Argomenti di discussione

(Discussion topics)

A GENERAL FRAMEWORK FOR MEASURING VAT COMPLIANCE IN ITALY

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N. 02/2016

Agenzia Entrate

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ISSN: 2420-773X

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A general framework for measuring VAT compliance in Italy

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Abstract

This paper provides a methodological overview of the approach applied by the Italian Revenue Agency to estimate VAT compliance. The national level of compliance is estimated using the VAT gap, defined as the difference between the expected VAT receipts if all the VAT which is due is collected and the actual VAT that is collected. In order to calculate the VAT gap, an indirect top-down method is applied, following two hypotheses, one with complicity between buyer and seller, where transactions are completely hidden, and the other without complicity, where the seller collects tax from the buyer, which is not remitted. In addition, the present framework takes into account other aspects that are disregarded in the standard approach to measuring the tax gap and concern either the VAT gap by final users (Households, General Government, others) and that by region. Regarding the territorial breakdown, this paper also considers the place where consumption occurs and then the VAT that arises, although its collection may occur in a different area.

The top-down method takes advantage of National Account (ISTAT) aggregates whose figures include the underground economy. Such method provides exhaustive macroeconomic non-compliance indicators, however it barely splits the overall gap according to some types of non-compliance behaviors. To overcome this drawback, the top-down approach can be also integrated with the bottom-up approach.

Sommario

Il lavoro illustra le linee metodologiche generali dell'approccio seguito dall'Agenzia delle Entrate Italiana per stimare l'indicatore di *compliance* basato sui dati IVA. Il livello di *compliance* è stimato attraverso il gap IVA, definito come la differenza tra l'IVA che dovrebbe essere versata se si adempisse perfettamente agli obblighi di legge e quella effettivamente incassata dallo Stato. Il gap IVA è calcolato adottando un metodo top down indiretto, seguendo due ipotesi: la prima che ci sia complicità tra il venditore e il compratore e, quindi, la transazione è completamente nascosta; la seconda che non ci sia complicità, pertanto il venditore non versa l'IVA fatturata al cliente. Inoltre, il lavoro prende in considerazione anche altri aspetti non evidenziati negli approcci standard, quali la disaggregazione del gap tra i differenti usi finali e per regione. Con riferimento alla disaggregazione territoriale, l'articolo considera anche la differenza tra il luogo dove si genera l'IVA e quello dove l'imposta è versata.

L'approccio top down si fonda sul confronto dei dati elaborati dalla contabilità nazionale ISTAT che includono una stima dell'economia sommersa. Il metodo fornisce un indicatore macroeconomico esauriente della non-*compliance*, difficilmente però riesce a disaggregare in base ai comportamenti evasivi dei contribuenti. Per superare questo limite è necessario integrare l'approccio top down con quello bottom up.

JEL classifications: H21, H26

Keywords: VAT, evasion gap estimation, methodology

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1. Background[1]

Value added tax (VAT)[2] is a consumption tax charged on most goods and services traded for consumption use. It is the main indirect tax revenue in the Italian tax system and provides about 25% of the total tax revenue, annually. From a theoretical point of view, its revenue is not affected by the length of the production and distribution chain, since it is collected fractionally at each stage of production and distribution on the value added[3] to products. This aspect assures neutrality to the degree of vertical integration of the production process and to the steps that goods and services follow before being purchased by final consumers.

Technically, tax neutrality is achieved with the right to deduct input VAT on purchases. Through the deduction mechanism, taxpayers who are legally burdened can be identified, and then report to the tax authorities and pay taxes. Those who may not apply this mechanism, act as final consumers (*de facto* taxpayers[4]), and actually undergo the economic effects of taxation.

In each stage, the amount of VAT paid by taxable persons is determined on the basis of their taxable sales, purchases, the right to recovery and the deduction mechanism[5].

VAT transactions involve different economic actors: Households, General Government and Businesses. Among them, whenever a buyer purchases goods and services and does not have the right to deduct input VAT, partially or totally[6], they act as final consumers[7]. Households cannot deduct input VAT on their purchases of goods and services. General Government may deduct input VAT only if it behaves as a market operator, selling taxable goods and services. Generally, businesses deduct input VAT on purchases, but there are some exceptions. The first, if their sales are mainly VAT exempted then they partially deduct input VAT; the second, if firms buy goods and services for which VAT legislation does not allow input VAT deduction at all.

Transactions carried out among economic actors may lead to non-compliant behaviors, concerning both the relationship among firms (business to business) as part of the recourse/deduction sequence and those between business and households. Theoretically, the deduction mechanism is a form of mutual control among business taxpayers which, however, does not remove the incentive to evade VAT, either by reducing and deleting the taxable base and then the VAT.

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[1] The authors thank the members of the Fiscalis Tax Gap Project Group who have provided insight and expertise that has greatly assisted the research, although they may not agree with all of the interpretations/conclusions of this paper.

[2] The VAT system in the European Union is governed by a common legal framework, the VAT Directive.

[3] Value added is defined as the difference between the cost of inputs used in the production of goods and services and the price at which they are sold, in each stage.

[4] *De facto* taxpayers and those by law may or may not coincide.

[5] The procedure is the following: seller charges VAT on the price of taxable goods and services sold (becoming indebted to the State), the amount of VAT paid to the tax administration is obtained as the difference between output VAT and the amount of VAT paid on its purchases (input VAT) due to the deduction mechanism. When the latter exceeds the former, there are conditions for claiming VAT refunds which can be considered a physiological aspect of the VAT system, closely associated to recoverability.

[6] See articles 17 and 19 in DPR no. 633 of 1972.

[7] Scholars define this aspect as the impurity of actual VAT with respect to the ideal concept of VAT.

Households tax evasion arises from transactions involving Households and it includes evasion engendered along the value chain of these goods and services. Business tax evasion concerns transactions among enterprises and includes evasion engendered along the value chain of the exchange of goods and services as final consumers.

This work is organized as follows: in section 2 the main aspects of the VAT gap method are illustrated, the third section describes the computational procedure and data employed in the estimation process. Section 4 explains the VAT gap broken down into different final users, by geographical area, by place of consumption and by place where the VAT is collected. The fifth section summarizes the main assumption of the procedures. Then, the last section is dedicated to some final considerations.

2. A general overview of the methodology

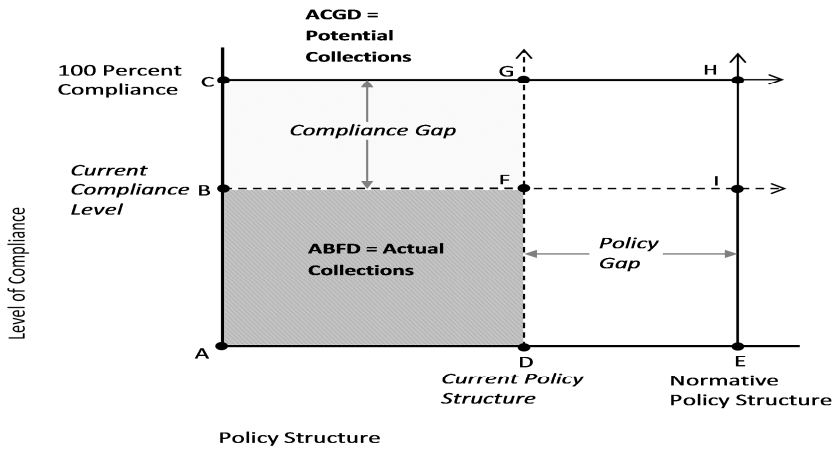
2.1 Definition of the VAT gap[8]

The broadest definition describes the VAT gap as the difference between the actual collection and the potential collection of the "ideal" VAT system. According to Das-Gupta, Mookherjee, 2000: "… potential collection is that which could be collected if no taxpayers would voluntary breach the law and involuntary errors would amount to zero". The VAT system is defined "ideal" when all the VAT is applied on the household consumption by applying only one standard rate without any exemptions.

A stricter definition of the VAT gap consists in identifying the gap as the difference between actual collection and potential collection "given the current policy framework".

The difference between the two definitions is named "policy gap", while the stricter definition of the VAT gap is named "compliance gap".

Figure 2.1 Definitions of the VAT gap[9]



[8] For an overview, see European Commission 2016.

[9] This figure is from Hutton (2015).

In the graph shown in figure 2.1 the differences between the "policy gap" and the "compliance gap" are presented, where the former is included in rectangle "D-F-I-E" and the latter by the area "B-C-G-F".

In formal terms, the relation among definitions can be written as:

$$VAT \text{ actual revenue} = (1 - \text{policy gap}) \cdot (1 - \text{compliance gap}) \cdot (\text{Potential VAT base} \cdot \text{VAT standard rate})$$

The compliance gap can also be calculated "net" of the sum collected through the fiscal audit activity.

The compliance gap can be seen either as an indicator of the voluntary VAT compliance and as a measure of the effectiveness of deterrence effects provided by the tax authorities. In fact, it arises as a consequence of the revenue losses from fraud and evasion, tax avoidance, bankruptcies, fiscal insolvencies as well as from miscalculations. The net VAT compliance gap also includes the effectiveness of fiscal audits measured in terms of revenue (plus sanctions) actually collected through fiscal audits. Hereafter, the VAT gap is also indicated as the VAT compliance gap.

2.2 Top-down approach

The national VAT gap is estimated by applying an indirect top-down approach. This method compares the tax collected with those that would have been collected if all individuals and enterprises had perfect compliance. The latter is defined as "potential" or "theoretical" liability. On the one hand, it is "potential", since it represents the maximum revenue achievable, given the current policy framework. On the other hand, it is also "theoretical", as such amount will never be achieved because some transactions would not occur[10] in the absence of evasion.
Two approaches can be identified to derive the "potential" or "theoretical" liability in the class of top-down methods based on National Accounts data. The first is based on the supply side[11] and the other on the demand side. In order to estimate the potential revenue, the former employs the value added at the sectorial level[12], the latter captures the end of the VAT chain, from the expenditure perspective.

Italy currently adopts the demand side approach.

In order to obtain an accurate measure of the potential (theoretical) liability, we have to correctly identify both the taxable base and the VAT rates with respect to the legislation. As a general rule, a highly detailed level of National Accounts aggregates is needed to capture the complexity of VAT regulations and to accurately calculate the potential base and tax[13]. For each detailed subclass of National Accounts, the share of

[10] In order to estimate the amount of evasion actually recoverable a "counterfactual" approach should be used. However, there is no reliable information about further consequential effects of compliance that allows us to perform this estimation (see Reckon, 2007).
[11] In Annex 1, a brief description of the supply side approach is provided.
[12] See IMF, 2014.
[13] For more details, see D'Agosto et al. (2014), Pisani (2014).

exempted base is deducted and its own proper statutory VAT rate is associated to the residual amount.

The voluntary taxpayer compliance is calculated on an accrual basis. For this purpose, the VAT revenue considered in the analysis is what the economic system generates as a result of transactions burdened with VAT in the reference period (a fiscal year). The declared VAT base (BID) is obtained by dividing IVAEC by the implicit rate computed on the bases of the data in VAT statements and accounting for both internal market components and imports.

VAT gaps are calculated as follows:

$$BIND = BIT - BID \quad [2.1]$$

$$IVAEV = IVAT - IVAEC \quad [2.2]$$

where BIND is the VAT base gap and IVAEV is the VAT gap.

The applied estimation method allows inclusion in the VAT gap of: intentional evasion as well as avoidance, unpaid VAT liability due to liquidity crises, errors or accidental omissions of various kinds.

2.3 The gap with and without complicity

The overall gap is estimated following two hypotheses[14]: first, with complicity (seller and buyer agree and there is no invoice, tax is not collected); second, without complicity (tax is collected but it is not remitted). An example of these kinds of behaviors is shown in Annex 2.

Tax evasion may originate from the reduced prices of goods and services sold, equal to the amount of tax, when the seller and buyer agree. In this case, the final consumers, not recovering VAT on their purchases, may be complicit in fraud by taking advantage of lower prices[15]. Consequently, several types of tax evasion take the form of underreporting of taxable transactions, even if VAT is paid to the sellers (evasion without complicity).

Currently, we are not able to identify the amount of evasion for each behavior, therefore we produce two estimates. First, we estimate the gap by assuming all evasion occurs with complicity, then we suppose all evasion is without complicity. Figures 2.2a and 2.2b provide a general overview of both the procedures: without and with complicity.

The starting point of the procedure is given by the national account figures (NA), e.g. let's consider NAg as a generic NA group of products (i.e. an item of Household Consumption). Our aim consists in decomposing NAg with respect to the definition

[14] The two types of behaviors are recognized within the EU and the European Commission in Decision 98/527/CE, G.U. no. Law 234 of 21/8/1998 pp. 0039-0042.

[15] Another case is related to the deduction mechanisms: for instance, the creation of false invoices on purchases for the purpose of increasing input VAT, accordingly, reducing the payment to the Tax Administration.

previously mentioned, as follows:

$$NAg = EXEg + BIDg + BINDg_{wout} + BINDg_{with} + IVAEVg_{wout} + IVAECg \quad [2.3]$$

where, in addition to the variables already defined, is denoted as:

$BINDg_{wout}$ = VAT base evaded without complicity;
$BINDg_{with}$ = VAT base evaded with complicity;
$EXEg$ = part of NAg exempted or not subject to VAT, $0 \leq NAg \leq 1$;
$IVAEVg_{wout}$ = VAT invoiced, collected but not remitted by evaders (without complicity);
$IVAECg$ = VAT actually collected and remitted;
$BIDg$ = actual VAT base.

Figure 2.2a: *Flow chart of the methodology used to estimate the potential VAT base and VAT gap (without complicity)*

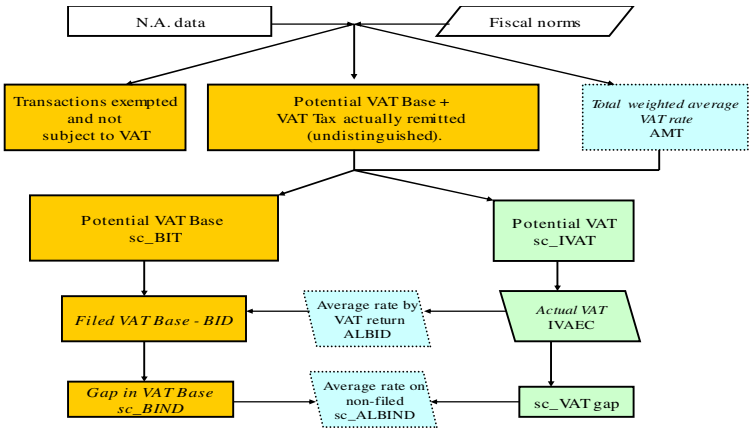
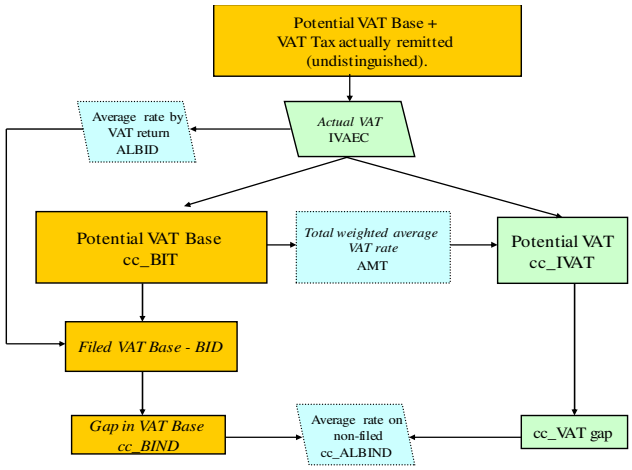


Figure 2.2b: *Flow chart of the methodology used to estimate the potential VAT base and VAT gap (with complicity)*



Equation [2.3] implies:

$$BINDg = BINDg_{wout} + BINDg_{with}$$

Under the assumption that the VAT rate τ_g, for eachNAg, is equal for both declared and hidden transactions[16], we can rewrite [2.3] as:

$$NAg = (BIDg + BINDg_{wout})(1 + \tau_g) + BINDg_{with} + EXEg \quad [2.4]$$

In the first step of the procedure, we exclude $EXEg$ from NAg (see figure 2.2a). On the basis of the fiscal norm and by using specific indicators, the $cexe$coefficient is calculated. It is a proxy of the ratio:

$$cexe = \left(\frac{EXEg}{[(BIDg + BINDg_{wout}) \cdot (1 + \tau_g) + BINDg_{with} + EXEg]}\right)$$

By applying $(1 - cexe)$to NAg, we derive an amount representing the potential VAT base plus VAT actually remitted and VAT invoiced and not remitted. That is equal to:

$$BITIVAECg = (BIDg + BINDg_{wout})(1 + \tau_g) + BINDg_{with} \quad [2.5]$$

Hereafter, the VAT gap calculations follow two different methodologies to determine the gap with complicity and that without.

On the one hand, if we assume that all evasion occurs with complicity (figure 2.2.b), then we subtract from [2.5] the VAT actually remitted (IVAEC), obtaining the potential VAT base, $BITg_{with}$, as:

$$BITg_{with} = BIDg + BINDg_{wout}(1 + \tau_g) + BINDg_{with} \quad [2.6]$$

The [2.6] equation over-estimates the potential VAT base, $BITg$, since it includes the amount of VAT invoiced and not remitted in the evasion without complicity.

On the other hand, if we assume that all gaps occur without complicity (figure 2.2a), then we divide [2.5] by $(1 + \tau_g)$,

The potential VAT base, $BITg_{wout}$, is:

[16]This assumption strongly depends on the level of detail for "g".

$$\text{BITg}_{wout} = \frac{(BID_g + BINDg_{wout})\cdot(1+\tau_g)+BINDg_{with}}{(1+\tau_g)} \qquad [2.7]$$

The [2.7] equation under-estimates the potential VAT base, $BITg$, since it is reduced by an amount of VAT not included in NA figures, due to $BINDg_{with}$.

From [2.6] and [2.7], we may conclude that the unknown "true" value of $BITg$ is included in the following range:

$$BITg_{wout} \leq BITg \leq BITg_{with} \qquad [2.8]$$

In order to obtain the potential VAT, $IVATg$, in both hypothesis, the VAT rate, τ_g, is multiplied by $BITg_{wout}$ and $BITg_{with}$. In formal terms:

$$IVATg_{wout} = BITg_{wout} \cdot \tau_g \qquad [2.9a]$$

$$IVATg_{with} = BITg_{with} \cdot \tau_g \qquad [2.9b]$$

On the basis of [2.8], we then obtain:

$$IVATg_{wout} \leq IVATg \leq IVATg_{with} \qquad [2.10]$$

The amount of BIT and IVAT referred to the total economy are obtained by summing up $BITg$ and $IVATg$ for the entire group of "g" products burdened with value added tax.

According to [2.1] and [2.2], the estimation of BIND and IVAEV requires computing the actual values of BID and IVAEC. The technical details of this calculation will be shown in section. 3. At this stage, two main general topics need to be pointed out:

1. on the basis of the characteristics of VAT, it is difficult to calculate BID and IVAEC by product. In fact, VAT is remitted by enterprises which usually sell a cluster of products that can be very heterogeneous among them;
2. so as to include in the gap estimates components such as avoidance, unpaid VAT liability due to liquidity crisis, errors or accidental omissions of various kinds, the VAT actually paid to the State Budget, IVAEC, has to be taken as basis for the calculation.

The actual VAT base (BID) is obtained by dividing VAT revenue on an accrual basis, IVAEC[17], for the implicit declared rate, τ_d

$$BID = \frac{IVAEC}{\tau_d} \qquad [2.11]$$

[17]For the detail of calculation, see section 3

It is worth noting that $\tau_d$is different from τ. The former is the actual VAT rate calculated on the basis of VAT statements while the latter is an implicit rate obtained by dividing IVAT for BIT[18].

On the basis of [2.6], [2.7], [2.9a], [2.9b] and [2.11], we may rewrite the [2.1] and [2.2], as:

$$BIND_{wout} = BIT_{wout} - BID \quad [2.12a]$$

$$BIND_{with} = BIT_{with} - BID \quad [2.12b]$$

$$IVAEV_{wout} = IVAT_{wout} - IVAEC \quad [2.13a]$$

$$IVAEV_{with} = IVAT_{with} - IVAEC \quad [2.13b]$$

Where [2.12a] and [2.13a] represent the lower bound of gaps estimates, while [2.12b] and [2.13b] are the upper bound.

3. VAT gap data sources and calculation procedure

In this section, a detailed description of the methodology outlined in section 2 is illustrated. The list of data sources used in the estimation procedure is contained in Annex 3.

The theoretical VAT base (BIT) is computed consistently with the classifications and definitions applied for the declared VAT base and its estimate employs detailed expenditure subclasses of National Accounts components[19]:

a. Households Consumption (261 items);
b. General Government Investments (12 items);
c. General Government Intermediate Consumption (17 items);
d. Market enterprises Intermediate Consumption (58 items),
e. Specific types of market enterprises Investments (e.g. cars).

For VAT purposes, either General Government which offers non-market services or specific segments of market enterprises act as final consumers when they do not recover tax[20].
Market enterprises may not recover VAT in two situations: the first is due to the type of purchased goods, denoted as “objective”; the second, denoted as “subjective”, is linked

[18]VAT statements are not employed for the estimation of BID and IVAEC, because of the bias due to missing payment. The latter makes the declared VAT base inconsistent with IVAEC. Under[2.11] there is the hypothesis that this bias does not affect the actual VAT rate, τd. The assumption is that missing payments do not modify the relationship between the base and the tax indicated in the VAT statement (that is, missing payments are proportionally distributed among legal rates), therefore they do not affect the average rate.

[19]In Annex 3 the National Accounts aggregates are purposely linked to each component.

[20] This second type also regards all purchases by public administration which offers non-market services.

to the kind of business: enterprises which sell exempt goods and services cannot reclaim VAT paid for their purchases. According to VAT legislation, among goods and services purchased by firms those items are identified whose tax is not recoverable. To take the "subjective" component into account, the not recoverable share is computed by detailed economic activities from VAT statements, then these percentages are applied to National Accounts Intermediate Consumption.

Each item included in the list from a) to e) represents the generic national account group of products, NAg, as equation [2.4] has shown. By applying the procedure described in section 2, the potential base (BIT) and the potential VAT (IVAT) can be calculated following [2.12a], [2.12b], [2.13a] and [2.13b].

The average potential (theoretical) VAT rate, AMT shown in figures 2.2a and 2.2b, for the whole economy, is equal to:

$$AMT = \frac{IVAT_{wout}}{BIT_{wout}} = \sum_{g=1}^{n} \tau_g \cdot \frac{BITg_{wout}}{\sum_{g=1}^{n} BITg_{wout}} = \frac{IVAT_{with}}{BIT_{whit}} \qquad [3.1]$$

The estimation of the potential VAT base (BIT), in addition to that of potential tax (IVAT), is relevant as it allows one to:

a) evaluate more precisely the share of transactions exempted and those not subjected to VAT;
b) provide a dynamic of compliance not affected by changes in VAT rates;
c) provide a proxy of other evaded tax bases (e.g. direct tax).

To obtain the actual VAT base (BID), we divide the VAT revenue (IVAEC) by the implicit declared rate, see [2.11]. The VAT revenue is calculated on an accrual basis, which represents the VAT revenue generated by the economic system as a result of transactions burdened with VAT in the reference period (a fiscal year).

The accrued revenue stems from all flows involving VAT as shown in the following equation[21]:

IVAEC =VAT Gross Revenue[22] *– (Refunds + Compensation*[23]*) – Adjusting for accrual accounting -variation in the amount of VAT credits to bring to the next year*[24] [3.2]

Where IVAEC denotes the economic accrued revenue consistent with our method of estimating the gap.

[21]See also Rodrigues (2015).
[22]It represents voluntary compliance and it excludes the amount collected through audits.
[23] It is an alternative way to the request for reimbursement, under which one may use VAT tax credit to pay other taxes.
[24]To have this opportunity, the taxpayer reports VAT credit in the tax return.

VAT gross revenue represents the taxpayers' voluntary compliance and is the tax due and paid to the Tax Authorities as a result of VAT transactions in the domestic market and those from imports. This VAT revenue is gross, as it comes before adjustments for refunds and compensations. After the latter corrections and adjusting for potential timing differences in revenues between the accrual basis and the cash basis, we derive the VAT accrual[25].

Every year taxpayers annotate in the VAT statement the amount of VAT credit they can use in the year following the statement. The aggregate variation of this stock measures the VAT credit that has been generated in the economic system after refunds or compensation have been requested.

To obtain IVAEC consistent with the National Accounts, we subtract the change in the stock from the accrued VAT.

The reported VAT base (BID) is obtained dividing IVAEC by the implicit rate[26], τ_d see [2.11]. The τ_d is calculated as a weighted average of the VAT rate applied to imported goods and services, τ_{dimp}, and the VAT rate on the domestic transaction,τ_{dom}. In formal terms:

$$\tau_d = \tau_{dimp} \cdot w_{imp} + \tau_{dom} \cdot w_{dom} \qquad [3.3]$$

where$\tau_{dimp}$and τ_{dom} are implicit VAT rates calculated by the fiscal statements and where w_{imp} and w_{dom} are weights, equal to:

$$w_{imp} = \frac{\frac{IVAEC_{imp}}{\tau_{dimp}}}{\frac{IVAEC_{imp}}{\tau_{dimp}} + \frac{IVAEC_{dom}}{\tau_{dom}}}$$

$$w_{dom} = \frac{\frac{IVAEC_{dom}}{\tau_{dom}}}{\frac{IVAEC_{imp}}{\tau_{dimp}} + \frac{IVAEC_{dom}}{\tau_{dom}}}$$

Where $IVAEC_{imp} + IVAEC_{dom}$=IVAEC

As result of the procedure, three different VAT rates are calculated (see figures 2.1b and 2.2a): AMT, see [3.1], is the VAT rate in case of perfect compliance; τ_d = ALBID, see [3.3], is the actual VAT rate and $ALBIND = IVAEV/BIND$ is the VAT rate that should be applied to the "evaded" transactions.

The empirical evidence shows the following inequality:

$$ALBID \leq AMT \leq ALBIND$$

[25] The procedure is defined by the European Union in accordance with Regulation ESA95.

[26] It is computed on the bases of the data from VAT statements, taking into account internal market components and imports.

This is due to the fact that the higher the VAT rate, the higher the share of evaded transactions.

In order to calculate the net VAT gap, the additional tax assessed actually collected by tax audits (OM) is subtracted by IVAEV [2.13a, 2.13b]. In fact,OM_t, at time *t*, is not time consistent with IVAEV, since it is given by:

$$OM_t = \sum_{i=1}^{Ta} \sum_{n=1}^{m} Tg_{i,t-n} \qquad [3.4]$$

where: "*Ta*" denotes the number of taxpayers audited; "*Tg*" is the tax gap assessed by the tax authority; and "*n*" represents the physiological time span between the tax year audited and the year in which the tax authority collects the amounts due. Basically, OM reduces tax gaps of years earlier than the current one. For instance, under the assumption of *n*=3, the formula [3.4] summarizes the situation shown in table 3.1. In the last row, we find OM, while the in last column the same OM is reclassified according to the fiscal year audited (OMa). Table 3.1 shows that the full information for OM is available at time "*t*", while the information for OMa is available with a certain delay, which depends on "*n*" in [3.4], namely by the physiological time span between the tax year audited and the year in which the tax authority collects the amounts due.

Table 3.1 Additional tax assessed that is actually collected by tax audits classified by years in which the additional taxes are actually collected and by fiscal years audited

Fiscal years audited	Years in which the additional taxes are actually collected					
	t-4	t-3	t-2	t-1	t	OMa
t-4	Tg_{t-4}	Tg_{t-4}	Tg_{t-4}			OMa_{t-4}
t-3		Tg_{t-3}	Tg_{t-3}	Tg_{t-3}		OMa_{t-3}
t-2			Tg_{t-2}	Tg_{t-2}	Tg_{t-2}	OMa_{t-2}
t-1				Tg_{t-1}	Tg_{t-1}	N/A[1]
t					Tg_t	N/A
OM	OM_{t-4}	OM_{t-3}	OM_{t-2}	OM_{t-1}	OM_t	

1:N/A indicates a year for which the full information is not available.

4. The breakdown of the VAT gap

4.1 Breakdown by non-compliance behavior

One of the most important drawbacks of the top-down method consists in providing macroeconomic indicators that can barely be split according to kind of non-compliance behavior.

To overcome this disadvantage, the United Kingdom integrates the bottom-up method with the top-down method. The former approach allows one to divide the VAT gap in the following categories (see Ahluwalia, 2015, Chislett, 2015):

1) Avoidance;

2) Legal interpretation;
3) Criminal attacks;
4) Non-payment;
5) Hidden economy;
6) Evasion;
7) Failure to take reasonable care;
8) Error.

Currently, in Italy, a measure of the VAT gap mainly due to errors in interpreting the laws or unpaid tax due to liquidity crises is identified inside the total VAT gap. This amount is computed with the information obtained from automatic audits (according to Art. 54-bis of Law 633/72). These kinds of audits are conducted on the entire VAT payers' target population, therefore they are not affected by a selection bias mechanism.

At the EU level, a very important aspect of the VAT gap is the one that comes from intra-Community VAT fraud. A possible way to account for this is by integrating V.I.E.S. (VAT Information Exchange System) communications in the tax gap computational procedure, by analyzing the discrepancies between the flows of sales and purchases among different countries.

4.2 Breakdown by kind of users

In order to break the VAT gap down by kind of users, the classification of the theoretical liability, BIT and VAT, shown in the previous paragraph, is grouped into three main clusters:

1. Households consumption (point a) section 3, BITcf, IVATcf);
2. General Government (point b) General Government Investments and point c) General Government Intermediate Consumption, BITpa, IVATpa);
3. Uses for Market Enterprises (point d) Market enterprises Intermediate Consumption and point e) specific types of market enterprises Investments, BITal, IVATal).

Similarly, declared and paid amounts, BID and IVAEC have to be split into three main categories.

General Government expenditure (BIDpa) is derived from Public finance data, conveniently harmonized in accordance with definitions and classifications stated by ESA 95. In this procedure BIDpa is equal to BITpa, under the hypothesis of no evasion[27].

The reported VAT base for Households (BIDcf) is derived from the VAT part of the VAT statement. The VT part contains taxable operations towards final consumers and those towards entities with VAT registration numbers.

The VAT base for market enterprises, BIDal, is obtained as follows:

[27]This is a very simplified hypothesis. We consider the evasion that arises from General Government purchases as equal to zero. We are aware of the limits of this assumption and some studies are underway to overcome it.

$$BIDal = BID - BIDcf - BIDpa \qquad [4.1]$$

VAT is calculated by applying the appropriate rate to each base. Similarly, tax is split as follows:

$$IVAEC = IVAECcf + IVAECpa + IVAECal \qquad [4.2]$$

Therefore, the gap in the VAT base, BIND, and the tax gap, IVAEV, can be broken down as follows:

$$BIND = BINDcf + BINDal + BIND\ pa \qquad [4.3]$$

$$IVAEV = IVAEVcf + IVAEVal + IVAEVpa \qquad [4.4]$$

where BINDpa =IVAEVpa=0.

The described distribution is also functional to the regional breakdown which will be shown in section 4.3.

43 Breakdown by geographical areas

The previous section has described an aspect disregarded, so far, in the standard approach to measuring the tax gap and concerning VAT collected by final users. This section illustrates further progress in the methodology, that of the VAT gap by region. The two issues are independent, however the final users estimate is crucial to determine reliable regional estimates. Indeed, the attitude of various final users towards tax evasion may vary significantly among them, and in turn affect regional evasion.

The spatial distribution of the reported VAT base shows some peculiarity regarding the regional economic systems: some areas emphasize household consumption, others Government Spending while others focus on intermediate goods Expenditure from Enterprises.

The information derived from a specific section of the VAT form, the VT part[28] allows one to obtain the estimates. These data, along with those of other sources, undergo consistency checks on different sections of the tax return before being applied to the analysis.

VAT has the peculiarity of arising where the consumption takes place, however, it may be collected in a different place. This is one of the issues to deal with, since it has important implications in estimating both the VAT gap and theoretical VAT for each region. The latter also represents the real regional contribution to overall VAT Revenue.

With the aim of analyzing the place of VAT consumption and that of VAT collection, two types of regional estimates are produced:

[28] See Convenevole (2006) for details about the introduction of the VT part.

1) those where consumption takes place, in order to compare the fiscal data with National Account figures;
2) those where VAT is collected, in order to provide an indication to the operational activity of the Revenue Agency.

4.3.1 Breakdown by place of consumption

The methodology applied to this purpose is similar to that employed at the national level. The key element for computing regional estimates is the territorial detail of all the information required, both statistical and administrative. Results at the regional level are consistent with national estimates.

The reported VAT base (BID) is split by regions, with the indicators that follow. The Households Expenditure is distributed by means of the VT part of the VAT form (see figure 4.1); the General Government purchases are distributed by means of National Accounts data, under the hypothesis of no evasion; final uses of Market Enterprises are shared out by the reported taxable base structure of IRAP[29].

The BIT is allocated at the regional level as follows: the Households Expenditure by means of regional Households Expenditure from National Accounts; The Regional General Government purchases are those obtained by National Accounts; while Uses for Market Enterprise by specific regional indicators for intermediate expenditures and investments from National Accounts.

Both regional distribution of BID and that of BIT are constrained to National estimates.

The regional distribution of VAT is estimated by applying the appropriate VAT rates to the regional distribution of BID and BIT.

Figure 4.1 VAT part of the VAT form

PART VT

SEPARATE INDICATION OF OPERATIONS CARRIED OUT REGARDING END CONSUMERS AND HOLDERS OF VAT NUMBERS

VT1 Division of taxable operations carried out regarding end consumers and holders of VAT numbers

Total taxable operations	1 ,00	Total tax	2 ,00
Taxable operations regarding end consumers	3 ,00	Tax	4 ,00
Taxable operations regarding holders of VAT numbers	5 ,00	Tax	6 ,00

		Taxable operations regarding end consumers	Tax
		1	2
VT2	Abruzzo	,00	,00
VT3	Basilicata	,00	,00
VT4	Bolzano	,00	,00
VT5	Calabria	,00	,00
VT6	Campania	,00	,00
VT7	Emilia Romagna	,00	,00
VT8	Friuli Venezia Giulia	,00	,00
VT9	Lazio	,00	,00
VT10	Liguria	,00	,00
VT11	Lombardy	,00	,00
VT12	Marche	,00	,00
VT13	Molise	,00	,00
VT14	Piedmont	,00	,00
VT15	Apulia	,00	,00
VT16	Sardinia	,00	,00
VT17	Sicily	,00	,00
VT18	Tuscany	,00	,00
VT19	Trento	,00	,00
VT20	Umbria	,00	,00
VT21	Aosta Valley	,00	,00
VT22	Veneto	,00	,00

[29]IRAP stands for Regional Tax on Productive activity. Using the IRAP form, it is possible to break the enterprise production down by local activity unit. The IRAP value is weighted according to the VAT base produced by the different economy sectors.

4.3.2 Breakdown by place where VAT is collected

The calculation of gap by place where VAT is collected is an ongoing project. Therefore, in this section, only general guidelines will be discussed.

Table 4.1 illustrates an example involving two regions. On the one hand, tax returns data allow us to calculate the last column of the table, or VAT according to the place where it is collected. On the other hand, the procedure outlined in paragraph 4.2.1 allows us to calculate the last row of table 4.1, that is, VAT for the place of consumption. By using the VT part of the VAT form, the complete matrix can be also calculated.

The example illustrates that both region 1 and region 2 remit VAT for 100. In region 2, however, all VAT is generated within the region, while for region 1, part of its revenue comes from the same region (90) and part from region 2 (place of consumption for 10).

Table 4.1. VAT actually remitted by place of consumption and by place where VAT is collected

	Region 1	Region 2	*Place where VAT is collected*
Region 1	**90**	**10**	**100**
Region 2	**0**	**100**	**100**
Place of consumption	**90**	**110**	**200**

The procedure described in paragraph 4.2.1 allows the calculation of the VAT gap by place of consumption (table 4.2)

Table 4.2. VAT gap by place of consumption

	Share VAT gap by *place of consumption*	Actual VAT by *place of consumption*	GAP
Region 1	10.0%	90	9
Region 2	20.0%	110	22
Total	15.5%	200	31

Under the hypothesis that the rates of evasion are referred to those where transactions occur, then the proper VAT gap in regions 1 and 2 is shown in table 4.3. As a result, the VAT gap estimates referred to the place where VAT is collected are obtained.

Table 4.3. VAT gap by place where VAT is collected

	Percentage VAT gap by *place where VAT is collected*	Actual VAT by *place where VAT is collected*	GAP
Region 1	11.0%	100	9+(10*20%)=11
Region 2	20.0%	100	22-(10*20%)=20
Total	15.5%	200	31

5. Assumptions underlying the procedure and application of the VAT gap

5.1 Assumptions used

The top-down approach based on National Accounts data has among its basic assumptions that National Accounts figures include the entirety of the underground economy (exhaustiveness).

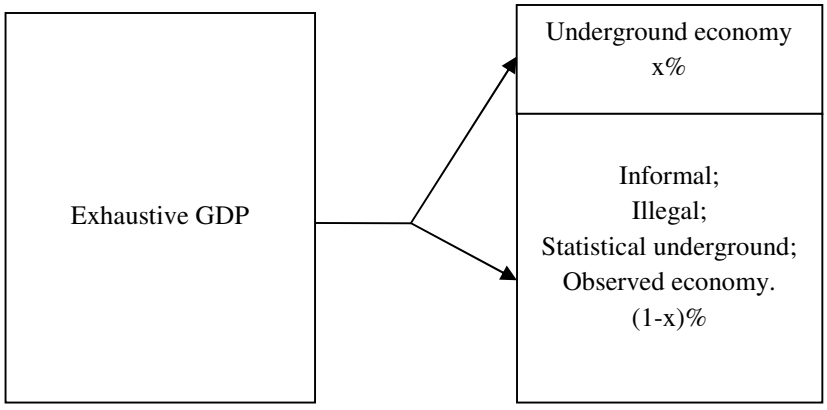
Since 1993, the United Nations System of National Accounts (United Nations et al. 1993) establishes that the National Accounts estimations shall also include the non-observed economy. The non-observed economy includes all productive activities that may not be captured in the basic data sources used for National Accounts compilation, in other worlds: all the "legal productive activities that are not registered mainly due to a deficiency of the statistical data collection system or to economic reasons; that is, the will to avoid the tax and social contribution obligations in order to reduce production costs".[30]

Within the non-observed economy the following typologies are distinguished: underground economy, informal economy, illegal, and other activities omitted due to deficiencies in the basic data collection program (statistic underground)[31].

For our purpose, we focus on the underground economy[32] (defined also as *"concealed activities", "hidden economy" or "black economy", "economic underground"*), that is, defined as production activities that are legal but deliberately concealed from public authorities in order to avoid paying tax (e.g. VAT or income tax) or social security contributions; meeting statutory standards; or complying with official procedures and regulations.

Under this definition the existing correlation between underground economy, tax evasion and the tax gap becomes evident.

According with the definition, exhaustive GDP can be split as follows:



[30]For a more in-depth analysis, refer to OECD (2002).

[31]The UE member States have to include all these components in the calculation of GDP in order to ensure the exhaustiveness of GDP. The main legal requirements are: Commission decision 94/168/EC on exhaustiveness (legal activities included, illegal activities outside scope); Commission Decision VAT fraud Commission Decision of 24 July 1998 on the treatment for National Accounts purposes of VAT fraud.

[32]For the other kind of non-observed economy, see Boogh Dahlberg (2015).

On the basis of the identity [A.1.3] in Annex 1, the inclusion of the underground economy[33] in the GDP implies that the demand side components[34] also include this amount. These components are the ones used to estimate the potential base in the top-down method based on the demand approach.

To simplify the concept, the gap in the tax base can be considered as equal to the underground economy ± Δ The correction Δ is determined by factors such as: specific characteristics of the tax base (e.g. hidden rent is included in the underground economy but is excluded by the VAT base gap, as itis out of the scope of VAT); difference between the concepts of the gap and tax evasion (e.g. the gap also includes the tax base declared without remitting taxes, while this component is included in the observed economy).

Despite the presence of Δ, the underground economy is a significant part of the gap in the VAT base, which makes it a crucial component that should be adequately estimated.

To this end it is recommended that:

a) the methodology used by national statistical institutes to estimate the underground economy be as transparent as possible;
b) the estimates of hidden economy are disseminated;
c) the results obtained by applying the top-down methodology are compared with other independent estimates (e.g. bottom-up).

A further critical aspect of the procedure is the level of detail adopted in estimating the potential VAT. In particular, the more complex the tax legislation, in terms of: number of legal VAT rates, types of exemptions (for instance those related to enterprises which do not have the right to deduct input VAT) the higher the level of detail to be used (see CASE 2013, 2014).

Moreover, to ensure that the VAT gap includes in its definition intentional evasion as well as avoidance, unpaid VAT due to liquidity crises, errors or accidental omissions of various kinds, it is crucial the use of VAT actually collected, instead of the VAT reported in the fiscal forms as a base for calculating voluntary compliance.

5.2 Applied bias correction

The main concern about the estimation method and procedure involves the correction of National Accounts data required to obtain the VAT base. Indeed, improper correction may induce bias in the resulting VAT base. In order to check for any bias introduced, a time series analysis is performed on the dynamics of both the implicit VAT rate and the rate of exemption. This allows one to verify whether changes in these rates are coherent

[33]Italy has included underground economy in its National Account figures since 1987. The method developed by the National Institute of Statistic (ISTAT) has also been adopted as best practice at the international level. Recently, a refined method has been applied and included in the new release of National Account data due to SEC2010. Such new method improves the estimates for the under-declared value added with supply side approaches.

[34] Namely: intermediate consumption, household consumption, non-profit institution and general government final consumption, capital formation.

with changes in tax legislation or in the composition of the VAT base.

Moreover, a further check deals with the coherence between the estimation performed and the VAT evasion calculated under the two hypotheses, with or without complicity.

Additionally, the definition of VAT actually remitted is verified, ensuring that:

a) the accrued criterion is consistent with the definition applied to calculate the VAT gap. Italian estimates assure this by correcting data provided by the Italian Institute of Statistics with changes in the stock credit.
b) VAT data includes or does not include the sum collected by the audit activity.

5.3 Nature and other characteristics of the methodology

Top-down methods produce estimates having a macroeconomic nature and then mainly employed for programming and for allocating resources.

Such methods do not permit the estimation of some types of gaps, for instance, according to type of firm or kind of fraud (see section 4 for details).

The main issues and as well as the disadvantages of the methodology arise by comparing the top-down method with the bottom-up one. The list of strengths and weakness of the former is shown in table 5.1, while table 5.2 illustrates the issues and disadvantages of the bottom-up method.

The analysis of tables 5.1 and 5.2 suggests that the best solution consists in performing both top-down and bottom-up estimates and then comparing the obtained results.

Table 5.1 Main strengths and weaknesses of the top-down method

Strengths	Weaknesses
♣ Provides a general overview of the phenomenon and also allows one to consider the hidden economy.	♣ Provides macroeconomic results, but ones that are less useful for operating purposes.
♣ Allows the building of extended series over time.	♣ Estimates are periodically under revision as are those of National Accounts.
♣ High level of international comparability, due to international standardization of National Account figures.	♣ Requires a very thorough knowledge of the definitions adopted by the National Accounts.
♣ Implementation is less expensive when compared with the bottom-up method.	

Table 5.2 Main strengths and weaknesses of the bottom-up method

Strengths	Weaknesses
♣ Provides a detailed vision of the tax gap.	♣ Does not provide an exhaustive overview of the tax gap; it does not include the completely hidden economy.
♣ Can easily be used for operational purposes.	♣ Can be biased by the quality of controls.
♣ Allows one to investigate the individual taxpayers' reasons for not fulfilling their tax obligations.	♣ More expensive than the top-down methods.
	♣ More difficult to perform international comparisons.

6. Final considerations

Value added tax (VAT) is a consumption tax charged on most goods and services traded for consumption use. VAT transactions involve different economic actors: Households, General Government and Businesses. Transactions carried out among these actors may lead to non-compliant behaviors, concerning the relationships among firms and those between business and households. Households tax evasion may arise from transactions involving Households and this typology includes evasion engendered along the value chain of these goods and services. Businesses tax evasion concerns transactions among enterprises and includes evasion engendered along the value chain of the exchange of goods and services as final consumers.

The VAT gap is an indicator of the effectiveness of VAT enforcement and a compliance measure, as it provides an estimate of revenue loss due to fraud and evasion, tax avoidance, bankruptcies, financial insolvencies as well as to miscalculations. This paper aims at describing the methodological framework employed by the Italian Revenue Agency (IRA) to estimate the VAT compliance gap.

Among the various definitions of the VAT gap, a stricter one defines the gap as the difference between actual collection and potential collection "given the current policy framework".

The national VAT gap is estimated by applying an indirect top-down method which compares the tax collected with those that would have been collected if all individuals and enterprises had perfect compliance. In particular, Italy currently employs the demand side approach along with other European Administrations but differently to other institutions, such as the IMF, which adopt a supply side approach.

The applied estimation method allows one to include in the VAT gap: intentional evasion as well as avoidance, unpaid VAT liability due to liquidity crises, errors or accidental omissions of various kinds. This latter may be identified and isolated by means of the outcomes of automatic controls. Moreover, results that come from the additional tax assessed and actually collected by tax audits (OM) permit the calculation of the net VAT gap.

The starting point of the estimation procedure is represented by National Account data. These figures undergo delicate steps of processing to get the VAT base and tax. Indeed, improper corrections of National Account data may induce bias in the outcomes. For this purpose, the procedure is developed following a level of detail that allows taking appropriate account of the current legislation. The more complex the tax legislation (for instance, in terms of legal VAT rates and types of exemptions), the higher the level of detail to be used.

For a general point of view, the adopted methodology is standardized at the international level (see various editions of the CASE report), nevertheless the paper takes into account some aspects disregarded in the standard approach to measuring the tax gap.

First of all, a more precise definition of accrual VAT actually collected (IVAEC) is provided. This definition takes into account an item neglected by the international standard (see Eurostat, 2010 and CASE), regarding the *variation in the amount of VAT credits to bring to the next year.* If this item is not considered, a serious bias in the dynamics of the VAT gap is introduced, and this bias does not allow inference to be made about the VAT compliance trend.

Secondly, the overall gap is estimated following two hypotheses: first, with complicity (seller and buyer agree and there is no invoice, tax is not collected); second, without complicity (tax is collected from the seller, but not remitted). The standard methods usually calculate the gap adopting only the hypothesis without complicity and this implies an underestimation of the VAT gap.
Thirdly, the gap is calculated in terms of VAT and VAT base. Usually the latter item is not explicitly calculated and this implies that the computation method is not completely transparent (e.g. it becomes difficult to compare the potential VAT figures with the corresponding National Accounts items). Moreover, in the analysis of the VAT gap, it is very difficult to separate what is due to the VAT rate and what is due to the dynamics of macroeconomic indicators.
A further peculiarity of the paper concerns the breakdown of the VAT gap either by final users or by region. The two issues are independent, however the final user estimates are crucial in determining reliable regional estimates. Both breakdowns are derived from the VAT form which contains taxable operations towards final consumers and those towards the VAT entity.
A further VAT peculiarity is analyzed through its statement, which can identify where the consumption takes place and then where the VAT arises. However, its collection may occur in a different area.
The VAT gap estimates computed applying the top-down approach provide macroeconomic indicators of the compliance tendency. Despite its advantages, this method can barely split the overall gap by some types of non-compliance behaviors. To overcome some drawbacks, the top-down approach can be also integrated with the bottom-up approach.
The two methodologies have pro and cons, however, providing both estimates and comparing their results may help in understanding the multiple facets of this complex issue.

Annex 1. The supply side top-down approach

A.1.1The goods and service account[35]

On the basis of the National Account rules, the amount of a product, *i*, available for use within the economy must have been supplied either by domestic production (OUT) or by imports (IMP). The same amount of the product must be used for intermediate consumption (INC), household consumption (HSC), non-profit institution and general government final consumption (GCC), capital formation (CFC, including changes in inventories) or export (EXP). These two statements can be combined to give a statement of a product balance

$$OUT_i + IMP_i = INC_i + HSC_i + GCC_i + CFC_i + EXP_i \qquad [A.1.1]$$

Since the uses of products are valued at the purchasers' price, but production at the basic price[36], it is necessary to add trade and transport margins, and taxes on products less subsidies products to the left-hand (or supply) side of the [A.1.1] so that both sides are expressed in the purchasers' price.

It is worth noting that OUT is equal to Value added (VAD) plus intermediate costs (INC), so that the identity [A.1.1] can be written as

$$VAD_i + ICS_i + IMP_i = INC_i + HSC_i + GCC_i + CFC_i + EXP_i \qquad [A.1.2]$$

If the [A.1.2] is drawn up for all goods and services, *n*, and these are aggregated, the total of ICS and of INC are equal, then we can simplify [A.1.2] in the following way:

$$\sum_{i=1}^{n} VAD_i + IMP_i = \sum_{i=1}^{n} HSC_i + GCI_i + GFC_i + EXP_i \qquad [A.1.3]$$

where $\sum_{i=1}^{n} VAD_i$ is equal to the Gross Domestic product (GDP) at market price.

A.1.2 The supply side approach to the calculation of the VAT gap

The national account figures used in the calculations shown in paragraphs 2 and 3 are listed in the right-hand (or demand) side of [A.1.2], namely: INC, HSC, GCC and CFC. For this reason, the top-down method adopted in paragraphs 2 and 3 are defined as the "demand side approach".

[35]National Account concepts and definitions are taken from SNA 2008 (United Nations et al 2008, chapter 14). The SNA 2008 has been adopted by the European System of Account ESA 2010(Eurostat (2010). Although more detailed and more precise in its definition of transactions and position, the latter standards are, with a few exceptions, fully compatible with the SNA 2008.

[36]SNA 2008, par. 2.63: "The preferred method of valuation of output is at basic prices, although producers' prices may be used when valuation at basic prices is not feasible. The distinction is related to the treatment of taxes and subsidies on products. Basic prices are prices before taxes on products are added and subsidies on products are subtracted. Producers' prices include, in addition to basic prices, taxes less subsidies on products other than value added type taxes…"
SNA 2008, par. 2.64:"Purchasers' prices are the amounts paid by the purchasers, excluding the deductible part of value added type taxes. Purchasers' prices are the actual costs to the users."

Given the identity [A.1.2], the same method can be developed using the supply side aggregates, namely: VAD + ICS + IMP – EXP. This can be defined as the "supply side approach". In this method, the aim is to deal with each sector's value added, i.e. output minus input, as the VAT tax base.

The "supply side approach"[37] looks at the amount of output which would be taxable per sector and the amount of input tax credits due to a sector to determine the potential net VAT per sector. Tracking value added by each sector along the line of production chains is exactly how VAT due is actually determined.

INC+HSC+GCC+CFC is a vector in commodity space, while VAT collections data is not provided in commodity space. Collections can be determined on a sectoral basis however, and since VAD + ICS + IMP – EXP can be expressed as matrices in the sector by commodity space, the results of the analysis can be expressed on a sectoral basis.

The approach is similar in structure to the method individual taxpayers use to determine their individual liabilities. The tax liability for an individual taxpayer is determined by the amount they pay customs on their imports, plus the VAT they must charge on their output sold domestically, less the VAT they paid on their inputs. The potential net VAT collection (PV) model works with the statistical data available through National Account supply and use or input-output tables. The PV of sector *s* is measured according to the following formula

$$PV^s = \sum_c (IMP_c^s \times \tau_c) + \left[\sum_c (OUT_c^s - EXP_c^s) \times \tau_c\right] \times r^s - \left[\sum_c (ICS_c^s + GFC_c^s) \times \tau_c\right] \times r^s \times (1 - e^s) \times \eta_c^s \quad [A.1.4]$$

In addition to the above-mentioned elements, [A. 1.4]includes:
c = commodity type;
τ = the VAT rate that applies to commodity c (zero if zero-rated or exempt);
r = the proportion of output for a sector produced by registered business;
e = the proportion of output for a sector which is exempt output;
η = the proportion of input tax credits for commodity *c* by sector *s* allowed to be claimed.

For OUT, IMP, EXP, ICS, and GFS, supply-use tables are the primary data source at most levels of disaggregation.

τ, the values are obtained from the tax rate structure for each commodity, except for the trade sector. To determine the value of τ applicable to the retail and wholesale trade services, a weighted average statutory rate is determined based on the trade margins by commodity type. For the other sector the standard rate is assigned to the full vector τ_c, apart from that suppliers that are typically exempted (e.g. financial services).

η, the values are determined by any specific statutory limitations on input tax credits.

e can be determined endogenously in the model (it is a function of τ_c). In fact, the supply-use tables tell us the value of all outputs of a sector, so it is simply a matter of comparing the value of the exempt items to the total value of output in the sector. The taxable output ratio (*e*) implicitly assumes that the proportion of inputs to output for

[37]The method is adopted by the IMF and is named "RA-GAP model", see: Thackray M., Ueda J. (2014), Hutton E. (2015).

taxable supplies and for non-taxable supplies are identical within a sector. In reality, the input patterns could be very different (for example, commodity X may be only used to produce exempt supply by the sector whereas 90 percent of the total output by the sector is taxable; the model assumes that 90 percent of input VAT on X used by the sector is creditable whereas none is actually creditable). However, as it is rather unrealistic to expect to get data on input patterns separately for taxable and non-taxable supplies by a sector, this simplification is reasonable.

*r*has to be provided from separate estimates. The output by registrants ratio (*r*) is assumed to be uniform within a given sector, whereas it could be different for each component (OUT, IMP, ICS, and GFS). Given that *r* is generally very close to 1, the impact is minor. It can also be shown that, in practice, it is only the difference between the *r* for exporters versus non-exporters which matters.

The "supply side approach" measures actual tax collection from the same economic activities upon which potential revenues are estimated. It requires reallocation of cash data into the periods in which tax due are actually accrued.

Annex 2. VAT gap with and without complicity

Definitions:

1. Vat gap **without** complicity (Not remitted) = measures the fraud that consists in not remitting VAT that traders have charged on invoices and collected;
2. Vat gap **with** complicity (Not collected) = measures the fraud that consists in not collecting VAT because of an agreement between trader and purchaser and VAT is not charged on transactions where it should be.

Table A.1 shows how the two hypotheses lead to different estimates of the VAT gap. In the example, three types of transactions toward final consumers are considered. First, the vendor sells goods to the buyer for € 1,000, issues the invoice, collects VAT and regularly remits VAT (no gap occurs). Second, the seller sells goods to the buyer for € 1,000, the seller does not issue the invoice and consequently does not remit VAT (gap with complicity). Third, the seller sells goods to the buyer for € 1,000, the seller issues the invoice, collects VAT but does not remit it (gap without complicity).

Table A.1.Example: final consumption, 3 types of transactions (VAT rate=20%)

ID.	VAT base	VAT invoiced	VAT actually remitted	National Account figures	Economic behaviour
1	1,000	200	200	1,200	No gap
2	1,000	0	0	1,000	Gap with complicity
3	1,000	200	0	1,200	Gap without complicity
Total	**3,000**	**400**	**200**	**3,400**	

This breakdown is unknown. The potential VAT and VAT base are derived from the following National Account figures: consumption=3,400, (of which) VAT actual remitted =200.

From the tax return comes from the following figures: VAT base 1,000 and VAT=200.

The procedures for estimating the gap with and without complicity are shown in table A.2. If it is assumed that all evasion occurs with complicity, National Accounts figures (€ 3,400) should be reduced by the VAT actually remitted (€200). It calculates a potential tax base equal to €3,200. If, however, it is assumed that all gaps occur without complicity, then National Accounts figures should be divided by the average VAT rate (20%). The resulting potential basis is equal to €2,833.

Table A.1 shows that the true evaded VAT base (not observable) is equal to €2.000. Table A.2 illustrates the way in which evasion with complicity is obtained and is equal to €2,200; the estimated amount without complicity is equal to €1,833.

Since it is known that VAT evasion happens both with and without complicity (but it is unknown how the evasion is split between them), when the method with complicity is adopted then the "true" gap is overestimated; conversely, the method without complicity underestimates the true gap.

Table A.2.Procedure adopted to estimate the gap with and without complicity

Aggregates	With complicity (Not collected)	Without complicity (Not remitted)
N.A.	3,400	3,400
VAT actually remitted	200	
Potential VAT base	3,200	3,400/1.2=2,833
VAT base actually declared	1,000	1,000
Estimation of VAT base evasion	**2,200 Over-estimate**	**1,833 Under-estimate**

Annex 3. data sources to calculate the VAT gap

Gap component	Data Sources
VAT economic accrued revenue (IVAEC): • VAT gross revenue, refunds and compensation; • Adjusting for accrual accounting; • Variation of the amount of VAT credit to bring to the next year.	State Budget; Correction provided by National Account Department of Italian Institute of Statistics (ISTAT); VAT Statements.
Actual VAT base (BID): • VAT economic accrued revenue; • Actual VAT rate.	Italian Revenue Agency calculation; VAT Statements.
VAT potential (theoretical) base (BIT): • Households Consumption; • General Government Investments (GGI); • General Government Intermediate Consumption (GGIC); • Market enterprises Intermediate Consumption (MEIC); • Specific types of market enterprises Investments (MEI); • Rate of exemption by Nace division.	ISTAT National Accounts figures and Households budget survey; ISTAT Accounts for General Government; ISTAT Accounts for General Government; ISTAT National Account for Production and Value added by Nace division; ISTAT National Account by type of Investment; VAT Own resources calculation (for HC, GGIC, GGI) VAT Statements (MEIC, MEI).
Potential (theoretical) VAT economic accrued revenue (IVAT): • Legal VAT rate by item.	Own resources VAT

References

Ahluwalia C. (2015), "VAT bottom-up", paper presented at the second meeting of Fiscalis tax gap project group, Brussels, February 4-5.

Boogh Dahlberg C. (2015) "Non-Observed Economy in National Accounts", paper presented at the second meeting of Fiscalis tax gap project group, Brussels, February 4-5.

CASE - CPB (2015) Study to quantify and analyse the VAT Gap in the EU Member States , 2015 Report, Final Report to the European Commission, TAXUD, May, Warsaw.

CASE - CPB (2014) Update Report to the Study to quantify and analyse the VAT Gap in the EU-27 Member States - Final Report to the European Commission, TAXUD, September, Warsaw.

CASE - CPB (2013) Study to quantify and analyse the VAT Gap in the EU-27 Member States - Final Report to the European Commission, TAXUD, July, Warsaw.

Chislett A. (2015) "UK VAT Gap Top-down Summary, paper presented at the second meeting of Fiscalis tax gap project group, Brussels, February 4-5.

Convenevole R. (2006), "A good start for VT part. Here are the first outcomes of the data included in the VT part of the 2005 VAT return", Italian Revenue Agency Working papers, Research dept.2006/3.

D'Agosto E., Marigliani M., Pisani S. (2014) Asymmetries in the territorial VAT gap, Discussion Topics, no .2, Italian Revenue Agency.

Das-Gupta A., Mookherjee D. (2000) Incentives and institutional reform in tax enforcement, an analysis of developing country experience. Lavoisier.

European Commission (2016) *The concepts of Tax Gaps, Report on VAT Gap Estimation*, FISCALIS Tax Gap Project Group, March, Brussels.

Eurostat (2010) European System of Account – ESA 2010, Luxembourg.

Hutton E. (2015) "VAT Gap methodology – an overview of the VAT gap modelling framework used in RA-GAP", paper presented at the second meeting of Fiscalis tax gap project group, Brussels, February 4-5.

OECD (2002) Measuring the non-observed economy. A Handbook Pars.

Pisani S. (2014) An approach to assess how the activity of the Italian Revenue Agency affects compliance, Discussion Topics, no.1, Italian Revenue Agency.

Reckon (2007) Study on VAT, excise duty and corporate tax fraud, Working Paper, Reckon LLP, London.

Rodrigues C. (2015) VAT revenue estimation on an accrual basis (based on IMF methodology), AutoridadeTributaria e Aduaneira, Centro de EstudosFiscais e Aduaneiros, February.

Thackray M., Ueda J. (2014) Report of findings from the revenue administration gap analysis program - the value added tax gap in Estonia, IMF Country Report no. 14/133, Washington, DC.

United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Cooperation and Development, World Bank (2008), System of National Accounts -2008, New York.

United Nations, Commission of the European Communities, International Monetary Fund, Organisation for Economic Cooperation and Development, World Bank (1993), System of National Accounts -1993, New York.