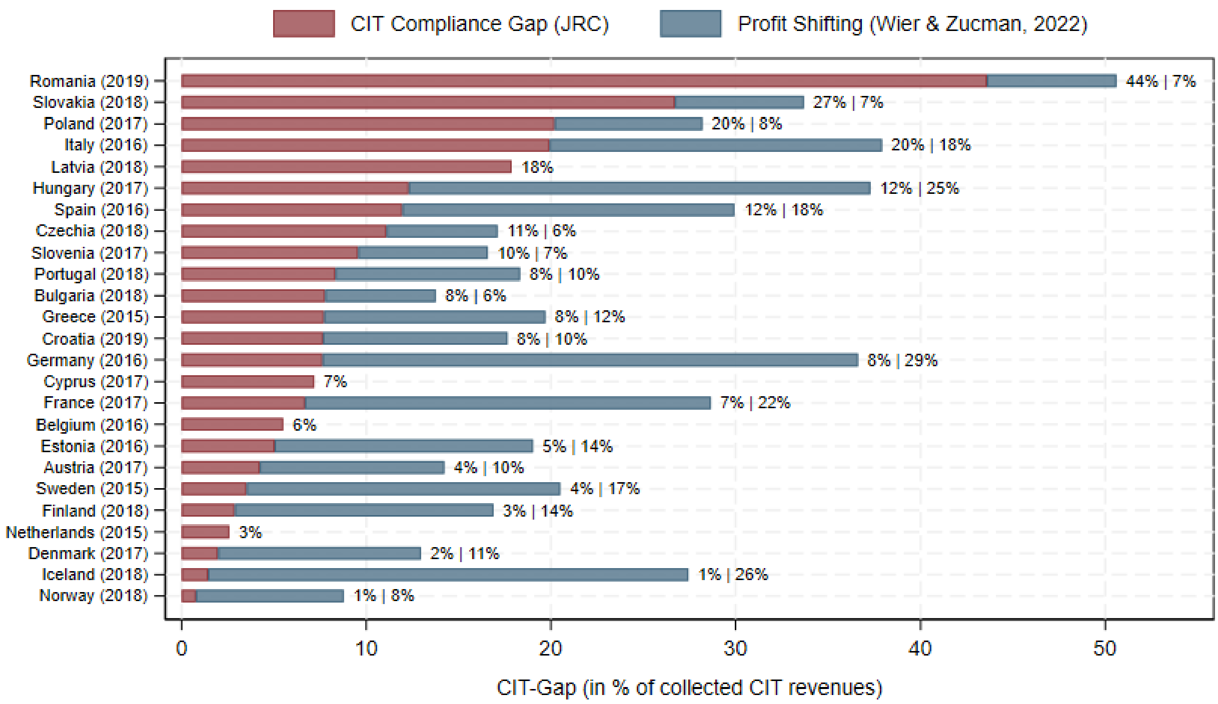
A key task in the top-down methods is deriving a potential CIT tax base by adjusting national accounts measures of aggregate profits, particularly GOS. These adjustments enhance comparability between national accounts and tax return data, replicating the steps that firms follow to calculate tax liabilities. Ideally, these adjustments should rely on data sources independent from tax return data. However, in practice, tax returns are often used in compiling national accounts and remain the best – or only – available source for many adjustments. An application of the IMF top-down method to Spain highlights the significant data requirements of this approach and the potential discrepancies between national accounts and tax return figures.

Importantly, top-down methods require that national accounts exhaustively cover the undeclared economy to derive an estimate of the tax compliance gap. To ensure this, Eurostat's "Tabular Approach to Exhaustiveness" requires Member States to adjust national accounts to reflect various aspects of the non-observed economy. These adjustments provide a valuable benchmark for estimating the CIT gap.

Specifically, the JRC method follows a top-down approach based on the exhaustiveness adjustments to national accounts, disentangling the portion of GOS associated with undeclared economic activity. It leverages Eurostat's "Tabular Approach to Exhaustiveness" to ensure that all productive activities – including informal and underground activities – are accounted for. The main difference between the IMF RA-GAP approach and the "simplified" top-down approach proposed in this report is the assumption of identical implicit tax rates on the observed and non-observed parts of the economy. Despite conceptual similarities, the IMF top-down method allows more flexibility in modelling the implicit tax rate on the non-observed economy. This way, the IMF RA-GAP approach can yield a more accurate estimate of the CIT gap, however it requires a wealth of data that is typically not publicly available and possibly difficult to compile.

The CIT gap estimated in this report varies significantly across countries. In Norway, Denmark, the Netherlands, and Finland, the CIT gap is below 3%, compared to Slovakia and Romania, who experience a much higher CIT gap, exceeding 20% and 35%, respectively. Across 23 EU Member States, the unweighted average CIT gap is 10.9%, translating to an estimated EUR 38 billion shortfall in CIT revenues for the EU-27 in 2017. To put this into perspective, **Figure 14** compares the estimated CIT compliance gap linked to (domestic) tax evasion to the available estimates of tax revenue foregone due to base erosion and (international) profit shifting from Wier and Zucman (2022).

Figure 14. CIT gap in Europe – an overview



Notes: The figure shows the GVA-based CIT gap linked to tax evasion estimated by exhaustiveness adjustment-based JRC top-down method proposed in this report (in blue); and the CIT gap linked to base erosion and (international) profit shifting estimated in Wier and Zucman (2022) in red (referring to numbers from 2019). We omit estimates from Wier and Zucman (2022) which are negative. Source: Studies mentioned before and JRC.

Figure 14 displays a large heterogeneity in CIT gap estimates across countries, whether linked to tax evasion or (international) tax avoidance. One of the main takeaways from this figure – and this report – is that in some countries, the CIT gap linked to tax evasion is the larger source of tax revenue foregone, while in others, base erosion and profit shifting is the predominant source of foregone revenues. In particular, Romania, Slovakia, Poland, Italy and Lithuania see a CIT gap linked to tax evasion at least twice the size of the CIT gap due to base erosion and profit shifting. In other countries, including Denmark, Finland, Sweden, Austria and France, it is base erosion and profit shifting that is the main source of CIT revenue foregone.

The measurement of the CIT gap is closely linked to the estimates of the non-observed economy. This is by no means a shortcoming of the methods discussed in this report, but a natural consequence of trying to estimate the unobservable. Importantly, any top-down estimate of the CIT gap, whether following the IMF RA-GAP approach, or the "simplified" approach proposed in this report, can only be as good as the exhaustiveness adjustments for the non-observed economy.

Micro and tax audit data can be especially helpful to inform the exhaustiveness adjustments to national accounts, as in the case of Sweden. With this in mind, the collaboration between the national task forces responsible for estimating the non-observed economy and the task forces conducting tax audits within national tax authorities, should be strengthened, as their activities are highly complementary. By refining data collection, enhancing the standardisation and harmonisation of non-observed economy estimates produced by Member States' national statistical institutes, and fostering inter-agency coordination, policymakers can improve the accuracy of CIT gap estimates and design more effective tax compliance strategies.

Appendix

Table A.1. Steps to implement the IMF top-down method

GROSS OPERATING SURPLUS (GOS)

Step 1: positive adjustments

+ Interest income after FISIM (received)
+ Distributed income of corporations (received)
+ Realised profits of foreign branches (received)
+ Other investment income, *except income attributed to insurance policy holders (received)*
+ Rents (received)
+ Current transfers, including net social contributions and non-life insurance claims and donations (received)
+ Capital transfers, such as investment grants and transfers from creditors or the government (received)
+ Inventory valuation adjustments (holding) gains
+ Realised capital gains
+ Cost of trading and issuing securities
+ Reversal of allowances and reserves

Step 1: negative adjustments

- Interest income after FISIM (paid)
- Other investment income, including income attributed to insurance policy holders (received)
- Rents (paid)
- Current transfers, including social benefits other than transfers in kind and non-life insurance net premiums, fines, penalties, and donations (paid). *Current taxes paid on income and wealth should not be subtracted except if deductible from the CIT base.*
- Capital transfers (payable)
- Accounting depreciation
- Realised capital losses
- R&D expenditure and software
- Provisions of allowances and reserves
- Stock options to employees

FINANCIAL ACCOUNTING PROFITS (P&L before tax)

Step 2: positive adjustments

+ Difference between tax and accounting depreciation that increases the tax base
+ Provisions for losses
+ Non-deductible costs
+ Other items that are deductible for accounting purposes (costs) but not for tax purposes (expenditures)

Step 2: negative adjustments

- Difference between tax and accounting depreciation that reduces the tax base
- Double taxation exemptions
- Special tax regimes
- Other items that are not deductible for accounting purposes (costs) but are for tax purposes (expenditures)

NET CURRENT TAX BASE (N-CTB)

Step 3: positive adjustments

+ Current losses

Step 3: negative adjustments

- Tax group consolidation
- Loss carry-forwards
- Allowance for corporate equity or Capital reserve.

TAX BASE (TB)

Step 4: positive adjustments

Step 4: negative adjustments

- Tax rate
- Tax credits

TAX LIABILITY (TL)

Source: JRC, based on Ueda (2018).

Table A.2. From EBITDA to tax liability in Spain, 2019

Top-down adjustments for the CIT gap (Non-financial corporations)

2019 (million €)	UNCONSOLIDATED		CONSOLIDATED					
	TOTAL		TOTAL		NO TAX GROUP		TAX GROUP	
Step 1 Derive FAP from GOS	All	TB > 0	All	TB > 0	All	TB > 0	All	TB > 0
EBITDA	**225,871**	**182,515**	**228,066**	**185,014**	**92,735**	**65,329**	**135,331**	**119,685**
Accounting depreciation	-76,008	-50,158						
Provisions	1,920	624						
Write-offs and capital losses from asset sales	-12,885	6,488						
EBIT	**138,898**	**139,469**						
Net financial income	**25,990**	**21,396**						
Financial income	57,279	24,136						
Financial expenses	-36,718	-13,146						
Capital gains	5,430	10,406						
FAP (P&L before tax)	164,888	160,865	**170,067**	**181,615**	**69,977**	**77,377**	**100,090**	**104,238**
Step 2 Define the tax base								
FAP — **FAP (P&L before tax)**	**164,888**	**160,865**	**170,067**	**181,615**	**69,977**	**77,377**	**100,090**	**104,238**
Adjustments to FAP	-81,571	-32,331	-88,250	-70,360	-21,685	-7,100	-66,565	-63,260
Difference between tax and accouting depreciation	268	1,268	207	555	45	215	162	339
Provisions for losses	39,232	9,910	45,037	32,470	5,836	2,568	39,201	29,902
Double taxation exemption	-127,823	-46,348	-140,724	-106,513	-30,216	-11,699	-110,508	-94,814
Special tax regimes	-3,965	-1,186	-4,367	-1,537	-3,653	-1,089	-714	-448
Non-deductible costs	825	430	1,370	901	2,012	749	-642	152
Other	9,893	3,594	8,330	2,185	4,297	2,160	4,033	25
Tax base before losses	**81,231**	**128,978**	**81,532**	**112,038**	**47,743**	**70,613**	**33,789**	**41,426**
Step 3 Treatment of losses								
Current losses	**47,747**		30,506		22,870		7,636	
Tax group consolidation losses				17,241				
Provision for capital reserves			2,153	2,136	1,186	1,170	967	966
Loss carry-forwards	**15,373**	6,314	15,152	8,030	11,181	4,398	3,971	3,632
Step 4 Tax rate and tax credits								
Positive tax base			**101,874**	**101,874**	**65,046**	**65,046**	**36,828**	**36,828**
Effective Tax Rate (%)			*24.6%*	*24.6%*	*24.4%*	*24.4%*	*24.9%*	*24.9%*
Full tax liability			**25,029**	**25,025**	**15,843**	**15,839**	**9,186**	**9,186**
Tax credits			3,209	3,209	929	929	2,279	2,279
For double taxation			1,118	1,118	231	231	887	887
Other			2,090	2,090	698	698	1,392	1,392
Bonuses			298	298	205	205	93	93
Effective tax liability			**21,525**	**21,521**	**14,712**	**14,708**	**6,814**	**6,813**
Effective tax rate				13.8%		20.5%		8.8%

Source: JRC, data taken from the Administración Estatal de la Agencia Tributaria (AEAT), Cuentas no consolidadas y Cuentas consolidadas del Impuesto de Sociedades para las Sociedades no financieras, 2019.

Table A.3. CIT gap estimates from the simplified top-down approach proposed by the JRC

Country	Year of observation	GDP-based CIT gap estimate	GVA-based CIT gap estimate	GOS-based CIT gap estimate
Austria	2017	3.75%	4.23%	7.39%
Belgium	2016	4.89%	5.50%	6.38%
Bulgaria	2018	6.65%	7.76%	n/a
Croatia	2019	6.20%	7.64%	2.70&
Cyprus	2017	6.20%	7.17%	13.68%
Czechia	2018	9.89%	11.10%	5.76%
Denmark	2017	1.69%	1.95%	2.33%
Estonia	2016	4.31%	5.03%	5.43%
Finland	2018	2.46%	2.87%	n/a
France	2017	5.89%	6.66%	10.95%
Germany	2016	n/a	7.62%	n/a
Greece	2015	6.74%	7.70%	n/a
Hungary	2017	10.23%	12.29%	n/a
Iceland	2018	1.28%	1.44%	n/a
Italy	2016	17.54%	19.93%	n/a
Latvia	2018	15.26%	17.86%	n/a
Netherlands	2015	2.31%	2.57%	n/a
Norway	2018	0.68%	0.77%	n/a
Poland	2017	14.30%	20.20%	n/a
Portugal	2018	7.11%	8.32%	n/a
Romania	2019	37.85%	43.61%	59.33%
Slovakia	2018	23.25%	26.70%	33.63%
Slovenia	2017	8.20%	9.56%	n/a
Spain	2016	10.71%	11.94%	n/a
Sweden	2015	3.11%	3.51%	1.36%

Notes: The CIT gap for each country is derived by applying Eq. (9) using either declared GDP, GVA or GSO as reported in the Process Table for each country and the sum of exhaustiveness adjustments for undeclared GDP, undeclared GVA, or undeclared GOS, respectively. Source: Process Tables for each country and JRC.

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List of abbreviations and definitions

Abbreviations	Definitions
Administración Estatal de la Agencia Tributaria (AEAT)	State Administration of the Spanish Tax Agency
BEPS	Base Erosion and Profit Shifting
CbCR	Country-by-Country Reporting
CGE	Computable General Equilibrium
CIT	Corporate Income Tax
CoE	Compensation of Employees
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
Eq.	Equation
ETR	Effective Tax Rate
FAP	Financial Accounting Profits
FDI	Foreign Direct Investment
FISIM	Financial Intermediation Services Indirectly Imputed
GDP	Gross Domestic Product
GNI	Gross National Income
GOS	Gross Operating Surplus
GVA	Gross Value Added
IMF	International Monetary Fund
Instituto Nacional de Estadística (INE)	Spanish National Statistics Institute
IP	Intellectual Property
IRS	Internal Revenue Service

ITR	Implicit Tax Rate
JRC	Joint Research Centre
LBT	Local Business Tax
MNE	Multinational Enterprise
NA	National Accounts
N-CTB	Net Current Tax Base
NOE	Non-Observed Economy
OECD	Organisation for Economic Co-operation and Development
PIT	Personal Income Tax
R&D	Research and Development
RA-GAP	Revenue Administration Gap Analysis Program
REIT	Real Estate Investment Trust
SME	Small and Medium-Sized Enterprises
TB	Tax Base
TL	Tax Liability
TR	Tax Revenue

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