

ASYMMETRIES IN THE TERRITORIAL VAT GAP

E. D'Agosto, M. Marigliani, S. Pisani

N. 02/2014

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ISSN: 2420-773X

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Asymmetries in the territorial VAT gap

Elena D'Agosto, Massimiliano Marigliani, Stefano Pisani

Agenzia delle Entrate, elena.dagosto@agenziaentrate.it

Abstract

This paper presents two original contributions to Italian VAT studies.

First, it provides the regional VAT distribution of non-reported components and its allocation between final uses as defined in European System of Account (ESA95). To this aim, an indirect top down approach is applied and key information are derived from National Account figures and VAT statements. Our main results reveal that the average VAT base gap over 2007-2010 is nearly 231 billion euro, of which the 77% accounts for base gap of Households final uses and the 23% for Enterprises final uses.

Second, it proposes two exploratory analysis to evaluate which characteristics may affect the spatial distribution of VAT gap. Our evidence allows to identify some aspects underlying the territorial differentiation. In fact, the VAT gap is positively correlated with: the economic condition, the business cycle and the tax moral of the geographic area. The most important result regards the deterrent effect caused by the Revenue Agency activity.

Moreover, these estimates indicate the contribution that each local economy might assure to public finance flows; it could be an worthwhile instrument for addressing appropriate policies at local level.

Sommario

L'articolo presenta due contributi originali riguardanti le analisi dell'IVA.

In primo luogo presenta una ripartizione regionale del gap nell'imposta distinte per le diverse componenti che generano il gettito: i consumi finali e gli impieghi intermedi, così come sono definiti nel Sistema Integrato dei Conti Europei (SEC95). Le stime sono state realizzate applicando un metodo indiretto di tipo Top Down utilizzando le informazioni derivate dalla Contabilità Nazionale e dall'archivio delle dichiarazioni dei redditi. I principali risultati ottenuti mettono in evidenza che il gap medio nella base IVA ammonta, negli anni 2007-2010, a circa 231 miliardi di euro, dei quali il 77% è ascrivibile al consumo finale delle famiglie e il restante 23% ai consumi finali delle imprese.

In seconda istanza si propone un'analisi esplorativa per valutare quali sono le caratteristiche che possono influenzare la distribuzione territoriale del gap IVA. Le evidenze trovate permettono di identificare alcuni aspetti che influenzano le differenziazioni territoriali. Infatti, il gap dell'IVA è positivamente correlato con le condizioni economiche, il ciclo economico e la tax moral dell'area geografica. Il risultato più rilevante riguarda la stima dell'effetto deterrente esercitato dall'Agenzia delle Entrate.

Le analisi proposte, oltre ad avere una valenza esplicativa, possono essere di ausilio per calibrare meglio le politiche di contrasto all'evasione a livello locale.

JEL classifications: H26, E01, E21

Key words: Tax evasion, VAT, Regional economy

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1. Introduction¹

Value added tax (VAT) is the main indirect tax revenue in the national 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 production chain and distribution since it is collected fractionally. This aspect assures the 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, it is possible to identify who are legally burdened (by law), namely who relate with the tax authorities and pay taxes (Wolf, 2007). Those who may not apply this mechanism, act as final consumers (de facto taxpayer²) interpreted in a broad sense, and actually undergo the economic effect 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. 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 VAT system, tightly associated to the recoverability.

VAT transactions involve different economic actors Households, General Government and Businesses. Among them, whenever purchasers buy goods and services and do not give the right to deduct input VAT, partially or totally³, act as final consumers⁴. Households cannot deduct input VAT on their purchases of goods and services. General Government deduct input VAT only when sales taxable goods and services, namely it behaves as a market agent. Generally, businesses deduct input VAT on purchases but there are some exceptions: first, if their sales are mainly VAT exempted, they partially deduct input VAT; second, they buy goods and services for which VAT legislation does not allow input VAT deduction, completely.

Transactions carried out among economic actors may lead to non-compliant behaviors concerning the relationship among firms (business to business) as part of recourse/deduction sequence or those between business and households. Theoretically, the deduction mechanism is a form of mutual control among business taxpayers, however not removing the incentive to evade VAT that involves the will to reduce or delete taxable base and then VAT.

Households tax evasion arise from transactions involving Households and it includes evasion engendered along the value chain of these goods and services. Again, business

¹ A preliminary version of this paper has been presented at “The Shadow Economy, Tax Evasion and Governance Conference, 2013”, July 25-28, Munster (D).

² De facto taxpayers and those by law may or may not coincide.

³ See, articles 17 and 19 in DPR n. 633 del 1972.

⁴ Scholars define this aspect as the impurity of actual VAT with respect to the ideal concept of VAT (Longobardi, 2009).

tax evasion concerns transactions among enterprises and includes evasion engendered along the value chain of goods and services exchanges as final consumers.

In this analysis, we assume a simplifying hypothesis concerning General Government. We consider the evasion that arises from its purchases equal to zero. We are aware of the limits of this assumption and some studies are underway to overcome it.

Tax evasion may originate from the reduced prices of goods and services sold, equal to the amount of the tax, when seller and buyer agrees. In this case, the final consumers, not recovering VAT on their purchases, may be complicit of the fraud taking advantage of lower prices.

Therefore, several types of tax evasion take the form of underreporting the taxable transactions, even if VAT is paid to the sellers (evasion without complicity). Others are related to the deduction mechanisms: for instance, the creation of false invoices on purchases to the aim of increasing input VAT, accordingly, reducing the payment to Tax Administration. The measurement of not fulfilled tax obligations is a crucial topic in the empirical research both to investigate its possible determinants and to evaluate suitable policy to limit reluctant attitudes.

The first part of this work aims at measuring VAT gap through an indirect approach, a top down method, examining two key aspects neglected in the previous analysis: the territorial dimension and the final consumption by final users involved.

This method compares the tax collected with those that would be collected if all individuals and enterprises had perfect compliance. The resulting VAT gap includes tax evasion, i.e. the deliberate intention to fraud, insolvency, negligent acts and misinterpretation of the law.

In this study, we take advantage of data from a specific section of the VAT form, the VT part. In this way, we properly measure VAT collected at regional level and by final users (Household Expenditure, Market enterprises and Public Administration). This latter is crucial to determine reliable regional estimates since final users show an attitude towards tax evasion vary significantly among them and in turn affect regional evasion.

Over 2007-2010, our results show the average VAT base gap is nearly 231 billion euro, 177 billion accounts for base gap of Households final uses and 54 billion for final uses of Market Enterprises. Southern area (including Isles) have an amount of nearly 83 billion and the highest quota, follow Northwest (27%) Northeast (21%) and Centre (17%).

The Vat base gap propensity is about 26% at national level⁵, its value for Households final uses is around 26,2% while 46,9% for market enterprises final uses. The regional distribution of Vat base gap propensities show higher value for southern area, six out of eight regions have figures higher than 32%. These regions have a very high gap propensities in the final uses of market enterprises, ranging from 60% to 75% and values between 33% and 39% for transactions related to final consumption of Households. Northeast regions present gap propensities to final uses of market enterprises above the national average and also above the northwest average. Moreover,

⁵ This figure is calculated by dividing Vat base gap and Vat base theoretical liability, including that from General Government.

the average gap propensity for Households final consumption in the North is lower than that of South.

The second part of this work aims at analyzing the spatial distribution of VAT gap through two exploratory analysis. By static shift share analysis, we differentiate three aspects of the regional VAT base gap propensity: that due to national context from those due to regional structure of the economic activity and to specific characteristics of the region. The national effect, 26.04%, explains a large portion of regional VAT gap propensity, mostly for regions in the North and Centre of Italy. The structural component produces a positive effect on gap, especially, in the South regions due to the quota of public sector in their economy, is worth about -1,5%, -2.5%. Nevertheless, the local component plays a significant role in South regions, too: it increases the VAT base gap propensity by 10% in almost all its regions.

Over the period 2007-2010, the dynamic shift-share analysis allows us to split the growth rate of regional VAT base gap in three components: the national growth effect, the structural effect and the regional effect. The decreasing changing rate of the VAT base gap is driven by the national trend, worth -8,64%. The worsening of tax compliance is mainly affected by local components. Specific factors mostly account for Lombardy, Friuli and Liguria and also for Calabria and Sicilia in explaining the overall regional growth rate of the VAT base gap.

A further step in the territorial analysis is done by using the longitudinal structure of our data. This preliminary study try to bring out which aspects of local components affect VAT gap. It turns out to be positively affected by the economic condition of the area expressed both in term of richness and in terms of ability to spend. We find a positive correlation with some business cycle variable, such as protested draft and promissory.

A noteworthy result derive from some variables expressing the deterrent effect caused by the Revenue Agency activity. It turns out to be an increase of 1% of the enforcement reduces VAT base gap of 7%. Even though we should consider this evidence just an exercise, they confirm some theoretical musings (Andreoni, 1998).

As a corollary, our study may be employed as a worthwhile instrument for policies in order to reduce the geographical differences in tax evasion and to suggest measures to distribute the tax burden among government levels.

This work is organized as follows: section 2, briefly reviews the theoretical and empirical literature on VAT tax evasion; the next section shows main methodological issues of measuring potential and not reported VAT, at national level, by economic actors involved and by regional distribution. In section 4, we present two exploratory studies in order to analyze which characteristics may affect both the spatial VAT gap and regional convergence of VAT gap. Finally, we add some concluding remarks.

2. A brief review of the theoretical and empirical contributions to VAT gap

Scholars have focused their attention on tax evasion and its effects for a long time. The seminal contribution that highlighted its economic mechanisms is due to Allingham and Sandmo (1972) referring to personal income tax. Later, many researches have been developing, but a limited attention was devoted to the analysis of business evasion and indirect taxation, in particular. Marrelli (1984) was the first contribution which focused on ad-valorem tax in a monopolistic environment. The author analyses the economic choices of a firm under-reporting revenue and concludes key variables for this decision are the level of production (which affects the shift of the tax) and the amount of tax evaded. The interdependence of these two choices depends on the probability of being detected. If the probability is exogenous, the tax shifting and the decision to evade tax are separable: evasion does not affect the amount of taxes shifted, firms may evade taxes and then shift to the final consumers as if they had not evaded. This result does not apply if the detection probability is a function of reported tax as the equilibrium value of the production will depend on this probability. Furthermore, the production will be smaller or larger than that would produce if did not evade (or in case of exogenous probability) depending on whether the probability of being detected is increasing or decreasing to reported revenue. If decreasing, firm would produce and report more than in case of constant probability (thus, this rule is efficient). In a later paper, Marrelli and Martina (1988) addressed their analysis to the relationship between production decisions and compliance within an oligopolistic market (for simplicity the duopoly) by examining various taxes including indirect ones. The authors find that the amount of production is not affected by the decision on reporting revenue, but the reverse nexus does not work. Therefore, it exists a weaker separability condition in case of exogenous probability. This means that collusion implies higher evasion only if it leads to higher profits: however, authors are not conclusive about this link. If the market share of each firm is quite homogenous within industry, an increasing degree of collusion leads to an increase in tax evasion regardless of the type of tax considered. In case of detection probability function of reported taxable base, once again, the authors state that the firm economic decisions are not independent. If detection probability decreases with increasing reported taxable base, this will lead to a lower evasion and lower tax shifting.

Virmani (1989) analyses evasion in a competitive industrial framework. First, the author considers a link between tax evasion and efficiency in case of a sales tax. Mainly, these taxes affect consumption decisions and also those concerning production if goods are used in the production process and a credit mechanism in the value added chain is not taken into account. In the presence of evasion, firms produce at a lower level than minimum efficient scale. This result is robust to various assumptions on detection probability function and affects the optimal tax rate for goods in the presence of evasion. In particular, this entails the hypothesis to burden with low tax rates those industries with a relatively small scale of production if their firms evade; an extreme case would be to exempt from taxation those with very low scale. The second issue analyzed concerns the relationship between tax rates and evasion. The author derives conditions under which a single tax rate, instead of two, is a threshold for the firm,

below they pay taxes and evasion possibility may be ignored. Higher rates may lead to a lower revenue, determining an effect similar to Laffer curve.

Yaniv (1995) shows an interesting synthesis of the previous studies, suggesting a general model of tax evasion (considering both underreporting revenue and overstating costs) relevant to various types of tax. He states that the production choices of the firms are independent of their tax compliance decisions. The separability is also confirmed in case of endogenous probability, even if it is not in case of uncertainty.

From what mentioned above, the theoretical literature has tried to underline which consequences cause the tax sales non-compliance to the economic system.

From an empirical literature viewpoint, a key issue concerns the measurement of non-compliance which is intrinsically a latent phenomenon. Over the years, various methods have been developed and refined in order to estimate the non-observed economy, also adopted to estimate tax evasion in its broadest sense of tax gap. Within these methods, two main approaches can be distinguished: the direct and the indirect one. The first, also called bottom-up approach, is based on microeconomic data coming from auditing activity or sample survey whose responses are voluntary; the second, also known as top-down method, employs macroeconomic indicators or information from National Accounts and financial services. The latter is further differentiated into two branches, one based on macroeconomic data and the other on econometric models. Particularly, the second stream has dealt with the limited availability of information to estimate tax evasion and unobserved economy (in this regard, contributions following Schneider and Enste, 2000).

In the last decade, the empirical evidence related to the EU countries has progressively increased as a result of the attention gained in academia and both at national and international⁶ institutional level. In this perspective, European Commission has shown its interest in the magnitude of the phenomenon within the EU by assigning to an independent research institute, Reckon LLP, the assessment of the VAT revenue losses. Reckon⁷ (2009), following a top-down approach, estimates the tax gap for the 25 countries of the European Community for the year 2006. The research institute estimates the tax potential, that would have in the absence of evasion, on the basis of National Accounts for each country and compares it with tax collected. The estimates reveals that, at European level (25 countries), the VAT gap is about 12% of potential, Greece is around 30%, Lithuania, Latvia and Italy are at 22%, France at 7%, Germany at 4% and Spain at 2%.

An important contribution to the gap estimation comes from the Revenue Agencies⁸ as they have access to confidential information. According to the European Commission (2011), European fiscal authorities develop their own gap estimates applying different approaches. In particular, UK (HMRC, 2010, 2012) uses top-down methods for indirect taxes and bottom-up for direct taxes; in Sweden, the tax authority adopts both methods and has prepared a program for measuring and monitoring evasion (Swedish National

⁶ The importance of measuring unobserved economy, of which evasion is only an aspect, and guidelines to achieve it are stressed in the document OECD (2002).

⁷ See also, Reckon (2008).

⁸ IOTA, the body which coordinates tax administrations has recently been trying to monitor the activity of different agencies with respect to gap estimates.

Tax Agency, 2008). In the same way, Revenue Agencies in Denmark, Estonia and Netherlands apply direct and indirect estimation methods separating by type of tax. In particular, the Danish Agency⁹ (Danish Tax and Customs Administration, 2006a, 2006b) has developed a comprehensive approach to gap estimation: a top down approach is applied to the personal income tax (such estimates are official and included in governmental documents) and an “every sector” approach to estimate the business gap, that is a bottom-up method in the form of random audit.

Among different type of taxes, VAT gap has been receiving a special attention by European institutions and its members both for the relevance in the total revenue of each country and because its tax base is a source for the EU budget.

Nam et al. (2001) measure VAT gap in the EU countries by adopting an indirect method based on the National Accounts: the theoretical VAT for each country is compared with the collected revenue thus obtaining a measure of the shortfall. The empirical evidence provided for the period 1994-1996 reveal that Italy shows a high level of VAT evasion: approximately 34.5% (three-year average) of theoretical tax is missing to the tax authority; Spain (22.6%) and Greece (20.2%) follow, while lower values are estimated for Netherlands¹⁰ (2.4%), United Kingdom (3.8%), Denmark (4.2%) and Germany (4.8%). The authors point out that the quality of estimates is conditioned to that of the information employed and its improvement requires a coordination among statistical agencies as well as among tax authorities within countries.

Keen and Smith (2007), in their review of available empirical evidence relating to EU members tax gap, compare estimates and highlight discrepancies. The authors note that HMRC has been estimating tax gap since 1992 by using a top-down approach. This method is deemed a valid instrument to understand the variability rather than the size of the phenomenon; it requires to be supported by bottom up method to provide independent estimates helping to qualify types of VAT fraud. For the 2001-2002 period, the latter method estimates a VAT gap between 10.2% and 14.6%, which is consistent with that calculated with the top-down approach, equal to 15.7% of tax potential.

Keen and Smith (2007) relate estimates provided by Gebauer and Parsche (2003) who employ a top-down method to the mid-nineties for 10 European countries. They notice the official UK VAT gap estimates are lower than those provided by Gebauer and Parsche and the trend shown in the official statistics is not the same reported by the authors. These discrepancies lead Keen and Smith to reflect about the importance of data quality in the estimation process and the need for coordination among countries on how macroeconomic data turns into useful figures for the estimation of the theoretical revenue.

For Italy¹¹, a seminal paper on VAT gap evaluation in non-governmental setting is due to Bernardi and Bernasconi (1997) who calculate gap comparing National Accounts and fiscal data for the 1991. They estimate the not declared VAT base with a dual approach

⁹ Among non-European Authorities see Australian Taxation Office (2012).

¹⁰ However they do not make public their estimates. These information are drawn from the contribution of European Commission (2011).

¹¹ A different approach is applied by Bordignon and Zanardi (1997).

on the demand¹² side and the supply side. The latter compares the National Accounts value added with the fiscal value-added, properly adjusted. They note that the undeclared value added counts for 38% of the theoretical one and provide a sectorial breakdown of the gap. For VAT purposes, demand approach is more suitable: they determine a missing declared tax base around 40% of the theoretical base. The measure of missing VAT is instead about 39% of the theoretical tax. The latter is calculated by adding the theoretical revenue of National Accounts Households expenditure to those of intermediate consumption from exempt sectors, and those of investment goods from PA and ISP. The missing revenue is obtained by subtracting the collected VAT on accrual basis to theoretical VAT.

Convenevo and Pisani (2003) describe VAT gap estimating procedure applied by Italian Revenue Agency. The method is a top-down approach that calculates theoretical base and tax from National Accounts data (NA)¹³ by demand components. Each component requires to be estimated at detailed level in order to capture all the complex rules of VAT system. To determine a non-reported tax base consistent with the theoretical value, they employ the VAT revenue on accrual basis. Their estimates reveal that the share of unreported in theoretical base has increased from approximately 34% in 1982 to 37% in 1991¹⁴. Later, based on such method, Marigliani and Pisani (2006) and D'Agosto, Marigliani, Pisani (2013) provide estimates in time series for later years.

To the best of our knowledge, Italian VAT gap estimates are not produced by regions¹⁵ or by type of economic actors involved in the VAT system. The present work intends to focus on these two aspects neglected so far by previous studies due to lack of information.

3. The main methodological issues in measuring tax gap

The estimation method applied to measure the national VAT gap is based on an indirect approach. This method compares the tax collected with those that would be collected if all individuals and enterprises had perfect compliance. In order to obtain a precise measure of the theoretical liability, we require to correctly identify both taxable base and VAT rates with respect to the legislation. To this aim, a detailed level of National Accounts¹⁶ is employed. The resulting VAT gap includes tax evasion, i.e. the deliberate intention to fraud, insolvency, negligent acts and misinterpretation of the law.

¹² Household expenditures on the economic territory, intermediate expenditure and gross fixed investments.

¹³ The National Accounts aggregates are built in accordance with the provisions of the ESA95 which requires to be “comprehensive”, i.e. inclusive of “observed” economy and that “not observed”.

¹⁴ National Accounts data are undergone to periodical revisions. Gap estimates series which result from them are not comparable.

¹⁵ We only found the contribution of Brosio, Cassone and Ricciuti (2002) showing regional estimates of the VAT gap. Unfortunately, authors did not indicate the estimation method.

¹⁶ For more details see Convenevole, Pisani (2003).

Our contribute to the studies of measuring tax gap is that of investigating some aspects disregarded, so far, concerning VAT collected by region and by final uses (Household Expenditure, Market enterprises and the Public Administration). Although the two issues are independent, the latter is crucial to determine reliable regional estimates since final users show an attitude towards tax evasion may vary significantly among them and in turn affect regional evasion.

These analyses are allowed by information derived from a specific section of the VAT form, the VT part¹⁷. These data, along with those of other sources, have been undergone to consistency checks on different sections of the tax return before being applied to our analysis.

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

VAT has the peculiarity to arise where the consumption takes place but may be collected in a different place. This is one of the issue to deal with since it has important implications in estimating VAT gap and theoretical VAT for each region. This latter also represent the real regional contribution to overall VAT Revenue.

The top-down methodology applied to our purpose is similar to that at national level. A key element for computing regional estimates is the territorial detail of all the information required: both statistical and administrative. While doing this, we ensure the consistency with national estimates.

In this section we discuss three important factors: section 3.1 presents how we infer the actual Revenue, the theoretical one and the VAT taxable base at national level; section 3.2 shows declared and theoretical taxable base by final uses; Section 3.3 describes the territorial structure of the gap.

3.1. Determining the VAT Revenue and Gap

With the aim of assessing taxpayer voluntary compliance, we calculate VAT revenue on 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:

$$IVAEC = VAT \text{ Gross Revenue}^{18} - (Refunds + Compensation^{19}) - Adjusting \text{ for accrual accounting} - variation \text{ in the amount of VAT credits to bring to next year}^{20} \quad [3.1]$$

¹⁷ See Convevole (2006) for details about the introduction of VT part.

¹⁸ It represents the voluntary compliance and it excludes the amount collected through the audits.

¹⁹ It is an alternative way to the request for reimbursement, under which you may use a VAT tax credit to pay other taxes.

²⁰ To have this opportunity the taxpayer reports VAT credit in the tax return.

where IVAEC denotes the economic accrued revenue consistent with our method to estimate gap.

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 accrual basis and cash basis, we derive VAT accrual²¹.

Every year, taxpayers annotate in the VAT statement the amount of VAT credits they can use in the year following to 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 get 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 rate²². The theoretical VAT base (BIT) is computed consistently with the classifications and definitions applied for BID and its estimate employ detailed expenditure subclasses of National Accounts components²³: Households consumption (261 items); General Government Investments (12 items); General Government Intermediate Consumption (17 items); Market enterprises Intermediate Consumption (58 items), and specific types of market enterprises Investments²⁴ (e.i. cars). We group them in three main clusters, the same applied for BID: Households, General Government and Market Enterprises final uses. The last two generate VAT base when tax is not recoverable.

VAT legislation identifies two kind of not recoverability, partial or complete²⁵: the first due to the type of goods purchased; the second is related to the economic activity: those who sell exempt goods and services, cannot reclaim VAT paid for their purchases, at least partially. Following VAT legislation, we have identified, among goods and services purchased by firms, those items whose tax is not recoverable. To take the “subjective” case into account, we compute non recoverable share by detailed economic activities from VAT statements, then we apply these percentages to National Accounts Intermediate Consumption.

As a general rule, we require highly detailed National Accounts aggregates in order to capture the complexity of VAT regulation and to calculate with accuracy theoretical base and tax. For each detailed subclass of National Accounts is deducted the share of exempted base and to the residual amount is associated its own proper statutory VAT rate.

²¹ The procedure is defined by the European Union in accordance with Regulation ESA95.

²² It is computed on the bases of VAT statements data, taking into account internal market components and imports.

²³ Applying the top-down method based on the national accounts may produce therefore different results from country to country. See for example Reckon (2009), Keen and Smith (2007).

²⁴ Includes data relating to valuables investments.

²⁵ See, articles 17 and 19 in DPR n. 633 del 1972.

The gap is estimated following two hypothesis²⁶: first with complicity (seller and buyer agree and there is no invoice, tax is not collected); second, without complicity (tax is collected but not remitted). Currently, we are not able to identify the amount of evasion for each behavior, hence we produce two point estimates. First, we estimate gap by assuming all evasion occurs with complicity, then we suppose all evasion is without complicity. The former represents an upper limit of gap estimates while the latter is a lower limit. In the Appendix we show a diagram (Figures B.1) which illustrates estimation procedure of VAT gap at national level.

3.2. VAT base distribution by Final Uses

We split BID into three main categories: Households (BIDcf), General Government (BIDpa) and Uses for Market Enterprises (BIDal). We derive the General Government expenditure (both intermediate and investment) from Public finance data, conveniently harmonized in accordance with definitions and classifications stated by ESA 95.

We get the reported VAT base for Households (BIDcf) from the VAT part of VAT statement. VT part contains taxable operations towards final consumers and those to entity with VAT registration numbers.

BIDal is then obtained as follows:

$$BIDal = BID - BIDcf - BIDpa \quad [3.2]$$

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

$$IVAEC = IVAECcf + IVAECpa + IVAECal \quad [3.3]$$

Finally, we impose the restriction of equivalence to the overall national base and tax.

3.3. Geographical Distribution of reported VAT base and gap

Each group, theoretical, reported and gap, estimated at the national level is broken down at regional level. The territorial distribution of VAT become a key issue, since VAT arises where consumption takes place while it is collected where firms have their fiscal headquarters. To make a consistent comparison with National Accounts data we reallocate the reported data, gathered by fiscal headquarter, to the place where goods and services are sold.

In order to split up the reported VAT base (BID) by region, we use the following indicators: the Households Expenditure is distributed by means of VT part of the VAT

²⁶ The two types are recognized within the EU and the European Commission in the Decision 98/527/CE, G.U. n. L234 del 21/8/1998 pag. 0039-0042.

form; the General Government purchases is distributed by means of National Accounts data, under the hypothesis of no evasion²⁷; Market Enterprises final uses are share out by means of the reported taxable base structure of IRAP²⁸.

The BIT is allocated at 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 means of 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.

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

3.4. Main estimation results

In Table B.1, we present results of our computations, showing the average regional gap estimates by final uses over 2007-2010. In this period, it turns out that the average VAT base gap is nearly 231 billion euro, decomposed into: 177 billion (77%) from base gap of Households final uses, 11% of which comes from transport services, and 54 billion (23%) from final uses for Market Enterprises.

South area (including Isles) shows an amount of nearly 83 billion and the highest quota, follow Northwest (27%) Northeast (21%) and Centre (17%). Regions like Lombardia, Campania, Veneto, Sicilia, Piemonte have an amount of Vat base gap over 20 billion. Among those regions having the higher level of Vat base gap from Market enterprises (Lazio, Lombardy, Veneto e Piemonte), Lazio has the highest quota in its regional gap (35%). However, Lombardia, Campania and Sicilia present the higher quota of Vat base gap from Households final Consumption.

Table B.2 provides estimates of Vat base gap propensities, namely Vat base gap divided by Vat Base theoretical liability. At national level²⁹, it is about 26% and its value for households final consumptions is around 26,2% while 46,9% for final uses of market enterprises.

The regional distribution of Vat base gap propensities show higher value for southern area, six out of eight regions have figures higher than 32%. These regions have a very high gap propensity in the final uses of market enterprises, ranging from 60% to 75% and values between 33% and 39% for transactions related to final consumption of Households.

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

²⁸ IRAP stands for Regional Tax on Productive activity. Using the IRAP form is possible to decompose the enterprise production by local activity unit. The IRAP value are weighted according to the VAT base produced by the different economy sectors.

²⁹ This figure is calculated by dividing Vat base gap and Vat base theoretical liability, including that from General Government.

Anyhow, 11 regions have the overall Vat gap propensities below the national average, Lazio Valle d'Aosta and Trentino Alto Adige show the lowest values Northeast regions present gap propensities to final uses of market enterprises above the national average and also above the northwest average. Moreover, the average gap propensity for Households final consumption in the North is lower than that of South.

4. Exploratory Empirical Analyses

In this section we address our analysis towards a preliminary investigation of the determinants of VAT gap. For this purpose, we follow two ways. The first one consists of a shift-share analysis³⁰ on VAT base gap. This technique allows to separate the national trend in the VAT gap from other factors determining the gap such as regional expenditure structure and regional environment characteristics. The second one is a panel econometric study. This is a tentative analysis which allows us to make some further progress in explaining VAT base gap.

4.1. A Descriptive Analysis

First, we apply a static shift- share analysis to the average VAT base gap propensity (hereafter, VAT gap propensity). It is calculated as the average over 2007-2010 of VAT base gap divided by theoretical VAT base liability. Afterwards, we apply a dynamic shift-share analysis to the VAT base gap. The methodological issues are described in Appendix.

The former analysis allows to differentiate three aspects of the regional VAT base gap propensity, the first one due to national context (denoted “national”) from those due to regional structure of the economic activity (denoted by “structural”) and to specific characteristics of the region (denoted “local”).

The overall regional VAT gap propensity is affected by the national component under the assumption that a common path of evasion exists over all the country, and the structural component is captured by imposing the same structure of final uses for each region. Finally, the local component expresses the specificity of the region in terms of grater or a smaller attitude to be non- compliant.

In Table B.3 we show the breakdown of the regional VAT base gap propensity (average 2007-2010) into its components and in Figure B.2. we represent them graphically. The national effect, equal to 26.04%, explains a large portion of regional observed VAT gap propensity, mostly for regions in the North and Centre of Italy. In the South, six out of eight regions show a higher propensity than at national level. The structural component produces a positive effect specially in the South regions due to the quota of public sector in the Southern economy. This component tends to lower the VAT base gap propensity.

³⁰ Giovannini Commission (2011).

The local component summarizes the effects produced by specific characteristics of the regions. It is shown that these aspects play a significant role in the South: it increases the VAT base gap propensity by 10% in almost all southern regions. Their features prevail on the beneficial effects of the structural component, encumbering their economies. This aspect is well illustrated in Figure B.1 where arise the regional VAT base gap propensities are highly affected by socio-economic factors and local behavioral attitude rather than those factors related to the economic structure.

The dynamic shift-share analysis allows us to split the growth rate of regional VAT base gap in three components: the national growth effect, the structural effect and the regional effect. In Table B.4 we show its decomposition. Over the period 2007-2010, almost all regions show a decreasing changing rate of the VAT base gap however the variability among regions is high. Firstly, the national trend largely drives the improved compliance. As for the structural effect, we show that both final uses, final households expenditure and market enterprises final uses, have decreased by about 10%. The compositional mix slightly affects the improvement of regional compliance. Regions, having a high quota of transport final expenditure in regional VAT base gap (2007 is the reference year), show a worsening in compliance: Valle d'Aosta, Lombardia, Friuli, Liguria, Toscana and Lazio have a quota of transport final expenditure in regional VAT base gap greater than 10% and show a structural positive effect. The local component plays an important role in explaining the overall regional growth rate of the VAT base gap. Specific factors mostly account for Lombardia, Friuli and Liguria and also for Calabria and Sicily. These result are shown in Figure B.3 where the structural and local components are in the same pile for each region: the overall height of the column is equal to the sum of the structural and local components.

4.2. A preliminary panel study on VAT gap

The territorial peculiarities highlighted in the previous section will be investigated more in depth in this part by using the longitudinal structure of our data.

4.2.1 Data and Variables description

Our set of VAT gap measures covers a period from 2007 to 2010 and determines a panel analysis bounded to 80 observations (20 regions times four years). Due to the limited data availability we consider the following analysis a preliminary exercise. We are interested in sketching economic factors that may affect VAT missing compliance.

As we pointed out in previous sections, the decision to evade VAT by means of non-reporting VAT taxable base allows the taxpayers to reduce also its direct tax burden, this makes VAT base gap a more appropriate dependent variable than VAT gap. In order to identify suitable explanatory variables³¹ for our VAT base gap, we have paid attention to minimize the possibility of endogeneity issues. Moreover, as we have few degrees of freedom, a limited numbers of independent variables can be used for controlling their effects on the gap.

³¹ See these studies for helping suggestions: Cappariello and Zizza (2004) and Christie and Holzner (2006).

Four groups of variables have been selected to account for different types of checks.

A first set intends to capture the extent of Public Administration (PA) in each region. This should help to capture its role on the regular part of the economy. Two different variables have been considered: the share of regional value added produced by PA and the numbers PA employees as percentage of resident population. The expected result is a negative correlation with tax evasion.

The second set concerns the role carried out by the Revenue Agency (IRA). The first variable measures the payments collected by the Agency through its audit enforcement (named OM, it includes: tax evasion, late payments and errors in filling the tax return)³². A second one is an index of victory in litigation. It measures the ability of defense in court and the goodness of the acts issued by the Revenue Agency in litigation. Both variables refer to tax evasion of earlier years. Anyhow we take them lagged.

A third group intends to consider the economic and social condition in the area. In this cluster are included variables concerning the dangerousness of social setting and the hazard in doing business activity. In the former we include the figures of thefts, robberies and also murders while in the latter we encompass the numbers of cheats and frauds and crimes against economy. We assume that in an area the more the social conditions are hard and it is risky doing business the lower is the attitude to pay taxes. In this group we also include variables that account for economic difficulties in running business, denoted as troubling business activity, measured as the number of drafts and promissory notes protested. These figures take into account the asymmetric effect of the business cycle upon regions because of their different economic structure. Their increase may reflect the economic difficulty of taxpayers in paying taxes.

A fourth group of variables includes measures that account for spending capability. Such measures intend to convey the expenditure attitudes to both Households and Firms in each region. Firstly, we introduce bank deposits that can be considered as a measure of wealth of the region. Then other checks involve the domestic wastes, resident population and energy consumption. We summarize information on data sources for control variables in Table B.5.

4.2.2 Estimation methods and econometrics findings

As stated in paragraph 4.1, Italian economic system is not homogeneous across regions and our estimation strategy requires to take into account for these disparities. This is going to affect in which way we control for heterogeneity. Regions are administrative

³² The OM at time t is given by: $OM_t = \sum_{i=1}^{Ta} \sum_{n=1}^m Tg_{i,t-n} + Pe_{i,t-n}$ [1]

where: Ta denotes the number of taxpayers audited (Ta); Tg is the tax gap assessed by the fiscal authority; Pe are the actual penalties and interest paid by the audited taxpayer and n represents the physiological time span between the tax year audited and the year in which the tax authority collects the amounts due (Pe).

Tg can be expressed as: $Tg_{i,t-n} = y_{i,t-n} \times \tau_{i,t-n} \dots$ [2]

where: y is the income reported by the taxpayer and τ is the rate of underreporting of the same taxpayer. The expressions [1] and [2] show that OM depends on the: a) enforcement produced by the tax authority (Ta); b) rate of underreporting, τ , discovered by the tax authority, related to the income y reported at time $t-n$, $n = 1, 2, \dots, m$; c) effectiveness of penalties imposed (Pe).

areas in which tax compliance may be not homogeneous. Internal studies conducted by the Italian Revenue Agency demonstrate that, in the same region coexists territorial units³³ characterized by a great differences in tax behaviors³⁴. Descriptive statistics in Table B.6 show that between regions variability always prevails over the temporal variation, for all variables examined. This information is helpful in choosing estimation method. The Breusch Pagan test supports us to affirm that a pooled estimation is not appropriate. We decide upon a random effect model in treating individual unobserved effects being aware of the limitations of our analysis³⁵.

In Table B.7 and B.8, we present our estimation results. We run numerous regressions trying to find a good support to our analysis.

In our baseline estimation (Table B.7 column 1) we show the important role developed by PA, its presence in the region is a limit to its irregular economy. PA represents a quota of legal economy in the area, the more this quota the more evasion decreases.

From the Revenue Agency point of view, the role of its enforcement is an interesting determinant of VAT gap. We use a specific enforcement dimension calculated by the Revenue Agency at regional level as well as other economic and social factors in the area. The variable is lagged to preserve us from possible endogeneity issue. Revenue agency activity concerns tax evasion from years before, then an increase in the enforcement would affect positively compliance of the following years: an increase of 1% of the enforcement reduces VAT base gap of 7%. This result seems to be confirmed by all the sensitivity analysis we run. Even though we should consider this evidence just an exercise, they confirm some theoretical musings (Andreoni, 1998).

Several checks are carried out by using different social and economic explanatory variables. In particular, the role of bank deposits has been controlled in order to represent the richness of the region, as a measure of its economic wealth. It turns out that its increase of 1% produces an increase in the tax gap. This positive correlation captures a measure of scale that indicates that the higher the level of wealth, the greater the part of the local economy hidden to Tax Authorities. We also consider domestic energy and domestic waste as a proxy of wealth conditions measured in terms of consumption (rather than richness³⁶). Their correlation with VAT base gap is positive.

We obtain a similar correlation after controlling for draft protested as a proxy of difficult economic conditions but also indicative of a less attitude of the social context to be compliant. We add a further group of checks, changing our basic explanatory variables. We use the employment of PA with respect to resident population instead of the share of value added of PA to overall regional value added. Our previous result are confirmed, the extend of regular economy in the region matters. Again, the VAT base gap is increased when we check for crimes against the economy as a proxy of dangerousness in doing business in the region: the VAT base gap increases.

Furthermore, we adopt an alternative measure of the enforcement of IRA which is a specific dimension of enforcement since it measures the ability of IRA in judicial claims. It can be considered a subset of the previous enforcement variable which

³³ In the nomenclature of territorial units, NUTS classification, level 3.

³⁴ Carbone et al. (2010).

³⁵ A further step will be trying to capture a possible endogeneity arising from IRA variables.

³⁶ Both richness indicators and consumption indicators capture a part of the underground economy.

represents more complex or difficult cases the agency is involved in. It comes out that an increase of the enforcement in judicial cases tend to reduce evasion. This measure remains significant when we consider the other previous controlling variables.

5. Conclusion

In this article, we present some new evidence on the distribution of VAT gap. The contribution of the paper is twofold: on one hand, original methodologies to calculate the VAT gap by different final uses and by regions have been developed; on the other hand preliminary models to investigate the territorial divergences in the VAT gap have been proposed.

A measure of VAT gap by final uses is crucial in order to obtain reliable VAT gap estimates at the territorial level. Currently our procedure selects the best macro-economic indicators both to allocate the theoretical VAT base in each region and to allocate the actual VAT base.

Our main results reveal that the average VAT base gap over 2007-2010 is nearly 231 billion euro, 177 billion accounts for base gap of Households final uses and 54 billion for final uses of Market Enterprises. Southern area (including Isles) shows the highest quota, followed by Northwest (27%) Northeast (21%) and Centre (17%).

The Vat base gap propensity is about 26% at national level, its value for Households consumption is around 26,2% while 46,9% for final uses of market enterprises.

Shift-share analyses suggest that different final uses can affect the difference in tax behavior by region. Furthermore, the descriptive analyses highlight a strong “local” effect that induces difference in tax compliance among areas of the country. Particularly, this aspect play a significant role in the South: it increases the VAT base gap propensity by 10% in almost all southern regions.

Over the period 2007-2010, the dynamic shift-share shows that the decreasing changing rate of the VAT base gap is driven by the national trend, worth -8,64%. The worsening of tax compliance is mainly affected by local components.

In order to further investigate this “local” component a preliminary panel analyses has been developed. The obtained results have many limitation but allow us to propose some indications. The VAT gap is positively affected by the economic condition of the area expressed both in term of richness and in terms of ability to spend, this aspect should be further investigated in order to qualify the tax evasion by distinguishing the non-compliance due to economic survival from the other that generates extra profit. A positive correlation with the business cycle has been identified: VAT gap is positively influenced by protested draft and promissory notes, this evidence could also highlight a relationship between tax gap and the tax moral of the area.

The presence of PA has a positive effect in reducing the VAT gap at local level: this aspect stresses the relevance of the purchases of the PA in generating the VAT base. The most important result regards the deterrent effect caused by the Revenue Agency activity, an effect that is due to: the effort (expressed in terms of number of audit), the

rate of penalties and the effectiveness of the penalties (both represented by the sums actually collected by the Revenue Agency through the audit).

Appendix

A. Shift and share methodology

A.1 Static version

The static analysis allows to differentiate three aspects of the VAT base gap share, the one concerning the national context (denoted national) from those due to the regional structure of the economic activity (denoted structure) and to the specific characteristics of the region (denoted local).

The overall regional VAT gap share is affected by national VAT base gap share and by two other components: the VAT gap share of the economic actors, typical of the region (regional specific propensity); the composition of the theoretical VAT base liability according to final uses (economic actors involved), also typical of the region and linked to its economic specialization.

These components can arise by adding and subtracting to the overall regional VAT gap share (p_r) both the national VAT base gap share (p_{IT}) and the regional one calculated, keeping constant the composition of the theoretical VAT base liability according to final uses at national level, (p'_r), as follows:

$$p_r = p_{IT} + (p'_r - p_{IT}) + (p_r - p'_r) \quad [A.1]$$

hence p'_r is the weighted average of the regional specific propensities, weighted by the theoretical national share of the final uses at national level. For each region, we use the same structure of weights, such that the second term of the [a.a.1.1], shows the difference between regional VAT gap share (p'_r), being equal the VAT theoretical structure by final uses, and the national one (p_{IT}). Then, this part denotes a local contribution as it expresses the specificity of the region in terms of more or less attitude to be non-compliant (VAT non-fulfillment) compared with the national level.

The third term in [a.a.1.1] shows the difference between the observed VAT gap share (p_r) and that with theoretical national structure (p'_r) and is denoted as structural contribution. This part is only affected by differences in composition of theoretical VAT base by final Uses, since the specific regional VAT gap share are the same in p_r and p'_r . This term measures how the difference in the composition of the theoretical VAT base by final uses between region and nation affects the difference between regional VAT base gap and National VAT base gap.

A.2 Dynamic version

The specific growth rate of the VAT base gap for the region r and for the final use s denoted by $g_{r,s}$ can be split, as follows:

$$g_{r,s} = g_{..} + (g_{.s} - g_{..}) + (g_{r,s} - g_{.s}) \quad [\text{A.2}]$$

whereby:

$$\Delta X_{r,s} = g_{r,s} \cdot X_{r,s} = [g_{..} + (g_{.s} - g_{..}) + (g_{r,s} - g_{.s})] \cdot X_{r,s} \quad [\text{A.3}]$$

where $X_{r,s}$ denotes VAT base gap in the region r and the final use s ; $g_{..}$ indicates the national growth rate of the VAT base gap; $g_{.s}$ denotes national growth rate of the VAT base gap for the final use s . Therefore:

- $g_{.s} - g_{..}$ shows the growth differential of VAT base gap in final use s with respect to the overall growth of VAT base gap;
- $g_{r,s} - g_{.s}$ indicates the growth differential of VAT base gap in final use s between the regional and the national level.

The regional growth rate of VAT base gap may be written, according to [A.3], as follows:

$$g_r = \frac{\Delta X_r}{X_r} = \frac{\sum_s \Delta X_{r,s}}{X_r} = \frac{\sum_s [g_{..} + (g_{.s} - g_{..}) + (g_{r,s} - g_{.s})] \cdot X_{r,s}}{X_r} = \frac{g_{..} \frac{\sum_s X_{r,s}}{X_r} + \frac{\sum_s (g_{.s} - g_{..}) \cdot X_{r,s}}{X_r} + \frac{\sum_s (g_{r,s} - g_{.s}) \cdot X_{r,s}}{X_r}}{1} \quad [\text{A.4}]$$

We denote by $w_{rs} = \frac{X_{r,s}}{X_r}$ the quota of VAT base gap (referred to 2007) of the final use s into the region r .

As we have: $\frac{\sum_s \Delta X_{r,s}}{X_r} = 1$, we can rewrite:

$$g_r = g_{..} + \sum_s (g_{.s} - g_{..}) \cdot w_{rs} + \sum_s (g_{r,s} - g_{.s}) \cdot w_{rs} \quad [\text{A.5}]$$

The growth rate of regional VAT base gap may be considered as the sum of three components: first, a national component $g_{..}$, called trend component, which expresses the part of regional growth due to national trend, that is how regions “share” with the National growth. Then, two shifts: the former denoted as structural component, $\sum_s (g_{.s} - g_{..}) \cdot w_{rs}$, that identifies how much the growth in VAT base gap can be attributed to the regional’s mix of final uses. Regions do not have identical final uses profiles. In some regions there is a preponderance of slow-growing final uses, while others may be specialized in uses with growth rates that are higher than the national average. The final uses mix effect in the shift-share equation tries to capture these regional variations in final uses composition. The final uses mix is the amount of growth attributable to differences in the final uses composition of the region versus that of the nation. The latter shift is the local component $\sum_s (g_{r,s} - g_{.s}) \cdot w_{rs}$, which shows the difference in growth between region and nation. This is a residual component and it is inferred to result from factors that are unique to the region. Then, the local effect arises from interregional differences affecting final uses in a given area which in turn develop because of endogenous factors inherent to the region.

B. Tables and figures

Table B.1. VAT base gap by final uses (Average 2007-2010)

	Overall Households Expenditures	of which: Households Expenditures in Transport	Households Expenditures net Transport	Uses for Market Enterprises
Piemonte	16.624	14.760	1.864	4.704
Valle d'Aosta	354	259	95	109
Liguria	4.101	3.436	665	1.801
Lombardia	28.275	23.977	4.297	5.467
NORD OVEST	49.354	42.432	6.922	12.081
Trentino A.A.	2.695	2.426	270	1.174
Emilia Romagna	14.651	13.184	1.467	4.426
Veneto	16.245	14.773	1.472	4.933
Friuli Venezia Giulia	2.779	2.328	451	1.236
NORD EST	36.370	32.711	3.659	11.770
Toscana	10.111	8.697	1.414	3.912
Umbria	2.144	1.906	238	959
Marche	4.519	4.071	448	1.758
Lazio	9.988	7.503	2.485	5.363
CENTRO	26.762	22.177	4.585	11.992
Abruzzo	3.320	2.998	323	1.109
Molise	1.100	1.045	55	325
Campania	19.871	18.258	1.613	4.677
Puglia	12.027	11.368	659	3.323
Basilicata	1.877	1.774	103	543
Calabria	6.751	6.332	420	2.004
Sicilia	16.671	15.467	1.204	4.517
Sardegna	3.284	2.927	357	1.500
SUD	64.902	60.168	4.733	17.998
ITALIA	177.387	157.488	19.899	53.841

Data in Millions of Euro

Table B.2. Propensity to VAT base gap by final Uses (Average 2007-2010)

	Overall Households Expenditures	of which: Households Expenditures in Transport	Households Expenditures net Transport	Uses for Market Enterprises	Total
Abruzzo	24.42%	25.19%	18.98%	61.98%	25.21%
Basilicata	37.41%	40.04%	17.54%	71.47%	35.26%
Trentino AA	16.95%	16.81%	18.31%	53.07%	18.91%
Calabria	38.63%	40.81%	21.42%	74.38%	36.34%
Campania	39.72%	40.84%	30.26%	62.91%	36.76%
Emilia Romagna	24.98%	25.59%	20.59%	48.65%	25.83%
Friuli Venezia Giulia	19.59%	18.86%	24.51%	47.63%	20.87%
Lazio	15.04%	12.95%	29.30%	35.35%	16.30%
Liguria	20.77%	19.66%	29.24%	53.17%	22.82%
Lombardia	22.84%	22.09%	28.21%	22.41%	21.18%
Marche	25.56%	26.51%	19.29%	63.05%	27.57%
Molise	36.21%	39.02%	15.32%	70.47%	34.34%
Piemonte	30.75%	31.30%	26.97%	51.38%	30.70%
Puglia	33.55%	35.48%	17.31%	65.10%	32.58%
Sardegna	20.13%	20.54%	17.28%	63.31%	21.79%
Sicilia	37.39%	39.18%	23.55%	67.78%	34.85%
Toscana	21.57%	21.33%	23.17%	53.36%	23.36%
Umbria	21.82%	22.47%	17.72%	62.53%	24.16%
Valle d'Aosta	17.73%	15.72%	27.23%	37.48%	17.50%
Veneto	26.11%	26.85%	20.46%	52.10%	27.19%
Italia	26.19%	26.44%	24.40%	46.94%	26.04%

Note: Propensity to VAT base gap in each use is obtained as VAT base gap in the final use divided by VAT theoretical liability in the corresponding final use

Table B.3. Regional VAT base gap propensity breakdown into national, structural and local component. Average 2007-2010.

Regions	VAT base gap propensity ⁽¹⁾	National	Structural	Local
Piemonte	30,70%	26,04%	0,58%	4,08%
Valle d'Aosta	17,50%	26,04%	-0,33%	-8,22%
Lombardia	21,18%	26,04%	0,81%	-5,67%
Trentino Alto Adige	18,91%	26,04%	-0,91%	-6,23%
Veneto	27,19%	26,04%	0,56%	0,58%
Friuli Venezia Giulia	20,87%	26,04%	-0,20%	-4,98%
Liguria	22,82%	26,04%	0,08%	-3,31%
Emilia Romagna	25,83%	26,04%	0,50%	-0,71%
Toscana	23,36%	26,04%	0,02%	-2,70%
Umbria	24,16%	26,04%	-0,60%	-1,28%
Marche	27,57%	26,04%	-0,12%	1,65%
Lazio	16,30%	26,04%	0,38%	-10,12%
Abruzzo	25,21%	26,04%	-1,43%	0,60%
Molise	34,34%	26,04%	-2,34%	10,63%
Campania	36,76%	26,04%	-1,56%	12,27%
Puglia	32,58%	26,04%	-1,21%	7,74%
Basilicata	35,26%	26,04%	-2,42%	11,64%
Calabria	36,34%	26,04%	-2,61%	12,90%
Sicilia	34,85%	26,04%	-2,35%	11,16%
Sardegna	21,79%	26,04%	-1,74%	-2,51%

Note: (1) regional VAT base gap divided by regional theoretical VAT base, denoted also as regional propensity to VAT gap.

Table B.4. Overall regional growth rate of VAT base gap breakdown into national, structural and local component. Average 2007-2010.

Regions	Regional growth rate	National	Structural	Local
Piemonte	-7,02%	-8,64%	-0,04%	1,66%
Valle d'Aosta	-9,12%	-8,64%	1,30%	-1,78%
Lombardia	-2,69%	-8,64%	0,72%	5,22%
Trentino Alto Adige	-23,03%	-8,64%	-0,31%	-14,08%
Veneto	-11,59%	-8,64%	-0,21%	-2,75%
Friuli Venezia Giulia	2,11%	-8,64%	0,25%	10,50%
Liguria	2,04%	-8,64%	0,21%	10,47%
Emilia Romagna	-15,46%	-8,64%	-0,14%	-6,68%
Toscana	-10,03%	-8,64%	0,11%	-1,49%
Umbria	10,59%	-8,64%	-0,19%	19,42%
Marche	-6,16%	-8,64%	-0,21%	2,69%
Lazio	-21,67%	-8,64%	0,68%	-13,71%
Abruzzo	-13,19%	-8,64%	-0,15%	-4,40%
Molise	-2,48%	-8,64%	-0,55%	6,71%
Campania	-8,32%	-8,64%	-0,21%	0,53%
Puglia	-8,04%	-8,64%	-0,46%	1,06%
Basilicata	-8,67%	-8,64%	-0,43%	0,40%
Calabria	-4,85%	-8,64%	-0,42%	4,22%
Sicilia	-3,55%	-8,64%	-0,33%	5,42%
Sardegna	-20,82%	-8,64%	-0,27%	-11,91%

Table B.5. Variables description and source of data

Variables	Description	Source
VAT base gap	Level of VAT base gap	Italian Revenue Agency estimates
Share_gg	regional general government value added divided by regional value added	ISTAT
Employee_gg	Number of general government employees	ISTAT
Share_Employ	Number of general government employees divided by resident population	ISTAT
Electricity	Domestic consumption of electricity (in GWh)	TERNA
Popres	Resident population	ISTAT
Deposits	Amount of bank deposits (in euro)	Bank of Italy
Waste	Urban waste (in tons)	ISPRA
Draft	Number of draft protested	ISTAT
Promissory	Number of promissory notes protested	ISTAT
Business_trouble	Number of promissory notes and draft protested	ISTAT
Cheats_frauds	Number of cheats and frauds	ISTAT
Against_economy	Number of crimes against economy	ISTAT
Social_danger	Number of thefts, robberies and murders	ISTAT
Murders	Number of murders	ISTAT
Thefts_robberies	Number of thefts and robberies	ISTAT
Enforcement_ob	Amount of tax evasion, late payments and errors, referred to four years before, or earlier.	Italian Revenue Agency
Enforcement_Invicto	Index of victory in litigation. It is the ratio of amount decided in favor of the Agency to total amount to be decided.	Italian Revenue Agency

Note: All variables are at regional level. Variables are considered in natural logarithm with the exception of Share_gg and Share_Employ.

Table B.6a. Descriptive statistics

Variables		Mean	Std. Dev.	Min	Max	Observations	
VAT base gap	overall	11561.34	9303.038	481	37213	N =	80
	between		9440.426	521.75	33407.75	n =	20
	within		899.576	8914.837	15366.59	T =	4
Share_gg	overall	0.189	0.062	0.056	0.311	N =	80
	between		0.063	0.059	0.305	n =	20
	within		0.007	0.170	0.206	T =	4
Employee_gg	overall	168592.6	123238.4	9294	424851	N =	80
	between		125714.2	10826.6	417877	n =	20
	within		4711.251	147958.2	185759.2	T =	4
Share_emplo	overall	0.061	0.010	0.042	0.092	N =	80
	between		0.010	0.043	0.088	n =	20
	within		0.002	0.044	0.065	T =	4
Electricity	overall	3426.438	2859.945	162	12047	N =	80
	between		2914.43	179.5	11685.5	n =	20
	within		89.096	2853.938	3787.938	T =	4
Popres	overall	2998.613	2419.127	125	9872	N =	80
	between		2466.161	127	9736	n =	20
	within		34.446	2856.613	3134.613	T =	4
Deposits	overall	1.48e+15	5.01e+15	1.66e+09	2.55e+16	N =	80
	between		4.67e+15	1.91e+09	1.79e+16	n =	20
	within		2.04e+15	-1.39e+16	9.06e+15	T =	4
Waste	overall	1619739	1297664	75755	5015502	N =	80
	between		1322791	78056.5	4957692	n =	20
	within		24556.91	1556901	1703723	T =	4
Draft	overall	3983.225	4478.765	11	20338	N =	80
	between		4517.82	21.75	18114.75	n =	20
	within		650.942	1283.225	6206.475	T =	4
Promissory	overall	46999.11	43175.3	824	151025	N =	80
	between		43737.02	987.5	141878.8	n =	20
	within		4880.83	27489.11	63511.11	T =	4
Business_trouble	overall	50982.34	47199.89	851	169844	N =	80
	between		47857.85	1009.25	159993.5	n =	20
	within		4942.812	32034.84	68303.84	T =	4

Table B.6b. Descriptive statistics

Variables		Mean	Std. Dev.	Min	Max	Observations	
Cheats_frauds	overall	5443.863	4826.206	243	19186	N =	80
	between		4891.165	284.75	17689.5	n =	20
	within		526.548	4459.613	7195.363	T =	4
Against_economy	overall	1711.3	1602.419	28	6687	N =	80
	between		1602.204	35.5	5820.25	n =	20
	within		313.328	785.05	2921.05	T =	4
Social_danger	overall	73446.13	75132.88	1794	336454	N =	80
	between		75876.14	2080.25	302450.8	n =	20
	within		10314.45	47746.88	117267.9	T =	4
Murders	overall	92.525	82.561	1	422	N =	80
	between		82.367	3	338.75	n =	20
	within		17.018	18.775	175.775	T =	4
Thefts_robberies	overall	73353.6	75053.57	1791	336032	N =	80
	between		75795.69	2077.25	302112	n =	20
	within		10306.11	47646.35	117193.4	T =	4
Enforcement_ob	overall	220223.6	243464.3	10515	1587466	N =	80
	between		217383.4	16231.25	955697.5	n =	20
	within		117532.3	-247145.9	851992.1	T =	4
Enforcement_invicto	overall	64.9725	15.28967	35.79	95.79	N =	80
	between		12.39901	37.58	85.19	n =	20
	within		9.266973	41.752	86.377	T =	4

Table B.7: Determinants of VAT base gap. Years 2007-2010.

Dependent variable: Vat base gap	(1)		(2)		(3)		(4)		(5)	
	Coeff..	Standard Error	Coeff..	Standard Error	Coeff..	Standard Error	Coeff..	Standard Error	Coeff.	Standard Error
Share_gg	-5.257***	1.549	-1.324*	0.800	-1.399*	0.813	-7.218***	0.975	-2.466**	1.041
Share employ										
Deposits	0.024*	0.013					0.026**	0.009		
Waste					0.849***	0.089				
Electricity			0.885***	0.0822					0.754***	0.081
Draft									0.109***	0.037
Promissory	0.608***	0.092	0.156***	0.053	0.131**	0.059	0.427***	0.078		
Against economy										
Enforcement_ob_lag	-0.075**	0.037	-0.131***	0.017	-0.091***	0.022				
Enforcement_invicto_lag							-0.133**	0.043	-0.087***	0.032
Cons	4.017***	0.874	2.321***	0.459	-2.836***	0.867	5.825***	0.847	3.119***	0.667
R-sq: within =	0.106		0.244		0.229		0.189		0.185	
between =	0.841		0.970		0.960		0.791		0.956	
overall =	0.837		0.968		0.957		0.788		0.954	
Theta =	.863		.852		.870		.921		.866	
Rho =	.929		.919		.936		.976		.932	
Observations:	80		80		80		80		80	

Notes: Robust standard error; significativity level: ****p< 1%, **p< 5%, *p< 10%.

Variables are considered in natural logarithm with the exception of Share_gg and Share_Employ

Table B.8: Determinants of VAT base gap. Years 2007-2010.

Dependent variable: VAT base gap	(6)		(7)		(8)		(9)	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
Share_gg								
Share_employ	- 6.030*	3.123	-10.617***	3.059	-7.092***	2.339	-2.405**	1.233
Deposits	0.0492***	0.017	0.023**	0.011	0.0764***	0.0183		
Waste							0.928***	0.077
Electricity								
business_danger			0.686***	0.054				
Draft								
Promissory	0.645***	0.085						
Business_trouble							0.096*	0.056
Against economy					0.365***	0.067		
Enforcement_ob_lag	-0.163***	0.029			-0.118***	0.039	-0.111***	0.023
Enforcement_invicto_lag			-0.1047**	0.051				
cons	3.413***	1.021	3.649***	0.483	6.332***	0.958	-3.467***	0.707
R-sq: within =	0.022		0.009		0.030		0.198	
between =	0.785		0.956		0.792		0.963	
overall =	0.781		0.949		0.785		0.960	
Theta =	0.864		0.836		0.884		0.862	
Rho =	0.930		0.900		0.949		0.928	
Observations	80		80		80		80	

Notes: Robust standard error; significativity level: ****p< 1%, **p< 5%, *p< 10%.

Variables are considered in natural logarithm with the exception of Share_gg and Share_Employ

Figure B.1: *Flow chart of the methodology.*

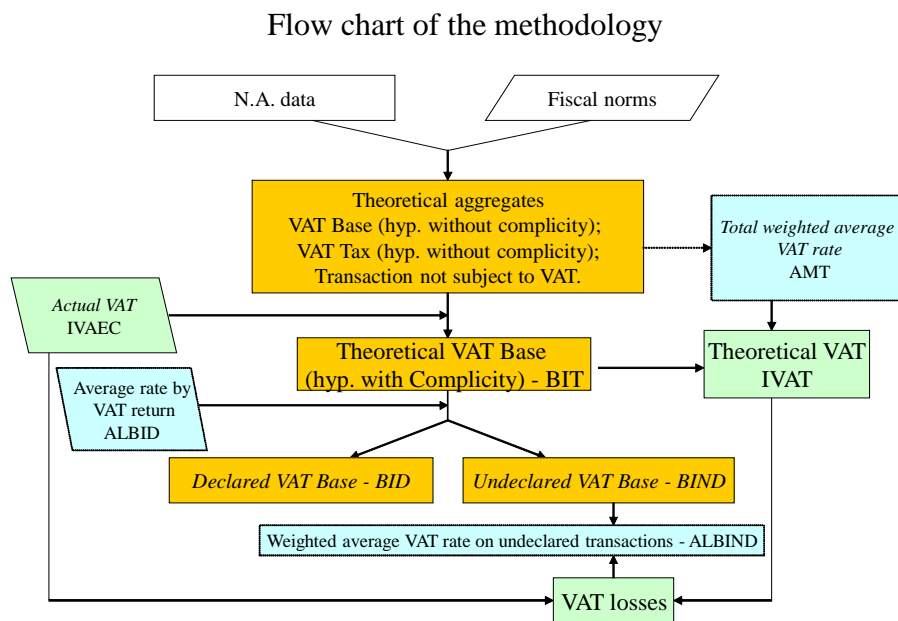


Figure B.2: *Structural and local components of the regional VAT base gap propensity. Average 2007-2010.*

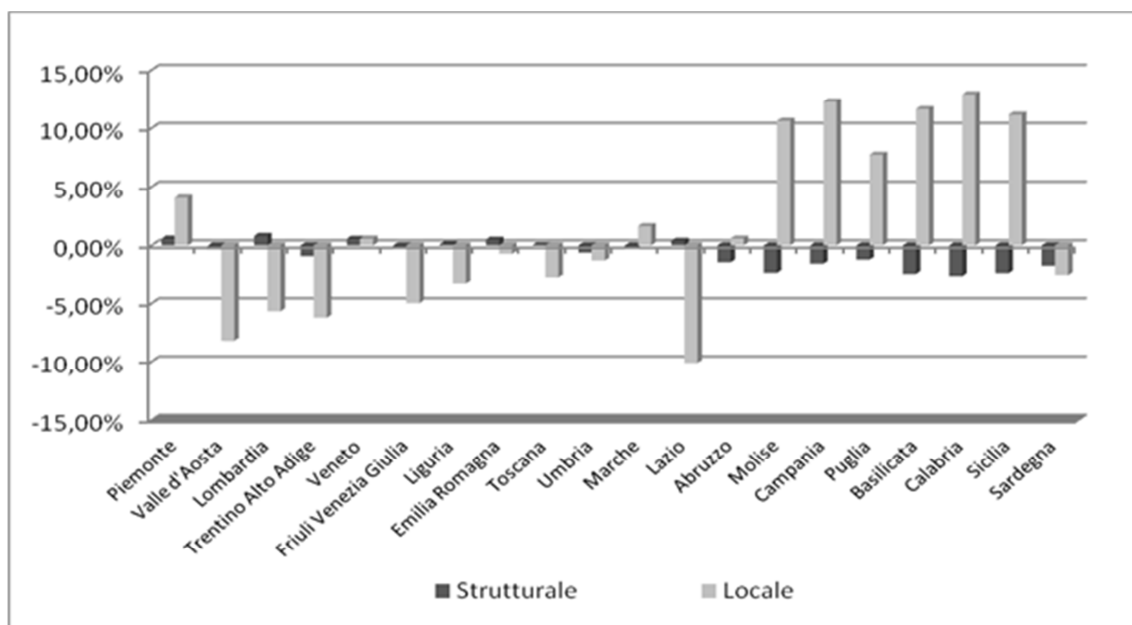
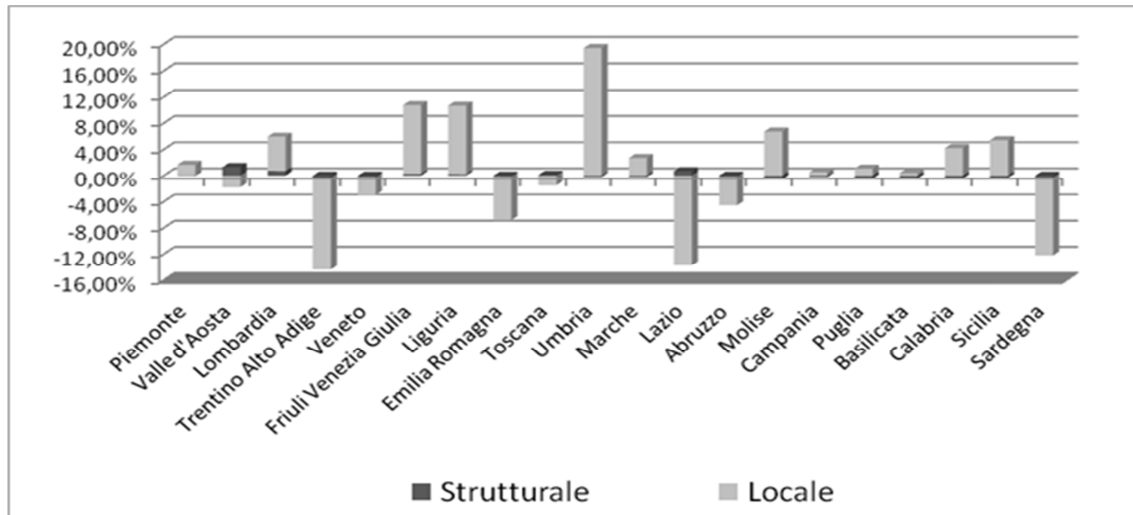


Figure B.3: *Structural and local components of the regional growth rate of VAT base gap. Average 2007-2010.*



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