CASE Reports

Study and Reports on the VAT Gap in the EU-28 Member States: 2018 Final Report

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List of Acronyms and Abbreviations

CASE	Center for Social and Economic Research (Warsaw)
COICOP	Classification of Individual Consumption according to Purpose
CPA	Statistical Classification of Products by Activity in accordance with Regulation (EC) No 451/2008 of the European Parliament and of the Council of 23 April 2008 establishing a new statistical classification of products by activity
CPC 42	Customs Procedure Code no. 42
EC	European Commission
ECM	European Common Market
EU	European Union
EU-28	Current Member States of the European Union
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
IC	Intermediate Consumption
MTIC	Missing Trader Intra Community
NAC	National Currency
NPISH	Non-Profit Institutions Serving Households
OECD	Organisation for Economic Cooperation and Development
ORS	Own Resource Submissions
o/w	of which
RR	Reduced Rate
SAF-T	Standard Audit File for Tax
SR	Standard Rate
SUT	Supply and Use Tables
TAXUD	Taxation and Customs Union Directorate-General of the European Commission
VAT	Value Added Tax
VTTL	VAT Total Tax Liability
VR	VAT Revenue

Executive Summary

This Study serves as the Final Report for the DG TAXUD TAXUD/2017/DE/329, "Study and Reports on the VAT Gap in the EU-28 Member States", which is a follow-up to the five reports published between 2013 and 2017.

In this Report, the Authors present the new Value Added Tax (VAT) Gap estimates for 2016, as well as updated estimates for 2012–2016. In addition to the analysis of the Compliance Gap, this Report examines the Policy Gap in 2016 as well as the contribution that reduced rates and exemptions made to the theoretical VAT revenue losses. Moreover, the Report contains an econometric analysis of VAT Gap determinants, which is a novelty introduced from this year's Study.

In 2016, most European Union (EU) Member States (MS) saw positive tailwinds with a combined real GDP growth of 2.0 percent. As a result of a growing base and increasing VAT compliance, VAT revenue increased in all MS with three exceptions. Most pronounced is the case of Romania, where VAT revenue decreased in response to reduction of the standard rate by four percentage points. In nominal terms, in 2016, the VAT Gap in EU-28 MS fell below EUR 150 billion and amounted to EUR 47.1 billion. In relative terms, the VAT Gap share of the VAT total tax liability (VTTL) dropped to 12.3 percent from 13.2 percent in 2015, and is the lowest value in the analysed period of 2012–2016. Denoted at the share of GDP, the VAT Gap in 2016 amounted to 0.99% compared to 1.05% in 2015.

Of the EU-28, the VAT Gap share decreased in 22 countries and increased in six—namely, Romania, Finland, the UK, Ireland, Estonia, and France. The biggest declines in the VAT Gap—of over five percentage points—occurred in Bulgaria, Latvia, Cyprus, and the Netherlands. The smallest Gaps were observed in Luxembourg (0.85 percent), Sweden (1.08 percent), and Croatia (1.15 percent). The largest Gaps were registered in Romania (35.88 percent), Greece (29.22 percent), and Italy (25.90 percent). Overall, half of EU-28 MS recorded a Gap below 9.9 percent.

The Policy Gaps and its components remained stable. The average Policy Gap level was 44.8 percent, out of which 9.95 percentage points are due to the application of various reduced and super-reduced rates (the Rate Gap). Countries with the most flat levels of rates in the EU, according to the Rate Gap, are Denmark (0.93 percent) and Estonia (2.97 percent). The Exemption Gap, or the average share of Ideal Revenue lost due to various exemptions, is, on average, 35 percent in the EU, whereas the Actionable Policy Gap—a combination of the Rate Gap and the Actionable Exemption Gap—is, on average, 16.5 percent of the Notional Ideal Revenue.

The econometric analysis can be considered a successful first attempt at inferring the impact of various determinants. Firstly, it can be observed that the productive structure of the econo-

my exerts an impact on the VAT Gap. The share of retailers has the strongest impact on the VAT Gap; however, telecommunications, industry, and art also have a positive impact. Secondly, liquidity constraints and the productive structure of the economy also play a role in determining VAT compliance. The most interesting results have to do with the impact of the variables under the direct control of the tax administration. We show that the impact of the size of the tax administration and the VAT Gap is concave. On the contrary, in the case of IT expenditure, the impact is convex, albeit small, until productivity vanishes when IT expenditure is about 9.8 percent of the total expenditure of the tax administration.

Introduction

This Report presents and discusses the findings of the sixth follow-up of the "Study to quantify the VAT Gap in the EU Member States", which was originally conducted by Barbone et al. in 2013, and updated later in 2014, 2015, 2016, and 2017.[1]

This update contains new Value Added Tax (VAT) Gap estimates for 2016, as well as updated estimates for 2012–2016. In addition to the analysis of the Compliance Gap, which is the main goal of the Study, this Report also examines the Policy Gap in 2016 as well as the contribution that reduced rates and exemptions made to the theoretical VAT revenue losses. Additionally, for the first time in this series of reports, an econometric analysis of VAT Gap determinants is included.

The VAT Gap, which is addressed in detail by this Report, refers to the difference between expected and actual VAT revenues and represents more than just fraud and evasion and their associated policy measures. The VAT Gap also covers VAT lost due to, for example, insolvencies, bankruptcies, administrative errors, and legal tax optimisation. It is defined as the difference between the amount of VAT collected and the VAT Total Tax Liability (VTTL)—namely, the tax liability according to tax law. The VAT Gap could be expressed in absolute or relative terms, commonly as a ratio of the VTTL or GDP.

The structure of this Report builds on the previous publications. Chapter I presents the main economic and policy factors that affected Member States (MS) during the course of 2016. It also includes a decomposition of the change in VAT revenues into base, effective rate, and tax compliance components. The overall results are presented and briefly described in Chapter II. Chapter III provides detailed results and outlines trends for individual countries coupled with analytical insights. In Chapter IV, we examine the Policy Gap and the contribution that VAT reduced rates and exemptions have made to this Gap. Chapter V discusses the findings of the econometric analysis. Annex A contains methodological considerations on the VAT Gap and the Policy Gap. Annex B provides statistical data and a set of comparative tables.

1 The first study of the VAT Gap in the EU was conducted by Reckon (2009); however, due to differences in methodology, it cannot be directly compared to these latter studies.

1. Background: Economic and Policy Context in 2016

a. Economic Conditions in the EU during 2016

In 2016, most European Union MS saw positive tailwinds; however, growth was, on average, slightly slower than in 2015. Combined real gross domestic product (GDP) growth in the EU was 2.0 percent in 2016, which was a 0.2 percentage point decline compared to 2015.

At the same time, consumer prices increased by 0.3 percent. In nominal terms in EUR, final consumption increased by approximately 0.7 percent and nominal gross fixed capital formation (GFCF) by roughly 2.5 percent (see Table 1.1). GDP increased only by 0.7 percent. The slow growth of EU figures denominated in EUR was caused somewhat by a depreciation of the GBP and PLN against the EUR.

The highest growth rates of real GDP were observed in Malta, Ireland, and Romania. Only Greece experienced a downturn in 2016. In nominal terms, GDP and final consumption in Greece fell by 1.2 percent.

In contrast to GDP, investment in 2016 was highly volatile. In Ireland, investment increased by 64.6 percent and in Cyprus, by 37.8 percent. The unusually high growth of investments in Ireland was mostly a one-off event. This rise of investments was due to an import of intellectual property assets by multinational corporations. As for Cyprus, the 37.8 percent growth in investments was due to the relatively small base in the previous year and the increasing interest of international investors in the real estate market in Cyprus. A record low of GFCF growth was observed in Latvia, where GFCF fell 15.7 percent.

Due to this volatility and the frequent revisions of GFCF figures by Statistical Offices, GFCF is the main source of VAT Gap revisions. Whenever new information on actual investment figures becomes available, the estimates of VAT Gap are revised backwards.

Table 1.1. Real and Nominal Growth in the EU-28 in 2016 (in national currencies (NAC))

Member State	Real GDP Growth (%)	Nominal Growth (%)			
		GDP	Final Consumption	GFCF	Intermediate Consumption
Belgium	1.4	3.1	2.7	4.2	1.8
Bulgaria	3.9	6.3	3.4	-6.1	-4.6
Czech Republic	2.5	3.9	4.1	-2.0	0.5
Denmark	2.0	1.9	2.0	6.8	0.5
Germany	**1.9**	**3.3**	**3.3**	**4.3**	**0.5**
Estonia	2.1	3.7	5.6	-2.0	3.1
Ireland	5.1	5.2	4.4	64.6	9.9
Greece	-0.2	-1.2	-1.2	0.7	-2.2
Spain	3.3	3.6	2.4	4.4	1.4
France	1.2	1.6	1.9	3.4	-0.1
Croatia	3.5	3.1	2.3	4.7	3.1
Italy	0.9	1.7	1.6	3.0	-0.9
Cyprus	3.4	2.7	1.5	37.8	1.6
Latvia	2.2	2.5	4.1	-15.7	-1.5
Lithuania	2.3	3.3	5.3	-0.2	-4.3
Luxembourg	3.1	1.7	2.4	1.2	-1.1
Hungary	2.2	3.2	4.2	-9.5	2.1
Malta	5.2	7.1	2.2	3.0	5.3
Netherlands	2.2	2.8	1.9	5.7	0.9
Austria	1.5	2.6	2.8	5.1	0.8
Poland	3.0	3.3	3.2	-7.1	3.7
Portugal	1.6	3.2	2.9	1.6	1.1
Romania	4.8	7.0	9.1	-0.7	-0.1
Slovenia	3.1	4.1	4.2	-3.0	2.6
Slovakia	3.3	2.9	2.5	-9.0	4.4
Finland	2.5	2.9	2.2	9.0	2.2
Sweden	3.2	4.9	4.2	7.1	4.0
United Kingdom	1.8	3.9	3.8	3.4	3.4
EU-28 (in EUR)	2.0	0.7	0.4	2.5	-0.7

Source: *Eurostat*.

b. VAT Regime Changes

In 2016, no EU-wide changes in regulations affected the VTTL, as happened in 2015, when the new rules for the taxation of electronic and digital services came into force.

Four MS implemented significant changes to the structure of their VAT rates. As of January 2016, Romania reduced its standard rate from 24 to 20 percent. The change of the standard rate had a substantial impact on the effective rate, which fell from 17.2 to 13.5 percent (see Table 1.2).

Greece raised the standard rate by one percentage point (from 23 to 24) as of July 2016. The withdrawal of the 30 percent VAT rate discount from the last group of islands together with the hike in the standard rate resulted in an approximately 1.5 percentage point increase in the effective rate.

Moreover, two MS introduced new reduced rates. Italy introduced a reduced 5 percent VAT rate for the provision of services carried out by social cooperatives. Austria implemented a new 13 percent VAT rate for select services—among others, domestic passenger air transport services, admission fees for sport events, cinema shows, services of recreation and educational centres, and the selling of wine directly from a farm.

Table 1.2. VAT Rate Structure as of 31 December 2015, and Changes during 2016

Member State	Standard Rate (SR)	Reduced Rate(s) (RR)	Super Reduced Rate	Parking Rate	Changes during 2016	Effective rate[2]
Belgium	21	6 / 12	-	12	-	10.1
Bulgaria	20	9	-	-	-	14.2
Czech Republic	21	10/15		-	-	12.7
Denmark	25	-	-	-	-	14.4
Germany	19	7	-	-	-	10.6
Estonia	20	9	-	-	-	13.0
Ireland	23	9 / 13.5	4.8	13.5	-	11.7
Greece	24	6 / 13	-	-	SR 23 to 24	12.4
Spain	21	10	4	-	-	8.5
France	19.6	5.5 / 10	2.1	-		9.7
Croatia	25	5/13	-	-		15.9
Italy	22	10	4 / 5	-	Additional Super Reduced Rate – 5	10.2
Cyprus	19	5 / 9	-	-		10.7
Latvia	21	12	-	-	-	11.5
Lithuania	21	5 / 9	-	-	-	17.1
Luxembourg	17	8	3	14	-	12.2
Hungary	27	5 / 18	-	-	-	14.9
Malta	18	5 / 7	-	-	-	10.3
Netherlands	21	6	-	-	-	10.2
Austria	20	10 / 13	-	12	Additional Reduced Rate – 13	11.1
Poland	23	5 / 8	-	-	-	11.9
Portugal	23	6 / 13	-	13	-	11.3
Romania	20	5 / 9	-	-	SR 24 to 20	13.5
Slovenia	22	9.5	-	-	-	12.0
Slovakia	20	10	-	-	-	16.1
Finland	24	10 / 14	-	-	-	12.4
Sweden	25	6 / 12	-	-	-	13.4
United Kingdom	20	5	-	-	-	9.3

Source: *TAXUD, VAT Rates Applied in the Member States of the European Union: Situation of 1st January 2017.*

2 Ratio of VTTL and tax base. See methodological considerations in Section III in Annex A.

c. Sources of Change in VAT Revenue Components

The value of actual VAT revenue can be expressed as the product of three components:

Actual Revenue = Net Base * Effective Rate * Compliance Gap, where Effective Rate is the ratio of theoretical VTTL to Net Base. Net Base (which is the sum of final consumption and investment by households, non-profit institutions serving households (NPISH), and government), in turn, is calculated as the difference between Gross Base, which includes VAT, and VAT revenues actually collected.

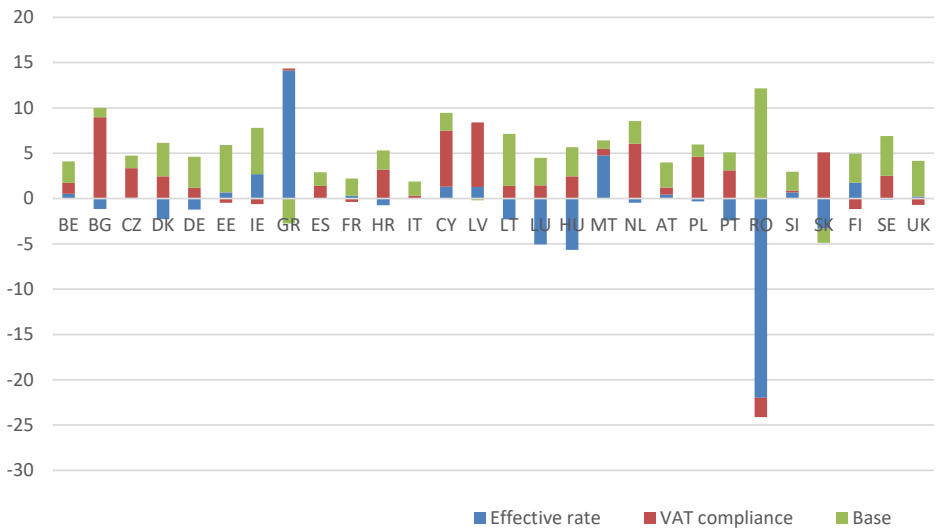
Table 1.3 and Figure 1.1 present the decomposition of the total changes in nominal VAT revenues into these three components: change in net taxable base, change in the effective rate applied to the base, and change in the compliance gap.

Table 1.3. Change in VAT Revenue Components (2016 over 2015)

Member State	Change in Effective Rate (%)	Change in VAT Compliance (%)	Change in Base (%)	Change in Revenue (%)
Belgium	0.5	1.2	2.4	4.1
Bulgaria	-1.2	9.0	1.0	8.8
Czech Republic	0.1	3.3	1.4	4.8
Denmark	-2.3	2.5	3.7	3.8
Germany	-1.2	1.2	3.4	3.4
Estonia	0.7	-0.5	5.2	5.4
Ireland	2.7	-0.6	5.1	7.3
Greece	14.1	0.2	-2.8	11.2
Spain	0.0	1.4	1.5	2.9
France	0.3	-0.4	1.9	1.8
Croatia	-0.7	3.2	2.1	4.6
Italy	0.0	0.3	1.6	1.9
Cyprus	1.3	6.2	2.0	9.7
Latvia	1.3	7.1	-0.2	8.3
Lithuania	-2.3	1.4	5.7	4.8
Luxembourg	-5.1	1.5	3.0	-0.8
Hungary	-5.7	2.4	3.2	-0.3
Malta	4.8	0.7	0.9	6.5
Netherlands	-0.5	6.1	2.5	8.2
Austria	0.4	0.8	2.8	4.0
Poland	-0.3	4.6	1.3	5.7
Portugal	-2.4	3.1	2.0	2.6
Romania	-22.0	-2.1	12.1	-14.4
Slovenia	0.7	0.2	2.1	3.0
Slovakia	-3.3	5.1	-1.6	0.0
Finland	1.8	-1.2	3.2	3.8
Sweden	-0.1	2.5	4.4	6.9
United Kingdom	0.2	-0.7	3.9	3.4
EU-28 (average)	**-0.7**	**2.1**	**2.6**	**4.0**

Source: *own calculations.*

Figure 1.1. Change in VAT Revenue Components (2016 over 2015, %)



Source: *own calculations.*

As Figure 1.1 depicts, in all EU MS but Greece, the growth of the base contributed to the growth of VAT revenue. Sudden changes in the effective rate were observed in Greece and Romania, which introduced significant changes in their VAT rates. On average, a change in the base was the main source of the increase in VAT revenue that contributed to 2.6 percent growth. Change in compliance was almost equally important and contributed to 2.1 percent growth.

2. The VAT Gap in 2016

The VAT Gap measured in this Study was estimated using the same methodology as in the previously-cited VAT Gap studies. The VAT Gap is defined as the difference between the VAT total tax liability (VTTL), sometimes also known as VAT total theoretical liability) and the amount of VAT actually collected. We compute VTTL in a "top-down" approach by deriving the expected VAT liability from the observed national accounts data, such as supply and use tables (SUT). In particular, VAT liability is estimated for final household, government, and NPISH expenditures; non-deductible VAT from intermediate consumption of exempt industries; and VAT from GFCF of exempt sectors. We also account for country-specific tax regulations, such as exemptions for small business under the VAT thresholds (if applicable); non-deductible business expenditures on food, drinks, and accommodation; and restrictions to deduct VAT on leased cars, among others. The precise formula is given in Section III in Annex A.

The availability and quality of SUT data varies greatly country by country and year by year. In the course of our computations, some expenditure and investment figures, which are not available for the most recent years, are estimated using industry- and sector-specific growth rates and taxable shares.[3] This requires the frequent revision of previous estimates whenever actual national accounts data is published or new information on taxable investment becomes available. The exact sources of revisions of the estimates presented in the 2018 Report are described in Section III in Annex A.

In nominal terms, in 2016, the VAT Gap in EU-28 MS fell below EUR 150 billion and amounted to EUR 147.1 billion.[4] The VTTL accounted for EUR 1,194.4 billion, whereas VAT revenue was EUR 1,047.3 billion. In relative terms, the VAT Gap share of the VTTL dropped to 12.3 percent, down from 13.2 percent in 2015. It is the lowest value in the analysed period of 2012–2016.

Of the EU-28, the VAT Gap share decreased in 22 countries and increased in six—namely, Romania, Finland, the UK, Ireland, Estonia, and France (see Figure 2.2). The biggest declines in the VAT Gap of over five percentage point occurred in Bulgaria, Latvia, Cyprus, and the Netherlands.

The smallest Gaps were observed in Luxembourg (0.85 percent), Sweden (1.08) percent, and Croatia (1.15 percent). The largest Gaps were registered in Romania (35.88 percent), Greece (29.22 percent), and Italy (25.90 percent). Overall, half of EU-28 MS recorded a Gap below 9.9 percent (see Figure 2.1, Figure 2.3 and Table 2.1).

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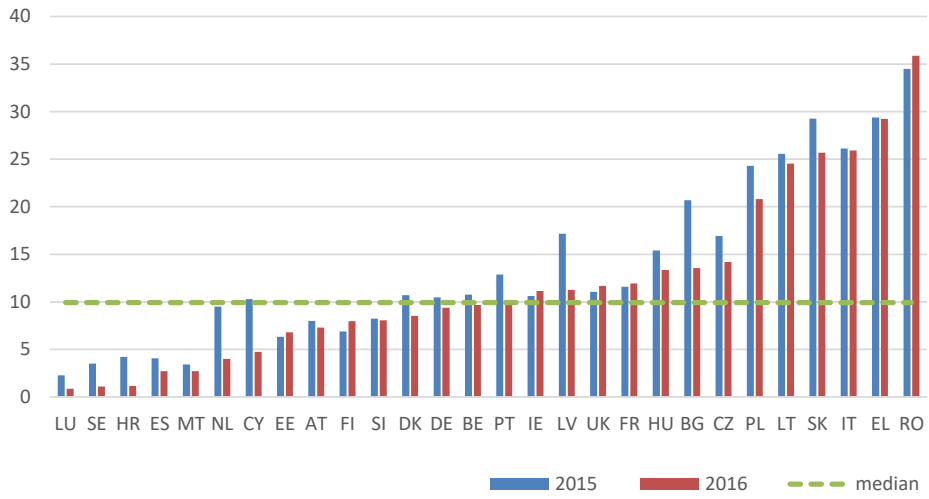
3 The SUT are estimated using the RAS method (https://ec.europa.eu/eurostat/cros/content/ras-method_en). The GFCF VAT liability is estimated based on national accounts investment data in the specific sector combined with the shares of investment taxed at different rates, which, in turn, are derived from ORS.

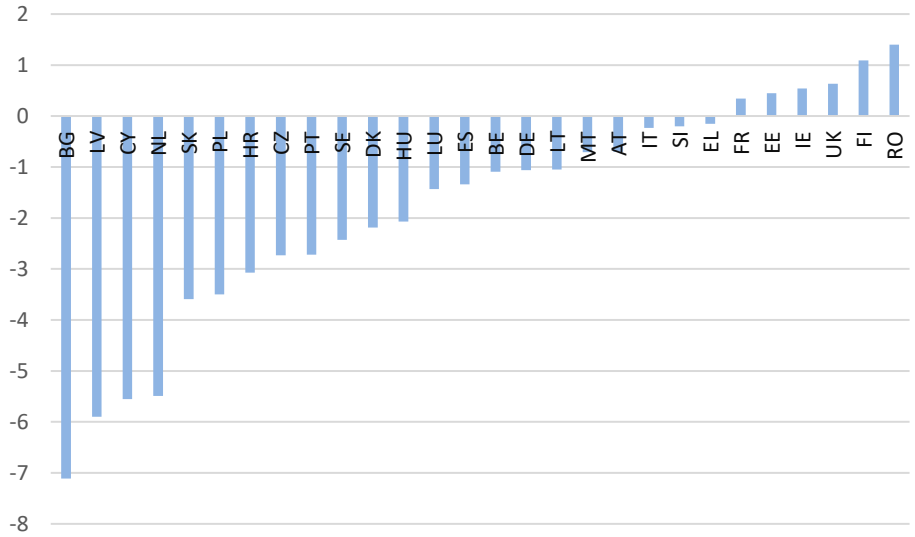
4 The VAT Gap in 2015 was revised upwards from EUR 151.5 billion. The main sources of revisions were VTTL from GFCF in Germany and Sweden.

Figure 2.1. VAT Gap as a percent of the VTTL in EU-28 Member States, 2016 and 2015[5]



Source: *own calculations.*

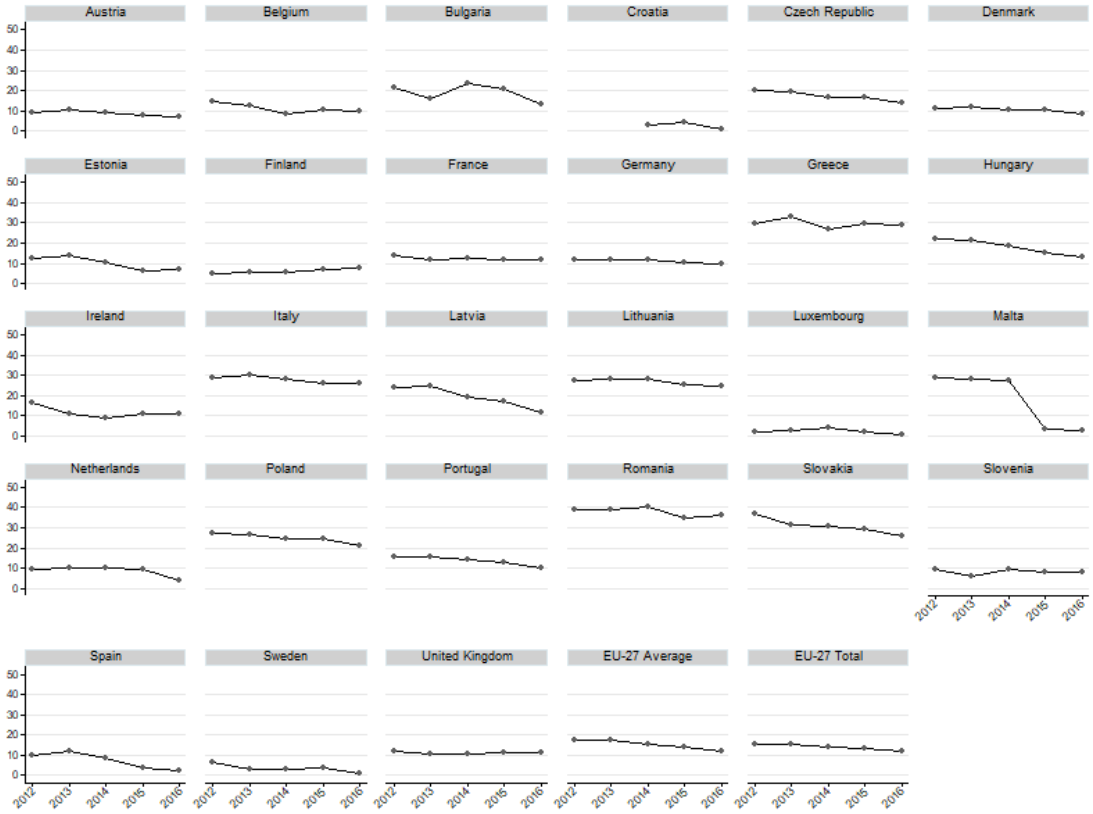
Figure 2.2. Percentage Point Change in VAT Gap (2016 over 2015)



Source: *own calculations.*

5 Note: data for Cyprus in 2014 was unavailable.

Figure 2.3. VAT Gap in EU Member States, 2011–2016



Source: *own calculations.*

Table 2.1. VAT Gap Estimates, 2015–2016 (EUR million)

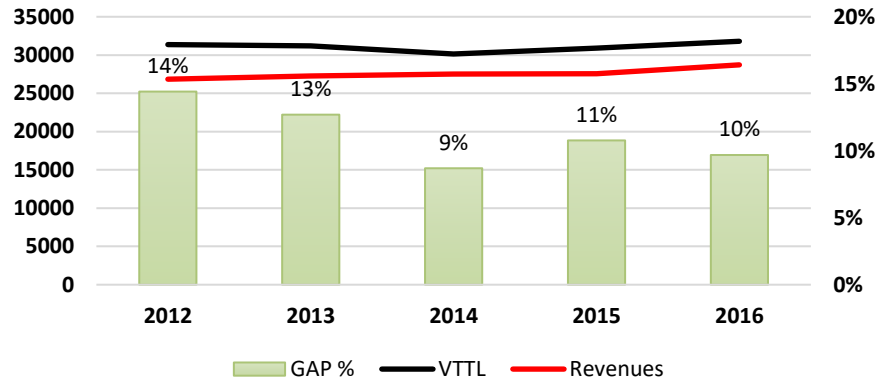
MS	2015				2016				VAT Change (pp)
	Revenues	VTTL	VAT Gap	VAT Gap (%)	Revenues	VTTL	VAT Gap	VAT Gap (%)	
BE	27578	30906	3329	10.77	28722	31801	3079	9.68	-1.09
BG	4059	5117	1058	20.67	4417	5110	693	13.56	-7.11
CZ	12382	14903	2521	16.92	13091	15256	2165	14.19	-2.73
DK	25493	28546	3054	10.70	26519	28985	2466	8.51	-2.19
DE	211616	236322	24706	10.45	218784	241463	22679	9.39	-1.06
EE	1873	1999	127	6.33	1974	2118	144	6.78	0.44
IE	11955	13375	1419	10.61	12826	14436	1610	11.15	0.54
EL	12885	18243	5358	29.37	14333	20249	5916	29.22	-0.15
ES	68601	71498	2897	4.05	70591	72557	1966	2.71	-1.34
FR	151680	171547	19867	11.58	154430	175326	20896	11.92	0.34
HR	5690	5941	251	4.22	6016	6086	70	1.15	-3.07
IT	101061	136814	35753	26.13	102957	138945	35988	25.90	-0.23
CY	1517	1690	174	10.28	1664	1746	83	4.73	-5.55
LV	1876	2265	389	17.17	2032	2290	258	11.27	-5.90
LT	2888	3880	992	25.57	3026	4009	983	24.52	-1.05
LU	3442	3523	80	2.28	3416	3445	29	0.85	-1.43
HU	10669	12611	1943	15.40	10587	12216	1629	13.33	-2.07
MT	684	708	24	3.42	729	749	20	2.71	-0.71
NL	44879	49584	4705	9.49	48557	50581	2024	4.00	-5.49
AT	26247	28529	2282	8.00	27300	29449	2149	7.30	-0.70
PL	30075	39727	9652	24.30	30479	38483	8004	20.80	-3.50
PT	15368	17640	2272	12.88	15770	17554	1784	10.16	-2.72
RO	12939	19747	6808	34.48	10968	17105	6137	35.88	1.40
SI	3218	3507	289	8.24	3315	3604	290	8.04	-0.20
SK	5420	7664	2243	29.27	5420	7292	1872	25.68	-3.60
FI	18974	20379	1405	6.89	19694	21401	1707	7.98	1.08
SE	40501	41975	1474	3.51	42770	43236	465	1.08	-2.43
UK	182152	204752	22600	11.04	166866	188906	22040	11.67	0.63
Total EU-28	1035722	1193392	157672	13.2	1047253	1194398	147146	12.3	
Median				10.7				9.9	

3. Individual Country Results

This Chapter reviews the individual results for each EU-28 MS, highlighting statistical trends and the most important changes in the particular VAT systems. The results are presented in the following order:

Table 3.1. Belgium: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Belgium	2012	2013	2014	2015	2016
VTTL	31361	31212	30137	30906	31801
o/w liability on household final consumption	17229	17586	17221	17572	18093
o/w liability on government and NPISH final consumption	1482	1419	1424	1457	1464
o/w liability on intermediate consumption	6234	6407	6073	6348	6593
o/w liability on GFCF	4895	4725	4739	4829	4948
o/w net adjustments	1526	1075	680	700	703
VAT Revenue	26844	27250	27518	27578	28722
VAT GAP	4522	3962	2620	3329	3079
VAT GAP as a percent of VTTL	14%	13%	9%	11%	10%
VAT GAP change since 2012					-5 pp

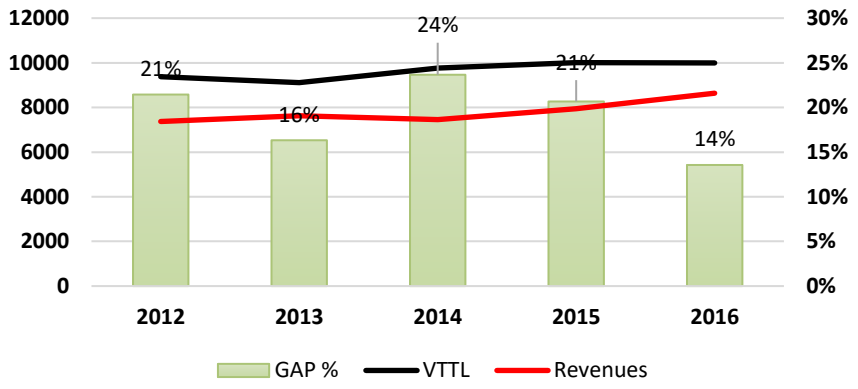


Highlights

- In 2016, VAT revenue increased by 4.1 percent despite no significant changes in VAT system parameters. At the same time, the VTTL increased by 2.9 percent. As a result, the VAT Gap decreased by over one percentage point in relation to 2015.
- No substantial changes to VAT structure occurred in 2016.

Table 3.2. Bulgaria: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (BGN million)

Bulgaria	2012	2013	2014	2015	2016
VTTL	9383	9112	9761	10008	9994
o/w liability on household final consumption	7059	6750	7067	7251	7411
o/w liability on government and NPISH final consumption	384	270	275	250	258
o/w liability on intermediate consumption	891	972	1162	1114	1177
o/w liability on GFCF	935	1020	1174	1306	1129
o/w net adjustments	113	100	84	87	20
VAT Revenue	7371	7624	7451	7940	8639
VAT GAP	2012	1488	2310	2069	1355
VAT GAP as a percent of VTTL	21%	16%	24%	21%	14%
VAT GAP change since 2012					-8 pp

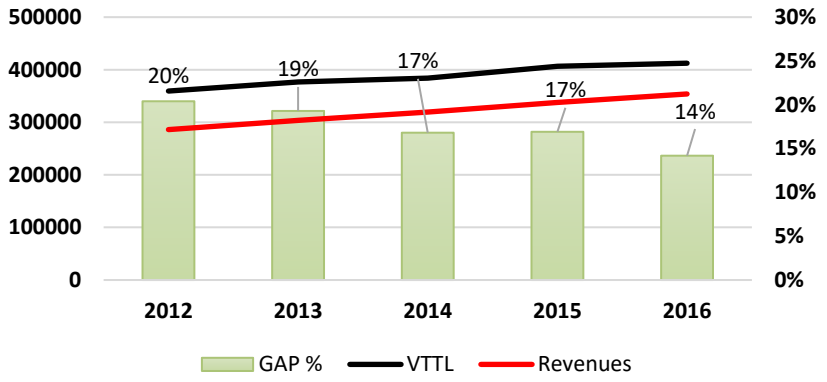


Highlights

- In 2016, the VAT Gap continued its downward trend for the third consecutive year.
- The growth of revenue by 8.8 percent in 2016 was driven mostly by the increase in VAT compliance and was the highest across all EU MS.

Table 3.3. Czech Republic: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (CZK million)

Czech Republic	2012	2013	2014	2015	2016
VTTL	359450	376467	384062	406544	412435
o/w liability on household final consumption	227951	241691	245538	254583	264054
o/w liability on government and NPISH final consumption	17834	18903	19387	21179	21573
o/w liability on intermediate consumption	68657	72040	71811	75262	77043
o/w liability on GFCF	44831	43902	48021	55874	50577
o/w net adjustments	177	-69	-695	-354	-811
VAT Revenue	286116	303823	319485	337774	353915
VAT GAP	73334	72644	64577	68770	58520
VAT GAP as a percent of VTTL	20%	19%	17%	17%	14%
VAT GAP change since 2012					-6 pp

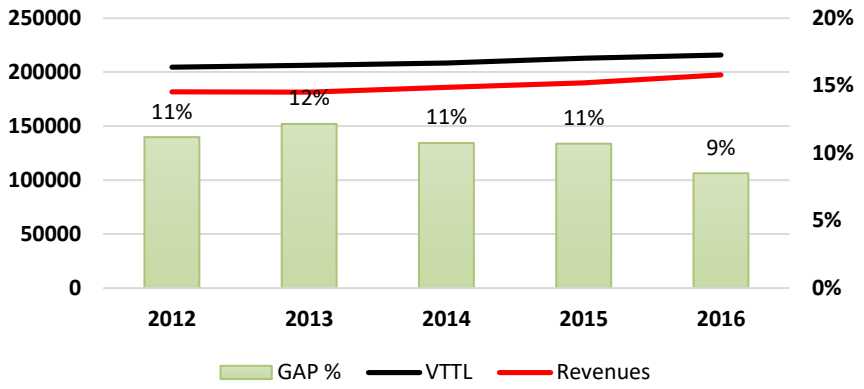


Highlights

- In 2016, the VAT Gap decreased by 2.7 percentage points to 14.2 percent.
- Thanks to a five-year positive trend in VAT Gap reduction, the VAT Gap was 6.2 percentage points lower compared to 2012.
- The Czech Republic reduced the VAT rate on restaurant services from 21 percent to 15 percent, thus growth of the VTTL in 2016 was subdued.

Table 3.4. Denmark: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (DKK million)

Denmark	2012	2013	2014	2015	2016
VTTL	204495	206490	208401	212919	215797
o/w liability on household final consumption	117004	119265	120503	123296	125966
o/w liability on government and NPISH final consumption	5230	5222	5283	5369	5426
o/w liability on intermediate consumption	53576	52897	52826	53319	51757
o/w liability on GFCF	23656	23709	24421	25372	27095
o/w net adjustments	5029	5397	5368	5564	5552
VAT Revenue	181618	181378	185994	190141	197437
VAT GAP	22877	25112	22407	22778	18360
VAT GAP as a percent of VTTL	11%	12%	11%	11%	9%
VAT GAP change since 2012					-3 pp

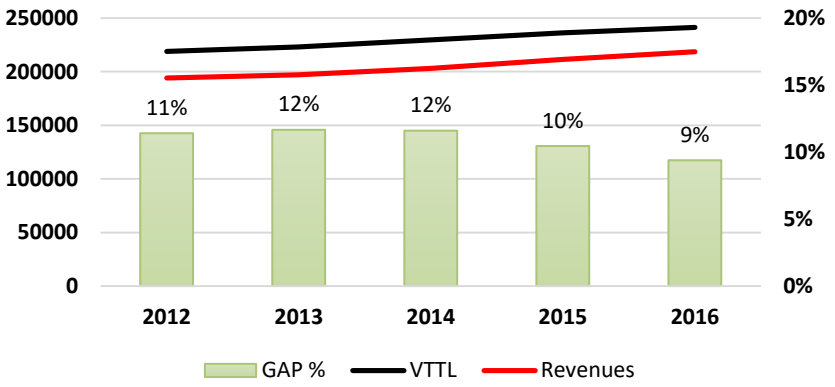


Highlights

- The VAT Gap, which remained stable between 2012 and 2015, fell in 2016 below 10 percent.
- No substantial changes to VAT structure occurred in 2016.

Table 3.5. Germany: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Germany	2012	2013	2014	2015	2016
VTTL	219031	223018	229735	236322	241463
o/w liability on household final consumption	138335	139672	142430	145965	148972
o/w liability on government and NPISH final consumption	5685	5896	6207	6479	6731
o/w liability on intermediate consumption	38345	39982	42562	44174	44424
o/w liability on GFCF	35350	36084	37176	38336	39948
o/w net adjustments	1317	1384	1360	1367	1388
VAT Revenue	194034	197005	203081	211616	218784
VAT GAP	24997	26013	26654	24706	22679
VAT GAP as a percent of VTTL	11%	12%	12%	10%	9%
VAT GAP change since 2012					-2 pp

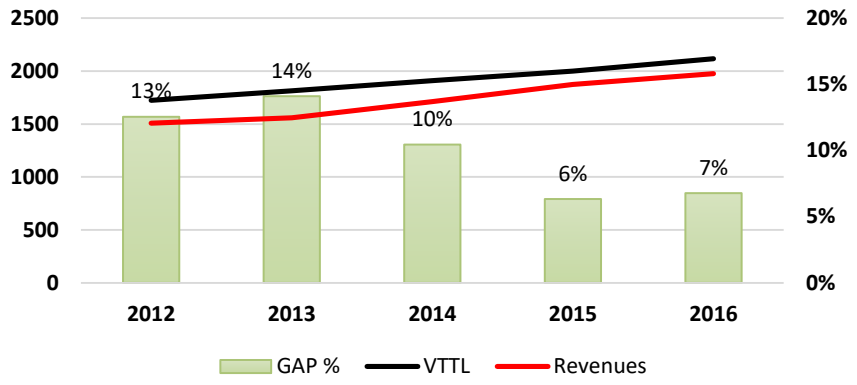


Highlights

- The VAT Gap, which remained stable between 2012 and 2015, fell to a single digit number in 2016.
- Germany did not implement any significant changes to VAT rates over the course of 2016.

Table 3.6. Estonia: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Estonia	2012	2013	2014	2015	2016
VTTL	1724	1814	1911	1999	2118
o/w liability on household final consumption	1202	1273	1338	1390	1459
o/w liability on government and NPISH final consumption	16	26	34	36	59
o/w liability on intermediate consumption	224	227	232	244	255
o/w liability on GFCF	272	278	298	321	336
o/w net adjustments	9	9	9	8	9
VAT Revenue	1508	1558	1711	1873	1974
VAT GAP	216	256	200	127	144
VAT GAP as a percent of VTTL	13%	14%	10%	6%	7%
VAT GAP change since 2012					-6 pp

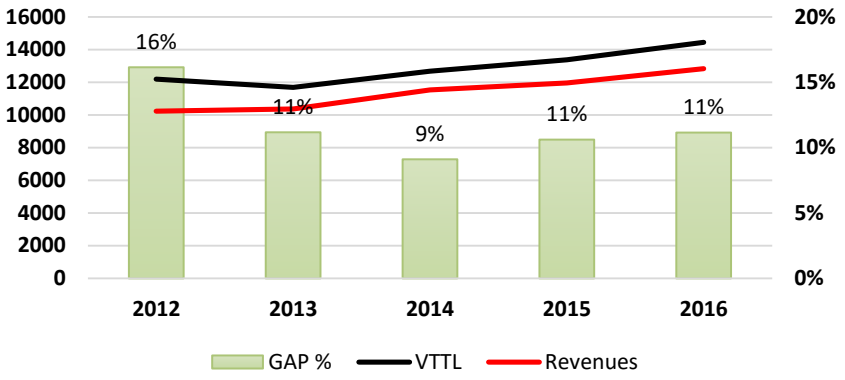


Highlights

- The VAT Gap, which was substantially reduced between 2013 and 2015, remained relatively stable in 2016.
- The VAT registration threshold for resident business was increased from EUR 16,000 to EUR 25,000 in order to free small businesses from bureaucratic burdens.

Table 3.7. Ireland: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Ireland	2012	2013	2014	2015	2016
VTTL	12187	11676	12675	13375	14436
o/w liability on household final consumption	7495	7255	7486	7857	8164
o/w liability on government and NPISH final consumption	232	181	153	164	172
o/w liability on intermediate consumption	3226	3050	3435	3554	3815
o/w liability on GFCF	1079	1031	1443	1629	2088
o/w net adjustments	154	160	159	170	197
VAT Revenue	10219	10372	11521	11955	12826
VAT GAP	1967	1304	1154	1419	1610
VAT GAP as a percent of VTTL	16%	11%	9%	11%	11%
VAT GAP change since 2012					-5 pp

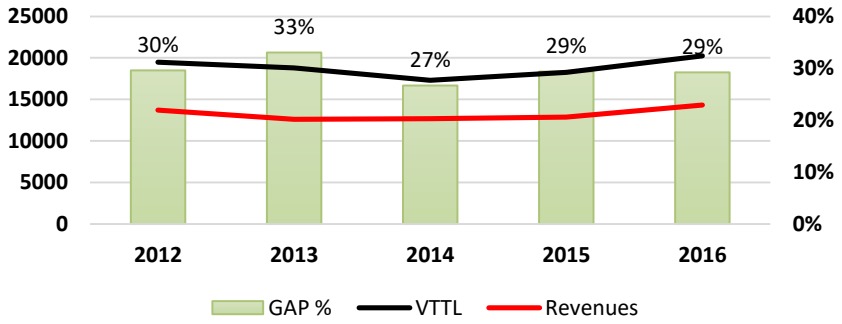


Highlights

- After a significant increase in VAT compliance between 2012 and 2014, the VAT Gap in Ireland continued its upward trend for the second consecutive year.
- Ireland introduced new tools to fight VAT fraud, namely a reverse charge on the provision of wholesale power, electricity, and gas supplies. It has also tightened the rules related to VAT on the capital goods scheme.

Table 3.8. Greece: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Greece	2012	2013	2014	2016	2016
VTTL	19478	18807	17289	18243	20249
o/w liability on household final consumption	13701	13498	12750	13508	15513
o/w liability on government and NPISH final consumption	756	582	424	565	566
o/w liability on intermediate consumption	1913	1769	1761	1853	1937
o/w liability on GFCF	2853	2691	2114	2066	1947
o/w net adjustments	254	267	239	250	285
VAT Revenue	13713	12593	12676	12885	14333
VAT GAP	5765	6214	4613	5358	5916
VAT GAP as a percent of VTTL	30%	33%	27%	29%	29%
VAT GAP change since 2012					0 pp



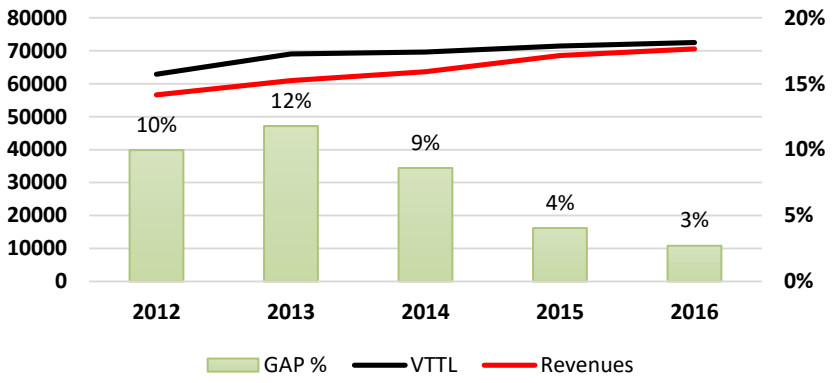
Highlights

- Greece raised the standard rate by one percentage point (from 23 to 24) as of July 2016. The withdrawal of the 30 percent VAT rate discount from the last group of islands together with the hike in the standard rate resulted in an approximate 1.5 percentage point increase in the effective rate.

- Despite the hike in the effective rate, VAT compliance remained stable in 2016.

Table 3.9a. Spain: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Spain	2012	2013	2014	2015	2016
VTTL	62924	69100	69637	71498	72557
o/w liability on household final consumption	46291	50150	50920	52651	53713
o/w liability on government and NPISH final consumption	2273	2387	2413	2490	2493
o/w liability on intermediate consumption	8419	8818	8619	8350	8669
o/w liability on GFCF	5632	7353	7311	7601	7274
o/w net adjustments	309	392	374	405	408
VAT Revenue	56652	60951	63643	68601	70591
VAT GAP	6272	8149	5994	2897	1966
VAT GAP as a percent of VTTL	10%	12%	9%	4%	3%
VAT GAP change since 2012					-7 pp



Highlights

- The VAT Gap in Spain continued its downward trend for the third consecutive year. In 2016, the VAT Gap fell below EUR 2 billion and 3 percent of the VTTL.
- According to the corrections to the stock of unsold dwellings, estimates were lower and amounted to 0.

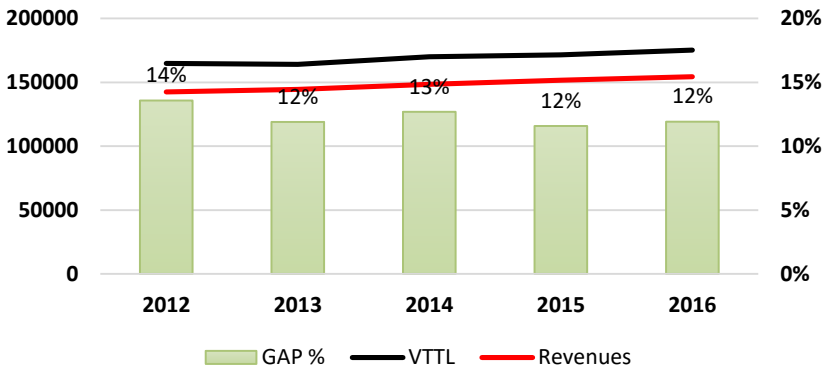
Table 3.9b. Spain: Alternative Estimates

Spain	2012	2013	2014	2015	2016
VAT Gap based on alternative data	5223	4483	2849	-762	233
VAT Gap based on alternative data, as a percent of VTTL	8%	7%	4%	-1%	0%

Note: *Adjusting revenues for the continuing reduction in the stock of claims and adjusting the VTTL for the difference between national accounting and tax conventions in the construction sector based on the data received from Spanish Tax Authorities led to a downward revision of the VAT Gap for the entire period 2012–2016. The accumulated liability of the stock of unsold real estate reached over EUR 12 billion.*

Table 3.10. France: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

France	2012	2013	2014	2015	2016
VTTL	164919	164004	170035	171547	175326
o/w liability on household final consumption	96868	96883	100510	102187	105302
o/w liability on government and NPISH final consumption	1379	1426	1606	1622	1640
o/w liability on intermediate consumption	28405	28953	29704	30273	30680
o/w liability on GFCF	33496	31814	32831	32200	32638
o/w net adjustments	4771	4928	5385	5265	5066
VAT Revenue	142527	144490	148454	151680	154430
VAT GAP	22392	19514	21581	19867	20896
VAT GAP as a percent of VTTL	14%	12%	13%	12%	12%
VAT GAP change since 2012					-2 pp

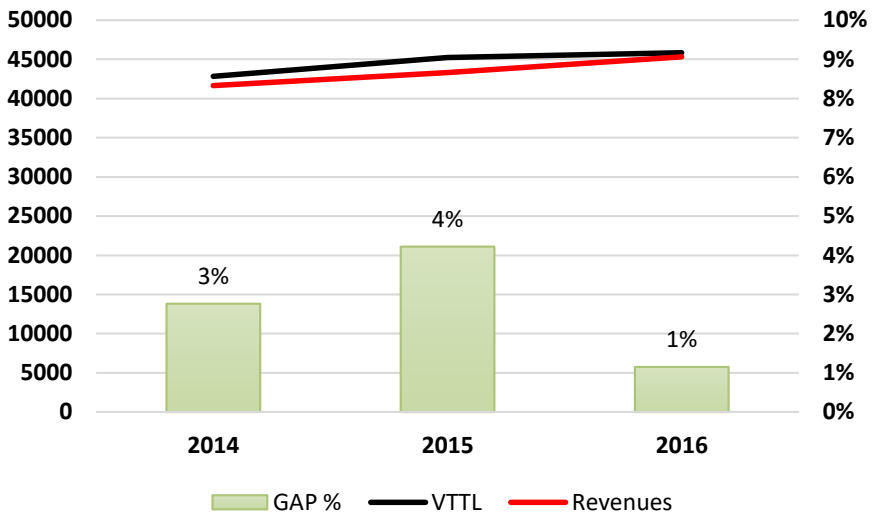


Highlights

- The VAT Gap in France has remained stable in the 2012–2016 period.
- France did not implement any significant changes to VAT rates over the course of 2016.

Table 3.11. Croatia: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2014–2016 (HRK million)

Croatia	2014	2015	2016
VTTL	42831	45231	45850
o/w liability on household final consumption	31238	32017	32720
o/w liability on government and NPISH final consumption	1749	1721	1761
o/w liability on intermediate consumption	5200	6546	6613
o/w liability on GFCF	4485	4384	4620
o/w net adjustments	159	564	136
VAT Revenue	41647	43322	45322
VAT GAP	1184	1909	528
VAT GAP as a percent of VTTL	3%	4%	1%

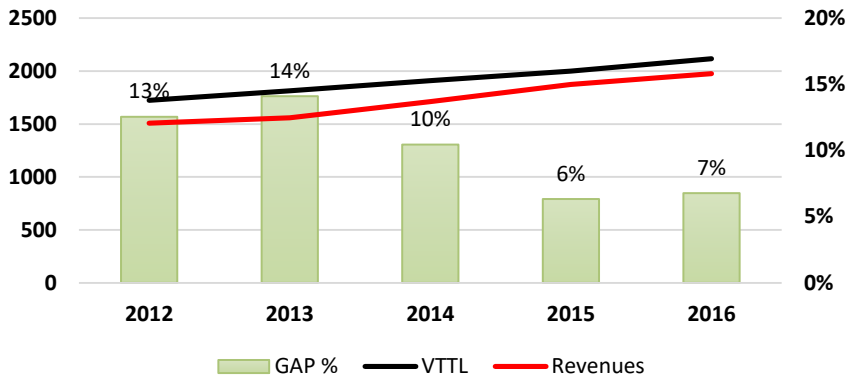


Highlights

- Strong revenue performance in 2016 (+4.6 percent) led to a significant decrease in the VAT Gap to nearly 1 percent of the VTTL.
- Croatia did not implement any significant changes to VAT rates over the course of 2016.

Table 3.12a. Italy: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Italy	2012	2013	2014	2015	2016
VTTL	134955	134345	135427	136814	138945
o/w liability on household final consumption	97495	95797	97232	99409	101204
o/w liability on government and NPISH final consumption	2098	2095	2054	1998	2017
o/w liability on intermediate consumption	18245	18786	19043	18797	18901
o/w liability on GFCF	12770	13564	13305	13378	13615
o/w net adjustments	4347	4102	3792	3232	3209
VAT Revenue	96170	93921	97071	101061	102957
VAT GAP	38785	40424	38356	35753	35988
VAT GAP as a percent of VTTL	29%	30%	28%	26%	26%
VAT GAP change since 2012					-3 pp



Highlights

- Italy reduced the VAT rate for e-books and online newspapers from 22 percent to 4 percent.
- According to the corrections to the estimates on the stock of VAT credits, the VAT Gap in 2016 was approximately EUR 1 billion higher and amounted to 27 percent.
- In nominal terms, the VAT Gap in Italy was the largest in the EU.

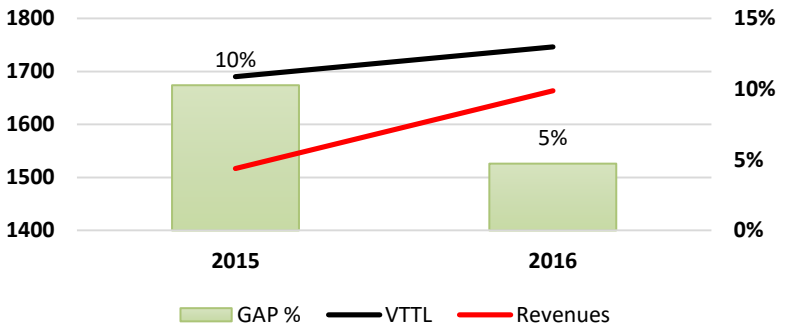
Table 3.12b. Italy: Alternative Estimates

Italy	2012	2013	2014	2015	2016
VAT Gap based on alternative data	37205	37819	36914	36636	36894
VAT Gap based on alternative data, as a percent of VTTL	28%	28%	27%	27%	27%

Note: *the estimates above are based on adjusted revenues for the changes in outstanding stocks of net reimbursement claims (to better approximate accrued revenues) and Italy's own estimates of illegal activities, namely illegal drugs and prostitution activities.*

Table 3.13. Cyprus: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2015–2016 (EUR million)

Cyprus	2015	2016
VTTL	1690	1746
o/w liability on household final consumption	1043	1070
o/w liability on government and NPISH final consumption	29	29
o/w liability on intermediate consumption	482	486
o/w liability on GFCF	115	152
o/w net adjustments	21	9
VAT Revenue	1517	1664
VAT GAP	174	83
VAT GAP as a percent of VTTL	10%	5%
VAT GAP change since 2015		-5 pp

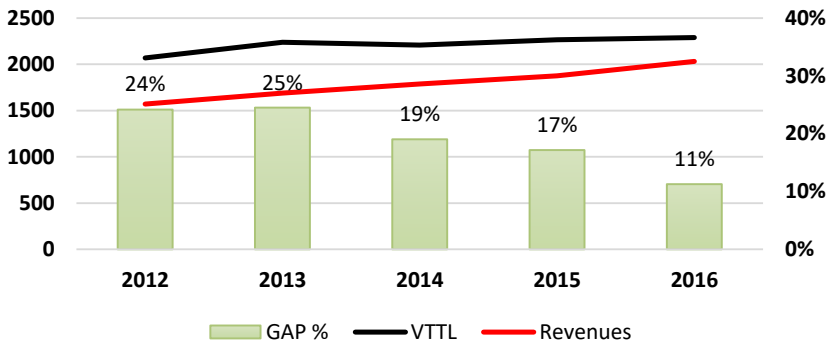


Highlights

- Strong revenue performance in 2016 (+9.7 percent) led to the third consecutive decline in the VAT Gap. Since 2014, the VAT Gap in Cyprus has decreased by nearly 10 percentage points.
- No substantial changes to VAT structure occurred in 2016.

Table 3.14. Latvia: VAT Revenue VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Latvia	2012	2013	2014	2015	2016
VTTL	2071	2239	2207	2265	2290
o/w liability on household final consumption	1633	1721	1759	1790	1862
o/w liability on government final consumption	47	45	46	48	50
o/w liability on intermediate consumption	299	303	311	319	323
o/w liability on GFCF	194	278	211	240	187
o/w net adjustments	-102	-108	-120	-132	-132
VAT Revenue	1570	1690	1787	1876	2032
VAT GAP	501	549	420	389	258
VAT GAP as a percent of VTTL	24%	25%	19%	17%	11%
VAT GAP change since 2012					-13 pp

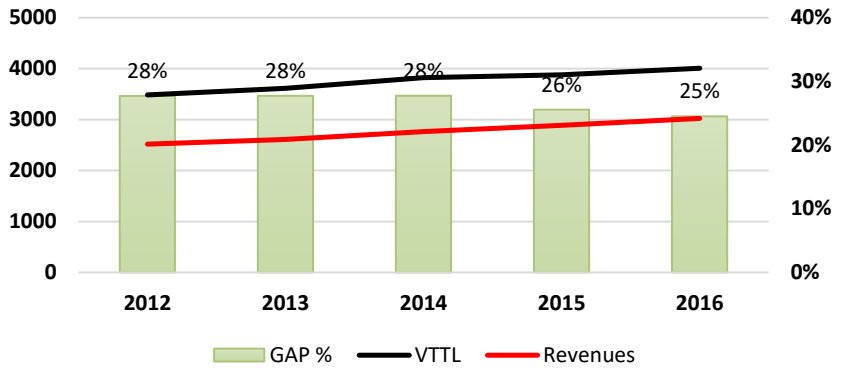


Highlights

- The VAT Gap in Latvia saw a nearly 6 percentage point decline in 2016. This was their fourth consecutive year showing an increase in VAT compliance.
- Latvia implemented no substantial changes to VAT structure in 2016.

Table 3.15. Lithuania: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Lithuania	2012	2013	2014	2015	2016
VTTL	3488	3614	3826	3880	4009
o/w liability on household final consumption	2884	3020	3140	3177	3368
o/w liability on government and NPISH final consumption	14	12	12	13	13
o/w liability on intermediate consumption	337	310	372	399	385
o/w liability on GFCF	378	398	450	488	466
o/w net adjustments	-125	-127	-147	-196	-222
VAT Revenue	2521	2611	2764	2888	3026
VAT GAP	967	1002	1062	992	983
VAT GAP as a percent of VTTL	28%	28%	28%	26%	25%
VAT GAP change since 2012					-3 pp

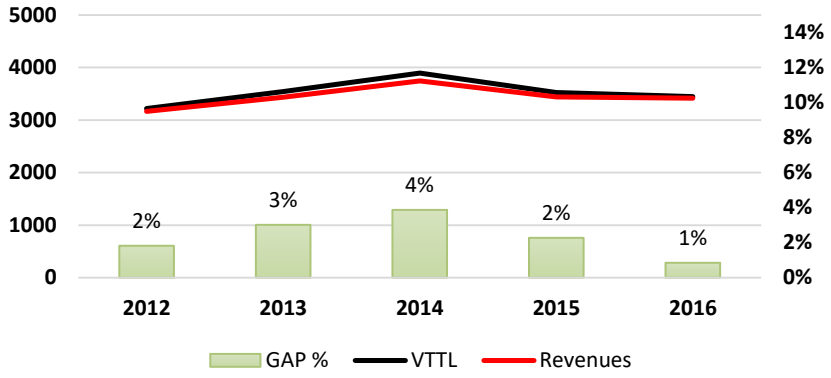


Highlights

- Although there were no significant changes in the VAT Gap over the past five years, Lithuania continues a declining trend.
- No substantial changes to VAT structure occurred in 2016.

Table 3.16. Luxembourg: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Luxembourg	2012	2013	2014	2015	2016
VTTL	3223	3545	3894	3523	3445
o/w liability on household final consumption	1105	1129	1240	1320	1374
o/w liability on government and NPISH final consumption	33	31	31	36	35
o/w liability on intermediate consumption	758	820	874	1066	1043
o/w liability on GFCF	317	306	351	392	409
o/w net adjustments	1009	1259	1398	709	584
VAT Revenue	3164	3438	3743	3442	3416
VAT GAP	59	107	151	80	29
VAT GAP as a percent of VTTL	2%	3%	4%	2%	1%
VAT GAP change since 2012					-1 pp

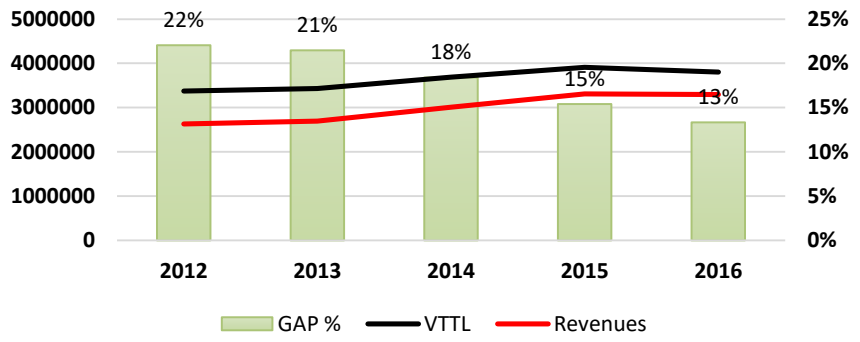


Highlights

- The VAT Gap in Luxembourg was the second lowest in the EU.
- Between 2012 and 2016, the Vat Gap fluctuated between 1 and 4 percent of the VTTL.

Table 3.17. Hungary: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (HUF million)

Hungary	2012	2013	2014	2015	2016
VTTL	3370781	3430096	3690098	3909547	3804471
o/w liability on household final consumption	2383007	2440438	2561233	2654818	2758642
o/w liability on government final consumption	116969	122358	114833	120367	126525
o/w liability on intermediate consumption	458595	444751	490655	501821	507607
o/w liability on GFCF	338232	362648	464953	576606	363733
o/w net adjustments	73978	59901	58425	55934	47964
VAT Revenue	2627571	2693555	3011162	3307312	3297156
VAT GAP	743210	736541	678936	602235	507314
VAT GAP as a percent of VTTL	22%	21%	18%	15%	13%
VAT GAP change since 2012					-9 pp

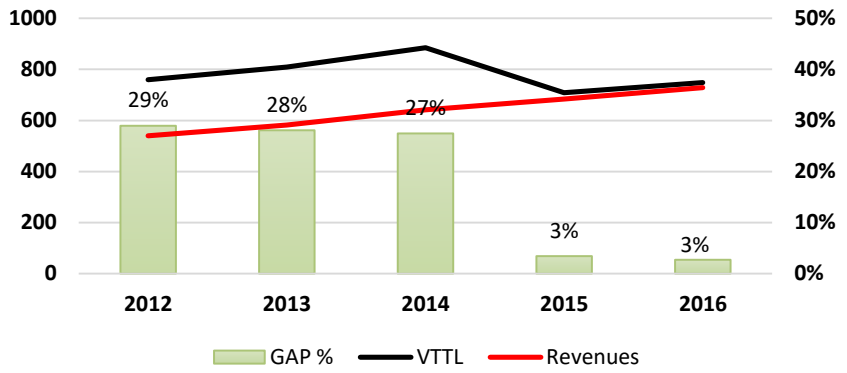


Highlights

- In 2016, the VAT Gap in Hungary continued its downward trend.
- Since 2012, the VAT Gap fell by roughly 9 percentage points.
- No substantial changes to VAT structure occurred in 2016.

Table 3.18. Malta: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Malta	2012	2013	2014	2015	2016
VTTL	760	809	885	708	749
o/w liability on household final consumption	421	437	457	484	503
o/w liability on government and NPISH final consumption	14	14	16	17	42
o/w liability on intermediate consumption	279	305	348	114	121
o/w liability on GFCF	45	50	63	88	77
o/w net adjustments	1	3	2	5	5
VAT Revenue	540	582	642	684	729
VAT GAP	220	227	243	24	20
VAT GAP as a percent of VTTL	29%	28%	27%	3%	3%
VAT GAP change since 2012					-26 pp

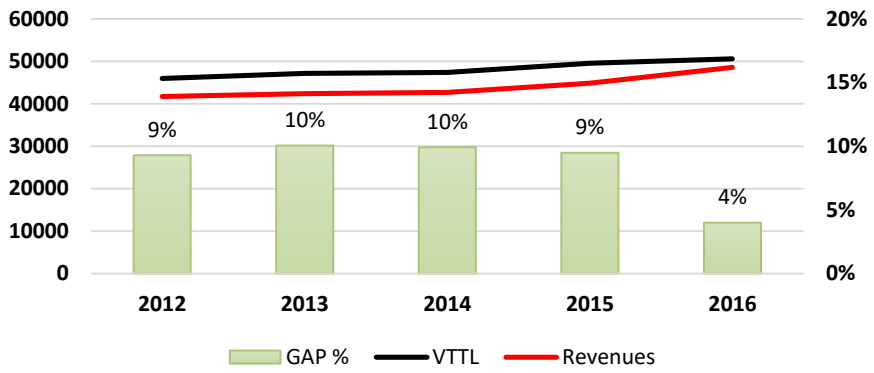


Highlights

- A significant drop in the VAT Gap in Malta resulted from the reclassification of inputs (from non-deductible to deductible) to the financial sector in 2015.
- Overall, the estimated liability from the intermediate consumption of the financial sector fell from EUR 209 million to EUR 12 million.

Table 3.19. Netherlands: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Netherlands	2012	2013	2014	2015	2016
VTTL	45971	47166	47414	49584	50581
o/w liability on household final consumption	24745	25882	25363	26087	26636
o/w liability on government and NPISH final consumption	586	565	556	555	561
o/w liability on intermediate consumption	12330	13000	13121	13472	13313
o/w liability on GFCF	7824	7205	7867	8936	9545
o/w net adjustments	487	514	508	533	526
VAT Revenue	41699	42424	42708	44879	48557
VAT GAP	4272	4742	4706	4705	2024
VAT GAP as a percent of VTTL	9%	10%	10%	9%	4%
VAT GAP change since 2012					-5 pp

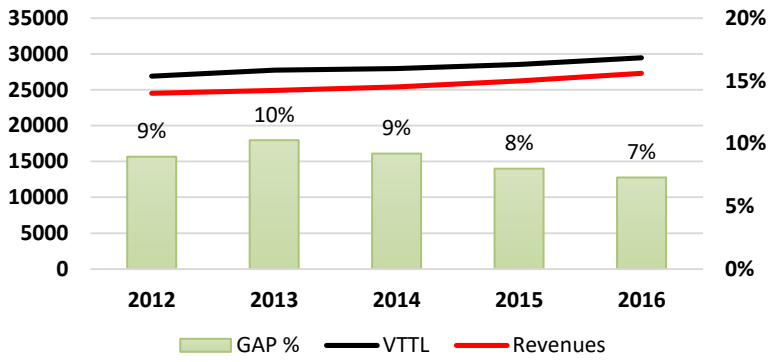


Highlights

- The VAT Gap in 2016 continued to decrease.
- The growth of base and improved VAT compliance resulted in overall 8.2 percent growth of VAT revenue.

Table 3.20. Austria: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Austria	2012	2013	2014	2015	2016
VTTL	26916	27744	27958	28529	29449
o/w liability on household final consumption	18296	18984	18998	19224	19470
o/w liability on government and NPISH final consumption	794	758	957	992	1024
o/w liability on intermediate consumption	3869	4021	4103	4222	4272
o/w liability on GFCF	2480	2545	2585	2659	2795
o/w net adjustments	1476	1436	1315	1432	1474
VAT Revenue	24507	24895	25386	26247	27300
VAT GAP	2409	2849	2572	2282	2149
VAT GAP as a percent of VTTL	9%	10%	9%	8%	7%
VAT GAP change since 2012					-2 pp

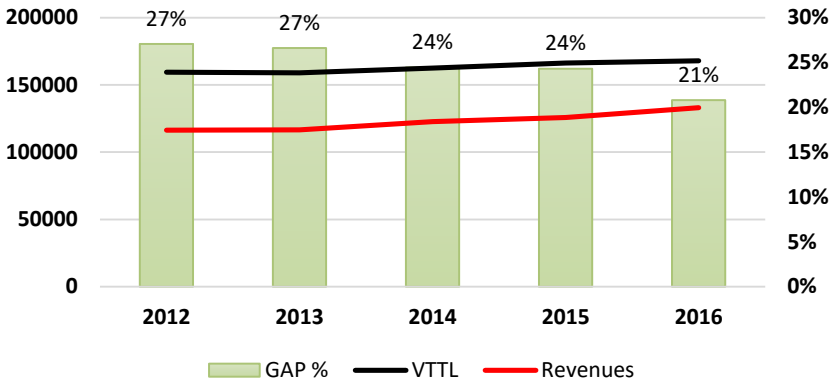


Highlights

- The VAT Gap in Austria continued its downward trend for the fourth consecutive year.
- In 2016, the estimated VAT Gap accounted for approximately 7.3 percent of the VTTL, which was the lowest in 2012–2016.

Table 3.21. Poland: VAT Revenue VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (PLN million)

Poland	2012	2013	2014	2015	2016
VTTL	159399	158882	162359	166223	167908
o/w liability on household final consumption	108887	109749	112465	114399	118622
o/w liability on government and NPISH final consumption	6505	6716	7113	7380	7524
o/w liability on intermediate consumption	23386	22919	22939	24649	25142
o/w liability on GFCF	16423	15306	16875	17444	14321
o/w net adjustments	4199	4191	2967	2351	2299
VAT Revenue	116265	116607	122671	125836	132987
VAT GAP	43134	42275	39689	40387	34921
VAT GAP as a percent of VTTL	27%	27%	24%	24%	21%
VAT GAP change since 2012					-6 pp

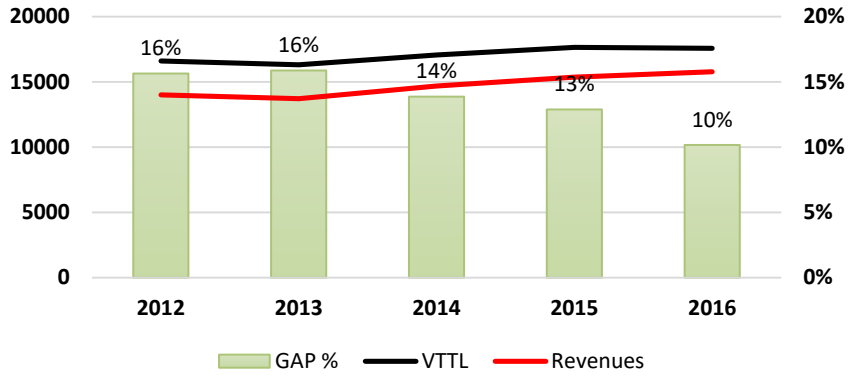


Highlights

- VAT compliance showed a significant improvement in 2016 (a decrease of 3.5 percentage points).
- In 2016, Poland introduced SAF-T for large economic operators.
- No significant changes regarding VAT system parameters were introduced.

Table 3.22. Portugal: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Portugal	2012	2013	2014	2015	2016
VTTL	16588	16295	17045	17640	17554
o/w liability on household final consumption	12371	12239	12818	13220	12953
o/w liability on government and NPISH final consumption	223	219	218	444	455
o/w liability on intermediate consumption	2654	2614	2657	2496	2730
o/w liability on GFCF	981	887	1017	1106	1038
o/w net adjustments	359	336	334	373	378
VAT Revenue	13995	13710	14682	15368	15770
VAT GAP	2594	2586	2363	2272	1784
VAT GAP as a percent of VTTL	16%	16%	14%	13%	10%
VAT GAP change since 2012					-5 pp

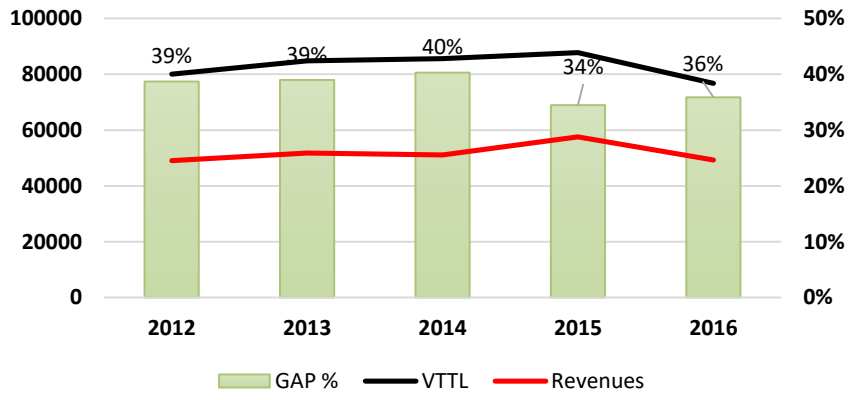


Highlights

- Portugal reduced the VAT rate for restaurants from 23 percent to 13 percent.
- The VAT Gap fell in 2016 by roughly 3 percentage points and continued downward trend.

Table 3.23. Romania: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (RON million)

Romania	2012	2013	2014	2015	2016
VTTL	80053	84811	85571	87783	76810
o/w liability on household final consumption	49115	49611	52014	52701	47038
o/w liability on government and NPISH final consumption	4932	4502	3795	3856	3730
o/w liability on intermediate consumption	8036	7907	9760	9598	7809
o/w liability on GFCF	15046	20944	16978	18959	15927
o/w net adjustments	2924	1848	3025	2669	2306
VAT Revenue	49066	51745	51086	57520	49253
VAT GAP	30987	33067	34485	30263	27557
VAT GAP as a percent of VTTL	39%	39%	40%	34%	36%
VAT GAP change since 2012					-3 pp

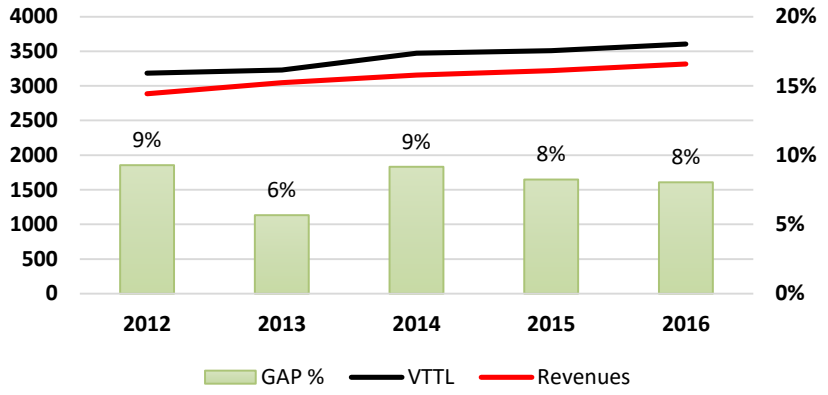


Highlights

- As of January 2016, Romania reduced its standard rate from 24 to 20. The change of the standard rate had a substantial impact on the effective rate, which fell from 17.2 to 13.5 percent.
- Despite the reduction of the rate, VAT non-compliance increased, and the VAT Gap amounted to nearly 36 percent of the VTTL.
- In relative terms, the VAT Gap in Romania was the largest in the EU.

Table 3.24. Slovenia: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Slovenia	2012	2013	2014	2015	2016
VTTL	3183	3229	3473	3507	3604
o/w liability on household final consumption	2285	2284	2442	2485	2587
o/w liability on government and NPISH final consumption	61	62	69	71	75
o/w liability on intermediate consumption	428	447	473	481	553
o/w liability on GFCF	303	334	401	394	315
o/w net adjustments	106	101	87	77	73
VAT Revenue	2888	3046	3155	3218	3315
VAT GAP	295	183	318	289	290
VAT GAP as a percent of VTTL	9%	6%	9%	8%	8%
VAT GAP change since 2012					-1 pp

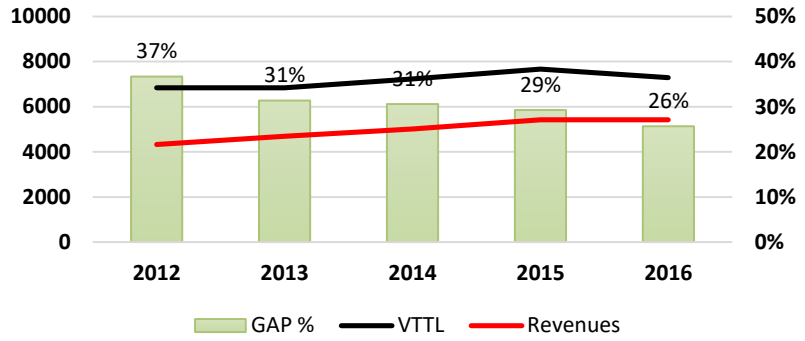


Highlights

- The VAT Gap in Slovenia remained stable and below the EU median.
- In 2016, the Gap accounted for 8 percent of the VTTL.
- No significant changes regarding VAT system parameters were introduced.

Table 3.25. Slovakia: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Slovakia	2012	2013	2014	2015	2016
VTTL	6836	6844	7235	7664	7292
o/w liability on household final consumption	5029	5101	5303	5397	5347
o/w liability on government final consumption	105	96	93	99	102
o/w liability on intermediate consumption	937	911	991	1088	992
o/w liability on GFCF	745	725	869	1093	856
o/w net adjustments	19	11	-20	-13	-5
VAT Revenue	4328	4696	5021	5420	5420
VAT GAP	2508	2147	2214	2243	1872
VAT GAP as a percent of VTTL	37%	31%	31%	29%	26%
VAT GAP change since 2012					-11 pp

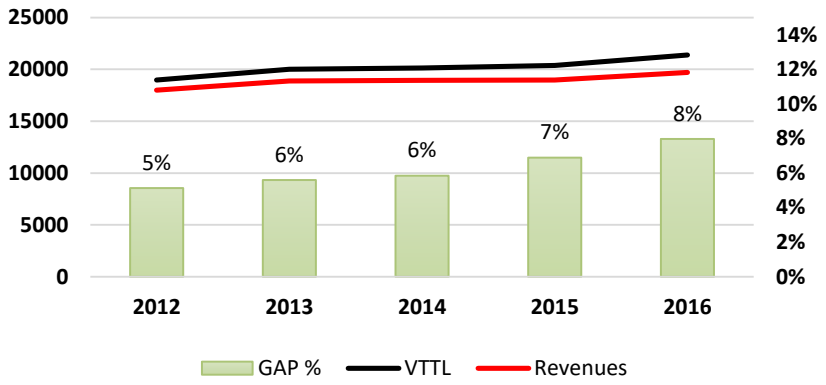


Highlights

- The VAT Gap in Slovakia continued its downward trend. Since 2012, the VAT Gap in Slovakia has fallen by 11 percentage points.
- In 2016, the VAT rate for basic foodstuffs was reduced to 10 percent.
- At the same time, the reverse charge was extended to industry supplies.

Table 3.26. Finland: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (EUR million)

Finland	2012	2013	2014	2015	2016
VTTL	18960	20008	20125	20379	21401
o/w liability on household final consumption	10513	11041	11074	11348	11680
o/w liability on government and NPISH final consumption	372	456	465	468	534
o/w liability on intermediate consumption	4030	4343	4485	4521	4721
o/w liability on GFCF	3570	3622	3498	3431	3794
o/w net adjustments	476	545	602	611	672
VAT Revenue	17987	18888	18948	18974	19694
VAT GAP	973	1120	1177	1405	1707
VAT GAP as a percent of VTTL	5%	6%	6%	7%	8%
VAT GAP change since 2012					+3 pp

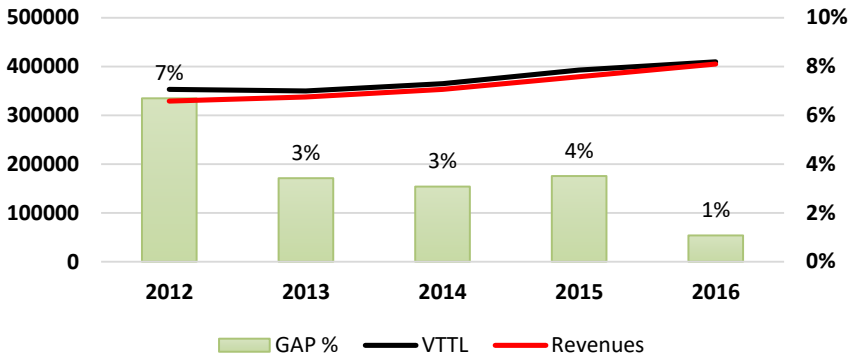


Highlights

- The VAT Gap in Finland was steadily increasing between 2012 and 2016.
- Despite the increase, Finland's VAT Gap is below the EU median.

Table 3.27. Sweden: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (SEK million)

Sweden	2012	2013	2014	2015	2016
VTTL	352947	349797	364667	392615	409394
o/w liability on household final consumption	185482	182545	188056	197358	203742
o/w liability on government and NPISH final consumption	18687	19231	19854	20499	21601
o/w liability on intermediate consumption	85395	86002	88515	95068	99573
o/w liability on GFCF	55764	56775	62428	73323	78032
o/w net adjustments	7620	5244	5814	6368	6446
VAT Revenue	329311	337823	353439	378830	404987
VAT GAP	23636	11974	11228	13785	4407
VAT GAP as a percent of VTTL	7%	3%	3%	4%	1%
VAT GAP change since 2012					-6 pp

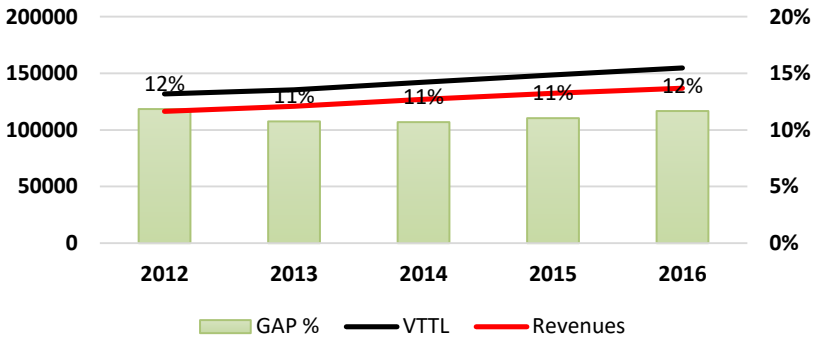


Highlights

- The revision of GFCF growth rates led to an upward revision of the VAT Gap in 2015.
- In 2016, the VAT Gap was the lowest in the EU and amounted to approximately 1 percent of the VTTL.

Table 3.28. United Kingdom: VAT Revenue, VTTL, Composition of VTTL, and VAT Gap, 2012–2016 (GBP million)

United Kingdom	2012	2013	2014	2015	2016
VTTL	131904	135335	142136	148617	154804
o/w liability on household final consumption	85343	88727	93847	99513	104178
o/w liability on government and NPISH final consumption	2558	2470	2812	3205	2788
o/w liability on intermediate consumption	29534	29719	31233	32126	33090
o/w liability on GFCF	12234	11436	12255	12535	12997
o/w net adjustments	2234	2984	1989	1237	1752
VAT Revenue	116283	120784	126946	132213	136743
VAT GAP	15621	14551	15190	16404	18061
VAT GAP as a percent of VTTL	12%	11%	11%	11%	12%
VAT GAP change since 2012					0 pp



Highlights

- The VAT Gap as a percent of the VTTL remained nearly stagnant between 2012 and 2016.
- No significant changes regarding VAT system parameters were introduced.

4. Policy Gap Measures

In this Chapter, we present an update of the series of estimates of the Policy Gap and its components for the EU-28.

As discussed in the 2016 Report, the Policy Gap captures the effects of applying multiple rates and exemptions on the theoretical revenue that could be levied in a given VAT system. In other words, the Policy Gap is an indicator of the additional VAT revenue that a MS could theoretically (i.e. in the case of perfect tax compliance) generate if it applied a uniform VAT rate on all goods and services. Due to the idealistic assumption of perfect tax compliance, the practical interpretation of the Policy Gap draws criticism. Nonetheless, the assumption of perfect VAT collectability is indispensable, as interdependencies between tax compliance and rate structure are not straightforward.

The Policy Gap could be further decomposed into different components of revenue loss, as we show in Section IV in Annex A. Such elements are, for instance, the Rate Gap and the Exemption Gap, which capture the loss in VAT liability due to the application of reduced rates, and the loss in liability due to the implementation of exemptions.

Moreover, following Barbone et al. (2013), the Policy Gap and its components could be further adjusted to address the issue of the extent to which the loss of theoretical revenue depends on the decisions of policymakers. Measures that exclude liability from the final consumption of "imputed rents" (the notional value of home occupancy by homeowners), financial services, and the provision of public goods and services, as charging them with VAT is impractical or beyond the control of national authorities, are named the "Actionable Gaps".

V. Policy Gap measures for 2016

The estimates of the Policy Gap, Rate Gap, Exemption Gap, Actionable Policy Gap, and Actionable Exemption Gap for the EU-28 MS are presented in Table 4.1.

For the EU overall, the average Policy Gap level was 44.8 percent, roughly 0.9 percentage points higher r than in 2015. More specifically, VAT from final consumption and investment, even in the case of 100 percent compliance, generates just slightly more than half of what it could bring in if taxed uniformly at the full rate. Of this 44.8 percent, 10 percentage points are due to the application of various reduced and super reduced rates (the Rate Gap).

According to the Rate Gap estimates, reduced rates are least applied in Denmark (0.93 percent) and Estonia (2.97 percent), and installing a uniform Standard Rate would generate less than 3 percent of notional additional revenue in these countries. On the other side of spectrum are countries with the highest Rate Gaps: Cyprus' revenue could increase by nearly 27 percent, and in Ireland, Luxembourg, Malta, and Poland, by more than 15 percent if they applied only the Standard Rate.

The Exemption Gap, or the average share of Ideal Revenue lost due to various exemptions, is 35 percent in the EU on average. MS with the highest Exemption Gap are Spain (46.71 percent) due to the application of other than VAT indirect taxes in the Canary Islands, Ceuta, and Melilla, the UK (44.47 percent), and Denmark (42.00 percent), whereas the lowest values of the Exemption Gap were observed in Cyprus (16.76 percent), Romania (24.88 percent), and Luxembourg (25.16 percent).

The largest part of the Exemption Gap is composed of exemptions on services that cannot be taxed in principle, such as imputed rents, the provision of public goods by the government, or financial services. The remaining level of the "Actionable" Exemption Gap is about 6.5 percent, on average.

The Actionable Policy Gap—a combination of the Rate Gap and the Actionable Exemption Gap—is, on average, 16.48 percent. This figure shows the combined reduction of Ideal Revenue due to reduced rates (9.95%) and exemptions (6.53%) which could possibly be removed. In other words, VAT revenue would increase by roughly 16.5 percent if MS applied the Standard Rate of VAT on the goods and services without exemptions that could be subject to such a rate.

Table 4.1. Policy Gap, Rate Gap, Exemption Gap, and Actionable Gaps

	A	B	C	D	E	F	G	H
	Policy Gap (%)	Rate Gap (%)	Exemption Gap (%)	o/w Imputed Rents (%)	o/w Public Services (%)	o/w Financial Services (%)	Actionable Exemption Gap (C - D - E - F) (%)	Actionable Policy Gap (G + B) (%)
BE	52.47	12.27	40.20	7.06	25.95	3.49	3.70	15.97
BG	29.00	3.66	25.33	9.88	13.16	1.29	1.00	4.66
CZ	38.49	6.12	32.37	8.30	16.92	2.30	4.85	10.96
DK	42.92	0.93	42.00	7.40	27.79	5.05	1.76	2.68
DE	44.38	7.25	37.13	6.72	21.61	2.78	6.03	13.28
EE	34.98	2.97	32.01	6.95	15.41	1.91	7.74	10.71
IE	49.39	16.72	32.67	10.05	23.07	-2.08	1.62	18.35
EL	47.55	7.32	40.24	9.61	17.36	1.90	11.36	18.67
ES	59.52	12.81	46.71	10.19	19.73	2.70	14.08	26.89
FR	52.43	11.87	40.57	9.32	22.19	3.16	5.89	17.76
HR	36.20	8.44	27.77	7.95	14.87	1.26	3.69	12.13
IT	53.78	14.91	38.87	10.92	19.43	1.52	7.01	21.92
CY	43.72	26.96	16.76	8.99	17.51	-6.21	-3.53	23.43
LV	41.70	3.07	38.63	10.04	15.69	0.63	12.27	15.34
LT	34.54	4.42	30.12	5.15	15.04	1.69	8.23	12.65
LU	40.50	15.34	25.16	8.23	-2.14	1.35	17.72	33.06
HU	45.26	5.13	40.12	7.44	20.40	3.55	8.74	13.88
MT	42.86	17.16	25.70	4.65	14.31	2.89	3.85	21.01
NL	51.53	11.15	40.38	6.48	25.64	5.93	2.34	13.49
AT	46.15	10.82	35.33	7.17	21.96	2.85	3.35	14.17
PL	48.69	15.32	33.37	3.82	15.52	3.66	10.37	25.69
PT	51.54	13.94	37.60	8.60	20.26	3.07	5.67	19.61
RO	33.94	9.06	24.88	9.41	10.55	0.20	4.72	13.78
SI	45.91	11.81	34.11	7.51	17.77	1.53	7.30	19.10
SK	38.84	2.53	36.31	6.62	18.40	3.00	8.29	10.82
FI	49.60	10.24	39.36	9.81	21.39	3.19	4.98	15.21
SE	46.32	8.07	38.26	5.37	20.47	-2.96	15.38	23.44
UK	53.06	8.31	44.74	11.77	19.66	3.74	9.57	17.88
EU-28	44.83	9.95	34.88	8.05	18.40	1.91	6.53	16.48

Source: *own.*

5. Econometric Analysis of VAT Gap Determinants

a. Literature Review

The seminal work on tax evasion is Allingham and Sandmo (1972). This was applied to personal income taxation. Within this theoretical framework, taxpayers decide the amount of tax evasion just as they would choose the composition of a risky investment portfolio—that is, depending on the expected return from evading taxes and given how they assess in terms of welfare the impact of the risk (risk-averse versus risk-neutral individuals). This is the deterrence model. The higher the penalty rate or the higher the tax audit probability, the lower the amount of tax evasion. An increase in the tax rate points to lower levels of evasion as long as the penalty is calculated based on the amount of evaded taxes rather than on the amount of evaded tax base (Yitzhaki, 1974). While the results of the model in terms of the marginal impact of the tax parameters on the level of evasion are sensible, its predictions—based on numerical simulations—regarding the level of tax evasion are not credible. The estimated level of tax evasion is too low given reasonable levels of the key tax parameters of the model—in particular, of the tax audit probability (see also the review by Andreoni et al., 1998).

In Allingham and Sandmo's (1972) model, the audit probability is fixed. This probably does not fit well with reality. Some taxpayers are more likely to be audited than others. Hence, the whole population cannot be condensed into a single model with a single tax audit probability. If so, as we observe in reality, the level of tax evasion will differ across groups of taxpayers. For example, employee taxpayers, whose income is subject to third-party reporting by means of withholding taxes, face a tax audit probability of one as long as they underreport income, which is in contrast with the self-employed. This causes noncompliance to differ across these two groups, with there being full tax compliance for those under third-party reporting (see, e.g., Kleven et al., 2011).

Therefore, the diversity of tax audit probabilities, which can be as high as one due to third-party reporting, reduces the discrepancy between the predicted levels of tax evasion by the deterrence model and reality. However, there are other factors that contribute to the explanation of higher levels of tax compliance with respect to those predicted by the deterrence model. One theoretical approach lies with the sense of civic duty to comply with tax obligations, regardless of the financial incentives taxpayers face. That is, individuals are intrinsically motivated to comply with the law, a line of reasoning that has been developed by the literature on "tax morale" (see a recent survey by Luttmer and Singhal, 2014). Evasion might also be determined by the attitude of taxpayers towards tax authorities, such as if they view legal authorities as legitimate (Tyler, 2006) or if taxpayers feel

active in the decision making process (Alm et al., 1993). Hence, in the end, the level of tax morale might also be contingent on the taxpayers' institutional and social context.

Most of the literature on tax evasion has been applied to personal income taxation; or, we should rather say, to situations where the potential evader is an individual. Nevertheless, as we will see in the next section, in the case of VAT, it is crucial to distinguish between individuals (final consumers and the self-employed) and corporations, as they both play a role in the decision to evade VAT. In the case of corporations, whether the standard models of tax evasion apply or not depends on whether the penalty for tax evasion applies to shareholders or to the tax director (Crocker and Slemrod, 2005). From now on, we will assume that the basic results of the literature regarding the determinants of tax compliance also apply to corporations. In any case, next, we will make clear what variables might explain the incentives to generate a tax gap taking into account the peculiarities of the tax under study: the VAT.

b. Econometric Model and Estimation Results

It is key to recall that in the EU, VAT is based on an invoicing mechanism. In any transaction, the seller issues an invoice and charges the *output tax* to the buyer. That amount of money minus the amount of VAT paid by the seller (*input tax*) has to be transferred to the tax administration. This is the basis of the self-enforcement mechanism, which *a priori* promotes voluntary tax compliance;[6] the seller has incentives to charge the tax in order to get back the money from input taxes. An exception to this lies in the incentives of final consumers. As they will not be able to deduct the input tax, they face *some* incentives to evade taxes. However, they require that the retailer accedes not to charge the output tax. Hence, they both play a role in the decision to evade taxes. This is a legal framework that departs from the theoretical models reviewed in Section V.a. and has to be acknowledged when one attempts to identify the determinants of non-compliance in VAT. As we will explain below, another situation that might generate a VAT Gap is when the VAT chain (i.e. the duo output-input tax) is broken. Essentially, this relates to intracommunity and international transactions and will be explained below.

6 In fact, the theoretical literature has stressed this positive characteristic of the tax (i.e. self-enforcing mechanism) to justify its inclusion in the tax system despite the existence of a personal income tax (Boadway et al., 1994).

Basic Framework: the Agents Involved

In accordance with our previous explanations, there are two private agents involved in our tax setting: the seller and the buyer. There is also the tax administration. The peculiar incentives of each agent are explained next.

(i) Private Agents

As we described in Section V.a., VAT is a tax where the incentives for self-enforcement might mitigate the existence of fraud. This is why the literature defines VAT as a "money machine" (Keen and Lockwood, 2006). As long as the chain of VAT is not broken, all involved agents—who have previously paid the input tax and will claim this amount to the tax administration—have incentives to charge the tax to the purchaser (output tax). That is, under a very simplified setting, the producer charges the wholesaler, the latter charges the retailer, and, lastly, the retailer charges the final consumer. VAT facilitates tax enforcement by generating paper trails on transactions between firms (Pomeranz, 2015).

In the last stage, as the final consumer cannot deduct VAT, she does not have incentives to pay the tax. Evasion at this final stage, though, requires the intervention of both the final consumer and the retailer; in particular, as Fedeli and Forte (1999) argue, given both agents' incentives, the final outcome will be the result of a negotiation between both sides of the transaction. While the incentive to evade on the consumer side is a necessary condition, this is not sufficient, as she needs the involvement of the seller. All in all, in an econometric model, to estimate the determinants of VAT Gap, we need to include variables proxying the behaviour of both private agents. Note that as long as the retailer faces a "demand" by the final consumer not to charge the tax, the retailer might also try to negotiate with the wholesaler not to pay the input tax, and analogously to previous phases of the productive chain. There might be a cascade tax evasion effect upwards.

As is noted in the introduction to the Report, VAT Gap is not only a measure of tax evasion. It also includes VAT lost due to, for example, insolvencies, bankruptcies, administrative errors and legal tax optimisation, and criminal activities, namely tax fraud. The other components of the Gap are also addressed by this analysis.

The two most popular schemes are distinguished as potential sources of tax fraud. First, we distinguish a scheme where a fraudulent trader supplies goods to other businesses, collects the VAT due on the supply from his customers, and disappears before remitting the VAT to the tax authorities. This type of fraud exists in the zero-rated intra-Community supply of goods and is called Missing Trader Intra-Community (MTIC). In recent years, MTIC became one of the main sources of VAT non-compliance. MTIC fraud may take different forms and sizes, but the basic idea behind it is essentially the same and relies on the fact that no VAT is chargeable on cross-border transactions between two or more EU MS.

Secondly, we control for the possible non-payment of VAT on imports to the European Common Market (ECM) under the Customs Procedure Code 42 (CPC42). This procedure is applied when

goods enter the EU in one MS and later, under duty-suspension, are transported to another MS. In such cases, the VAT is only due in the latter—the country of destination. As the VAT chain is broken, there is a risk of fraud, either if the imports remain in the MS of importation without payment of VAT or if the imports are consumed in the country of destination without VAT being collected there. Consequently, the effectiveness of this special regime—that is, that the chain of VAT should be initiated in the country of destination—depends on the control of customs at the entry country and on coordination with the destination tax administration.

In summary, we have two different scenarios as far as VAT fraud is concerned. In the first one, generally a basic B2C domestic transaction, the VAT chain is not broken and both agents involved in the corresponding transaction are located in the same MS. In this setting, our empirical framework should take into account the incentives (or level of ease) of consumers and sellers to evade. In the second one, the VAT chain is broken, and we should account for the importance of CPC42 by country. We will explain later what variables might pick up both types of scenarios, with a particular emphasis—due to data availability and research focus—on the first situation.

(ii) Tax Administration

Given the incentives of taxpayers to evade taxes, the role of the tax administration involves diminishing its impact (see the recent review by Slemrod and Gillitzer, 2014). To do so, the tax administration might promote tax compliance—that is, it might attempt to reduce the existence of tax fraud in advance (*ex-ante control*). But given its existence, it might try to reduce it by means of the efforts of tax inspectors in discovering it (*ex-post control*). Consequently, tax administrations make ex-ante and ex-post efforts, although it is particularly desirable—aligned with a collaborative tax administration (IMF, 2015; or OECD, 2017)—to promote voluntary tax compliance. Regarding the incentives to comply with the tax law, the deterrence model described in Section V.a. fits well with *ex-ante* control incentives.

In our empirical framework, we estimate the impact of the *ex-ante* role of the tax administration. This focus is due to the nature of our endogenous variable. According to the literature, we estimated the *gross* tax gap—that is, the gap before the tax administration has carried out any effort to close it by means of tax auditing. Therefore, we account for variables proxying the impact of the administration on voluntary tax compliance.

Basic Framework: Variables to Explain Agents' Incentives

In this Section, in accordance with the agents involved in VAT transactions (including the tax administration), we identify the variables we employed to estimate their (positive or negative) impact on the VAT Gap.

(i) Private Agent Variables

Private agents' behaviour will be mediated by the incentives created by the tax administration—that is, the deterrent effect as we explained in Section V.a. The variables picking up this effect will be described in detail (definition, statistical descriptives, and data sources) in the section about the tax administration's variables. Independent of these variables (basically, efforts of the tax administration to force tax compliance), there are other incentives that might also have an impact on taxpayers' incentives.

As we explained in the basic framework, individuals[7] may have an intrinsic incentive to comply with the tax law. That is, they might show a given level of tax morale. Tax morale is certainly an intrinsic motivation, but there are also context factors that could affect it. In particular, *Age structure* (*Age*), usually the literature assumes that older people are more aware of the benefits of adopting a prosocial behaviour. Hence, we will include in the regression the percentage of people over 50 years old as a proxy of tax morale.[8]

Age structure could be picking up other factors with an impact on the VAT Gap. This is why its estimate should be taken with caution. As we will explain later, we estimate a fixed effects model, and while the fixed effect itself cannot be economically interpreted, the fixed effects will capture the intrinsic factors which explain tax morale.

Taxpayers might suffer from liquidity constraints. If so, tax evasion could be interpreted as a risky loan where the expected penalty rate is part of the financial cost (Andreoni, 1992). In fact, this constraint could affect both businesses (either incorporated or not) and final consumers. We will control for this potential impact through the unemployment rate (*Unemp*). The incentive to free ride, and so to avoid paying taxes, can also be affected by the perception of how well public revenues are spent or by the perception about the performance of the public sector, as we explained earlier. In particular, as Godin and Hindriks indicate (2015, p. 47), the quality of the government—that is, the degree of independence the tax administration from political pressures, but also the quality of policy formulation and implementation—affects the effectiveness of the tax system (Godin and Hindriks, 2015). We will account for this potential impact by means of a country variable of government effectiveness (*Gov't Effect*), which was constructed by the World Bank.

Most of the previous variables have to do with an individual's (including the self-employed) incentives to comply with tax law. The exception is probably the variable picking up the existence of liquidity constraints, although Andreoni's (1992) theoretical analysis focuses on individuals.

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7 As we explained in this section, by individuals we strictly refer to final consumers and the self-employed (when they play the role of sellers of goods or services). However, for the sake of simplicity, we will assume incorporated firms also face the same incentives. In any case, what is also important to note here is that variables like age structure might also have an impact on sellers as long as those characteristics might create an incentive for them to engage in tax evasion activities. This is not crucial to our empirical analysis, as we only want to know what the determinants are rather than what is the role played by each agent.

8 This range of age might be too wide, but we wanted to include taxpayers who are still active; otherwise, if we define it in a more restrictive way (for example, above 65 years old), we would be picking up retired people, for whom the nature of their most likely main source of income (pensions) is very peculiar.

As we suggested, the main origin of the VAT Gap lies in the incentives of final consumers not to pay the tax. Hence, *ceteris paribus*, the productive structure of the economy could be important. This is why in our regression models we include as explanatory variables the productive structure of the country; in particular, we distinguish the following sectors: retail (*Sellers*), which could be the key sector, along with other labour-intensive sectors; as well as real estate (*Estate*), construction (*Constr*), industry (*Ind*), telecommunications (*Teleco*), and art (*Art*). The sum of all shares amounts to 100 percent once we have excluded those sectors that are not subject to or are exempted from VAT (such as health, education, or financial services). The success of our empirical model lies in the fact that our explanatory variables are time variant; otherwise, the influence would be captured as a fixed effect. Unfortunately for our purposes, VAT tax rates do not change very often; hence, we will not be able to estimate their impact on the Gap.[9] Instead, we will control for the dispersion of tax rates (within a country) (*Disp*)—that is, the standard deviation of tax rates given the potential existence of reduced and super-reduced tax rates, apart from the standard tax rate. In this case, there is more within-variation over time. We include this variable because of the potential effect that the dispersion of rates has on the VAT Gap, as the wider the dispersion, the greater the benefits from a misapplication of reduced and super-reduced rates.

Finally, as further controls in all regressions, we have included population (*Pop*) and GDP per capita (*GDPpc*).

(ii) Tax Administration Variables

To infer the impact of the tax administration, principally in accordance with the deterrence model, we will employ variables that promote voluntary tax compliance. In particular, we require variables that pick up the expected efforts of the tax administration to close the tax gap *ex-ante*. Hence, *ceteris paribus*, the greater the expected efforts of the administration, the greater the level of voluntary tax compliance, and so the lower the gross tax gap. This is the hypothesis we want to test with respect to the behaviours of the tax administration. Note that to account for expectations, we will include these variables lagged one period.

In particular, we have used the following three variables:

1. Scale of the Tax Administration (*Scale*), constructed as the ratio of total administrative costs divided by GDP;
2. Information and Technology Expenditure (*IT Exp*), constructed as the share of information and technology expenditures over total administrative costs; and
3. Public Deficit (*Def*), the tax administration might have greater incentives to close the tax gap and, in our case, to promote voluntary tax compliance when public finances are in a worse financial condition (Esteller-Moré, 2005).

9 Ideally, we would have liked to control for firm size as well. A priori, one could argue small firms are more likely (probably, due to relatively lower expected control from the tax administration) to accept the demand of final consumers not to charge the output tax. However, this variable does not show much within-variation over time. Thus, we have the same problem we found with VAT tax rates: we cannot identify its impact. This is left for future research.

The first variable is picking up the scale of the tax administration primarily through the number of tax professionals in the administration, and the second one is picking up the nature of that expenditure. In particular, we will test whether greater emphasis on information and technology promotes voluntary tax compliance either as a deterrent to fraud or simply as a way to facilitate the taxpayer to comply *ex-ante* with tax obligations.

Empirical Application

In this section, first, we provide an overview of the data we employ for the empirical analysis, and next, we explain the empirical methodology of the analysis and show the results.

(i) Descriptive Statistics and Sources

Table 5.1 shows the descriptive statistics of the variables used in the econometric model. For every variable, we have the number of observations, the unity of measure, the mean, the standard deviation, and the minimum and maximum values. There are 420 observations of VAT Gap. The average value of these observations is 16.45 percent, with a standard deviation of 10.51, a minimum value of -1.42 percent (Sweden, 2015), and a maximum of 49.28 percent (Romania, 2009). The ratio of total administrative costs divided by GDP (*Scale*) is available 290 times, with a mean value of 0.28 percent, a standard deviation of 0.46, a minimum value of 0.04 percent (Malta, 2004), and a maximum value of 5.75 percent (Slovakia, 2003). Finally, for example, the share of information and technology expenditures over total administrative costs (*IT Exp*), with 201 observations, has a mean value of 10.16 percent, a standard deviation of 6.96, a minimum value of 0.1 percent (Malta, 2012), and a maximum value of 27.8 percent (Finland, 2012).

Table 5.1. Descriptive Statistics and Data Sources

VARIABLES	SOURCE	OBS	MEAN	STD DEV	MIN	MAX
Vat Gap (Vatgap)	2013, 2014, 2015, 2016 and 2017 Study	420	0.16	0.11	-0.01	0.49
Retail sellers (Sellers)	Eurostat	448	0.31	0.05	0.13	0.44
Real estate (Estate)	Eurostat	448	0.14	0.04	0.07	0.28
Construction (Constr)	Eurostat	448	0.09	0.02	0.03	0.19
Industry (Ind)	Eurostat	448	0.30	0.07	0.12	0.55
Telecommunications (Teleco)	Eurostat	448	0.07	0.02	0.04	0.16
Art (Art)	Eurostat	448	0.05	0.02	0.02	0.21
Dispersion of tax rates within a country (Disp)	Own, based on DG Taxud	436	0.07	0.03	0.00	0.12
Unemployment (Unemp)	Eurostat	448	0.09	0.04	0.02	0.28
Government effectiveness (Gov't Effect)	World Bank	448	1.15	0.62	-0.37	2.35
Age structure (Age)	Eurostat	448	0.35	0.03	0.26	0.43
Information and technology expenditure (IT Exp)	OECD	201	0.10	0.07	0.00	0.28
Scale of the tax administration (Scale)	OECD	290	0.00	0.00	0.00	0.06
Public deficit (Def)	Eurostat	413	-0.03	0.04	-0.32	0.07
Population (Pop)	Eurostat	448	1.78	2.25	0.04	8.25
GDP per capita (GDPpc)	Eurostat	446	23.73	10.89	5.60	77.40

(ii) The Empirical Model

In order to test the impact of the different actors on the VAT Gap, we estimate a fixed effects model. Our endogenous variable runs from 2000–2015 for the EU-28 MS and comes from the most recent vintages of the Study available.

A fixed effects model seems particularly appropriate, as one could argue some explanatory factors like the efforts of the tax administration or institutional variables might be correlated with many other factors that are not included in the regressions. As we suggested before, though, the drawback is that we will not be able to interpret the estimates of the fixed effects, nor will we be able to estimate the impact of the variables that show little within-country variation, as for example, level of VAT tax rates or firm size. This has to be explicitly acknowledged.

Analytically, the basic model we estimate is as follows:

$$VAT\ GAP_{it} = \beta_1 Age_{it} + \beta_2 Unemp_{it} + \beta_3 Gov't\ Effect_{it} +$$
$$+ \beta_4 Sellers_{it} + \beta_5 Estate_{it} + \beta_6 Constr_{it} + \beta_7 Ind_{it} + \beta_8 Teleco_{it} + \beta_9 Art_{it} + \beta_{10} Disp_{it} +$$
$$+ \beta_{11} Scale_{it-1} + \beta_{12} IT\ Exp_{it-1} + \beta_{13} Def_{it-1} +$$
$$+ \beta_{14} GDPpc_{it} + \beta_{15} Pop_{it} + \beta_{16} Pop^2{}_{it} + Fixed\ Effects + Time\ Effects + Error\ Term_{it}$$

Our endogenous variable, VAT Gap of country *i* in year *t*, is explained by a set of variables as indicated above. In the first row, there are the variables related to final consumers; in the second row, we include the variables related to the behaviour of firms; and in the third row, lagged one period to account for expectations, there are the variables related to the behaviour of the tax administration. Finally, in the fourth row, there are the control variables, including fixed effects (a variable for each country that remains unchanged along time), time effects (a common variable for all countries that varies along time), and the error term with the usual statistical properties. The beta coefficients are the estimates of the impact of a given variable on our endogenous variable. With the exception of *Pop*, we expect the impact of all variables to be linear—that is, to be independent of the value of the variable. However, due to its potential interest for policymakers, we will also test whether the impact of the variables under direct control of the tax administration is non-linear. This could imply that its impact holds from a given value of the explanatory variable onwards or that its impact vanishes when the variable has reached a given threshold.

Empirical Results

We have proceeded parsimoniously—that is, we have tested one group of factors after another, and in the end, we have tested all groups simultaneously. In all models, though, we control for population (and its square), VAT tax rate dispersion, and GDP per capita. Next, we discuss the results, which are shown in Table 5.2.

In column 1, we have tested the importance of only those factors picking up the impact of the tax administration. All estimated signs are the expected ones, although the estimate of *IT Exp* is not statistically significant. Thus, the greater the scale of the administration or the greater the importance of IT expenditure and of the public deficit, the lower the level of the VAT Gap. These estimates have to be taken with caution, though, as we have not included all variables that might have an impact on the Gap (the last two columns of the table present the results of the model including all variables). However, we can use these first results as an example of the quantitative explanation of the estimates. For example, when *Scale* increases by 0.1 percentage points (pooled average of the sample = 0.3 percent over GDP), the Gap decreases by 0.18 percentage points (pooled average = 16.45 percent).

Similarly, in column 2, we have included only those factors that might explicitly affect seller behaviour. In column 3, we have included only those explicitly affecting final consumers. In column 4,

we have included the three groups of factors simultaneously, and in column 5, with respect to the previous model, we have added the tax administration variables squared (in particular, *Scale* and *IT Exp*). In this way, as we have already said, we are able to conclude whether the impact of a given variable starts from a given threshold of that variable or whether it vanishes when it reaches a given threshold. From now on, we will discuss the results from the most complete model, shown in column 5, whose estimates are the most reliable.

Regarding the variables affecting firms, we see that the productive structure of the economy exerts an impact on the VAT Gap. The residual category is agriculture; hence, the estimates have to be interpreted as whether the share in a given sector has an impact on VAT with respect to the impact of agriculture. As expected due to the fact that they are the ones that have a direct relationship with final consumers, the share of retailers (*Sellers*) has the biggest impact on the VAT Gap; however, telecommunications, industry, and art (in this case, the estimate is hardly significant) also have an impact. In all cases, the impact is positive—that is, in favour of a larger tax gap. A higher dispersion of tax rates shows a positive impact, also as expected, but the estimate is not statistically significant. Regarding the variables affecting individuals, we see that although the signs of all estimates related to "tax morale" make sense (the higher the share of older people, the higher the perception of government effectiveness), their estimates are not statistically significant. In contrast, the higher the unemployment rate (as a proxy of "liquidity constraints"), the higher the level of the tax gap (this estimate is statistically significant at the 90 percent confidence level).

Hence, liquidity constraints and the productive structure of the economy play a role in the VAT Gap, but they cannot be directly affected by the tax administration. In spite of this, the added value of this type of analysis is making the tax administration aware of the exogenous constraints it faces regarding the VAT Gap. That is, efforts to reduce the tax gap should be larger when the economy suffers liquidity constraints, or when the productive structure is such as the one described before.[10]

Probably, though, the most interesting results from column 5 have to do with the impact of the variables under the direct control of the tax administration. For instance, if the impact of *Scale* is always negative (lower VAT Gap), as in column 4, one could argue that the size of the tax administration should be larger with no limit.[11] However, testing non-linearities as we do in column 5 allows us to be more precise.[12] This is shown in Figure 5.2. Technically, the relationship between *Scale* and the VAT Gap is concave (first, positive, and then, negative).[13] In particular, if *Scale* is below 2.4 percent, the marginal impact of that variable is very small, and if at all, negative. From this point

10 Another potential explanatory variable – which we left for future research – would be the share of labour as an input factor at the aggregate level by country.

11 See the caveats about the optimal size of the tax administration, though, Slemrod and Yitzhaki (1987).

12 Data on IT expenditure is limited—that is, there is missing data. On top of this, as we will see, the impact of this variable, albeit statistically significant, is small. This is why we have replicated the regressions of column 4 without this data limitation, and the qualitative results remain unchanged.

13 This exercise of simulation has been carried out varying marginally the key variable (*Scale* or *IT Exp*) and maintaining constant—at their average values—the rest of covariates.

on, the impact is positive until reaching a threshold of 5.5 percent. Further increases of the Scale are unproductive. Given the caveats expressed in the footnote, we can only conclude that the optimal size of the tax administration—taking into consideration only its impact on the VAT Gap—is no larger than 5.5 percent (recall, administrative expenditure as a percentage of GDP). In that graph, we see that marginal productivity (variations of the Gap when *Scale* varies) is higher with higher levels of IT expenditure.

Similarly, in Figure 5.1, we provide a numerical simulation with respect to *IT Exp*. In this case, the impact is convex, albeit small. Here, productivity vanishes when IT expenditure is approximately 9.8 percent of the total expenditure of the tax administration. And again, both tax administration variables reinforce with each other. That is, the positive impact of *IT Exp* is larger, the larger the scale of the tax administration. In the graph, we show only average scale and minimum scale, as the maximum scale (approximately 5.8 percent) is above the threshold found in Figure 5.1.

Finally, note the impact of GDP per capita is not statistically significant. The impact of population is statistically significant and non-linear, and, in particular, concave. Concerning levels of population, below 51 million inhabitants, the marginal impact is positive (i.e. in favour of a higher VAT Gap); from 51 million to 74 million, the impact is null (there is no difference between increasing one inhabitant there being 51 million or 74 million inhabitants); from 74 million onwards, the impact is in favour of lower levels of the VAT Gap (recall in our sample, the greatest number of inhabitants is 82.5 million). While the cause of this population pattern is unknown, it is clear that either being a small country or an extremely large country is beneficial for the VAT Gap.

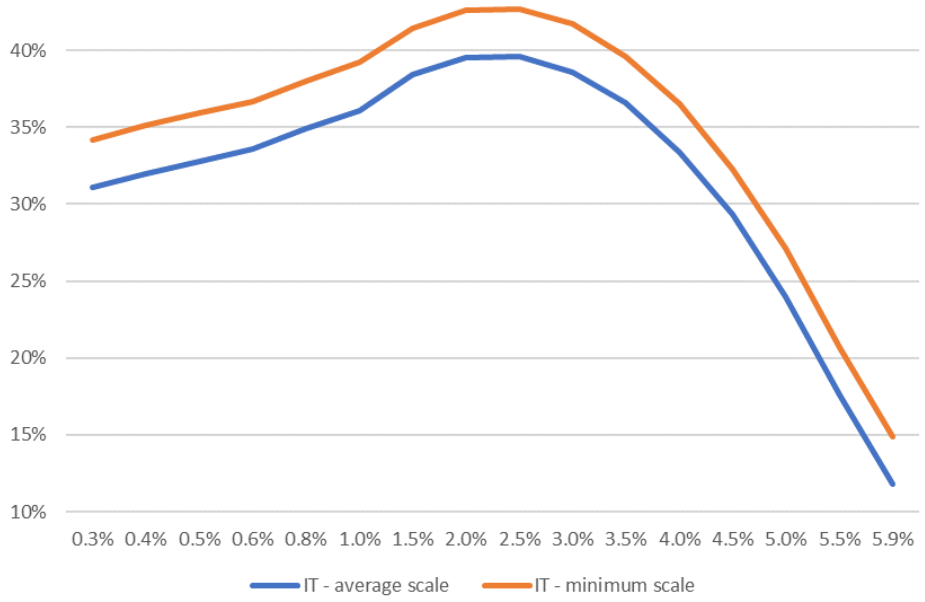
We have also performed an empirical analysis to test the impact of CPC42 on the VAT Gap. We do not show the results here since there are severe data limitations. The data only runs from 2011 to 2015. We have constructed a proxy for CPC42 procedures. In particular, we have the amount of imports under this procedure by country. Then, as a first proxy, we attempt to explain VAT Gap in country *i* with the share of imports under this procedure with respect to total imports. As a second proxy, we have constructed an alternative which attempts to impute total imports under this procedure by country (independently of the country where they entered the EU). In order to do so, we use the total amount of CPC42 at the EU level and impute them by country according to the share of each country out of total EU imports. In both cases, the estimate is positive (in favour of more VAT Gap). However, here we have met data limitations. This is why the estimates of this procedure should be taken with caution. This is also why this variable is not included in our basic model.

Table 5.2. Estimation of the Determinants of VAT GAP. Fixed Effects Specification

VARIABLES	(1) VAT GAP	(2) VAT GAP	(3) VAT GAP	(4) VAT GAP	(5) VAT GAP
Retail sellers		0.539		1.557**	2.394**
		(0.491)		(0.638)	(0.997)
Real estate		0.211		0.633	1.070
		(0.371)		(0.770)	(1.028)
Construction		0.0968		1.361	2.048*
		(0.507)		(0.908)	(1.131)
Industry		0.579		1.663**	2.258**
		(0.479)		(0.720)	(1.042)
Telecommunications		-0.0743		1.616*	2.156**
		(0.689)		(0.816)	(1.045)
Art		1.921***		1.586	1.890*
		(0.503)		(0.959)	(1.038)
Dispersion of tax rates within a country	0.549*	0.277	0.393**	0.549*	0.362
	(0.295)	(0.210)	(0.157)	(0.322)	(0.264)
Unemployment			0.223	0.347	0.412*
			(0.177)	(0.223)	(0.204)
Government effectiveness			0.0531*	-0.0304	-0.0202
			(0.0301)	(0.0363)	(0.0381)
Age structure			1.309	-0.512	0.129
			(0.789)	(0.918)	(0.795)
Information and technology expenditure (-1)	-0.191			-0.131	-0.445*
	(0.116)			(0.0968)	(0.246)
Scale of the tax administration (-1)	-1.757***			-2.380***	10.57**
	(0.345)			(0.483)	(4.312)
Information and technology expenditure (-1)^2					1.203*
					(0.699)
Scale of the tax administration (-1)^2					-223.0***
					(73.91)
Public deficit (-1)	-0.220**			0.0285	-0.0121
	(0.0888)			(0.124)	(0.103)
Population	0.924***	0.416**	0.528***	0.743***	0.610***
	(0.308)	(0.154)	(0.174)	(0.260)	(0.214)
Population ^2	-0.0708***	-0.0330**	-0.0383**	-0.0603***	-0.0481***
	(0.0237)	(0.0132)	(0.0146)	(0.0195)	(0.0158)
GDP per capita	0.00126	-0.000787	0.000462	-0.00230	-0.00109
	(0.00212)	(0.00212)	(0.00208)	(0.00254)	(0.00204)
Constant	-1.060***	-0.794	-1.035**	-1.928***	-2.663***
	(0.372)	(0.507)	(0.374)	(0.682)	(0.883)
Observations	187	418	418	187	187
R-squared	0.259	0.233	0.188	0.341	0.380
Number of countries	28	28	28	28	28

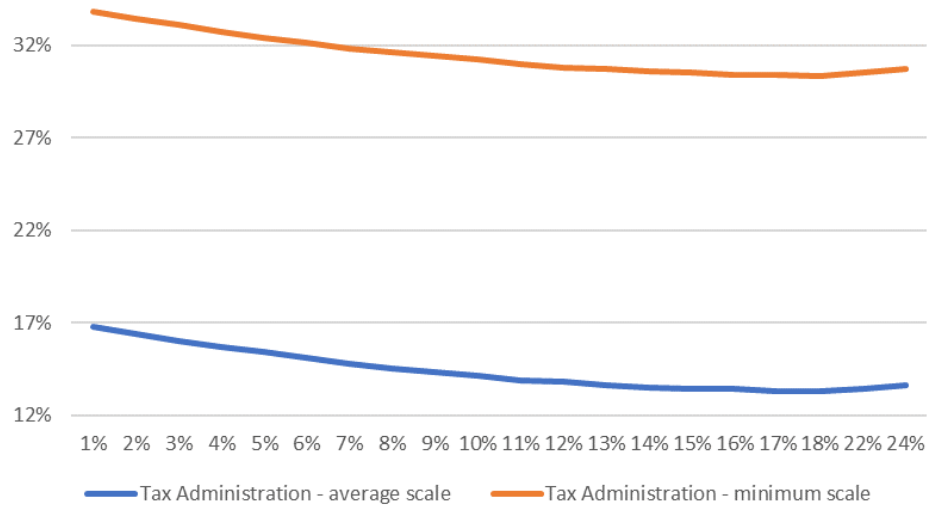
Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Figure 5.1. Impact of Administrative Scale of the Tax Administration on VAT Gap, Contingent on IT expenditure



Source: *own calculations.*

Figure 5.2. Impact of IT on VAT Gap, Contingent on Tax Administration Scale



Source: *own calculations.*

Annex A. Methodological Considerations

I. Source of Revisions of VAT Gap Estimates

Every year, the estimates of the VAT Gap are updated and revised backwards. There are three different sources of such revisions:

1) Updates in the underlying national accounts data published by Eurostat: updates in VAT revenues, new supply and use tables, and revised industry specific growth rates, among others.
2) Updates in the estimated GFCF liability, based on the new information from the own resource submissions (ORS) on taxable shares of GFCF by five sectors: households, government, NPISH, and exempt financial and non-financial enterprises.
3) Revision of the parameters of the VTTL model: effective rates, pro-rata coefficients, and net adjustments, either due to new information from ORS or due to correcting errors in the previous computation.

The most significant revisions in 2016 concerned liability from GFCF in Germany and Sweden. The use of more accurate estimations led to an upward revision of the VAT Gap in Sweden above 0. In Slovakia and Lithuania, the revisions concerned the liability from government consumption. Thanks to the figures on individual government consumption delivered by MS Authorities, the Gap in these MS was revised downwards for the entire period of the analysis.

II. Decomposition of VAT Revenue

As VAT Revenue (VR) is the difference between the VTTL and the VAT Gap (, and the VTTL is a product of the effective rate and the base (), VAT revenue could be decomposed using the following formula:

$$VR = VTTL \times VAT\ compliance = effective\ rate \times base \times \left(1 - \frac{VAT\ Gap}{VTTL}\right)$$

Thus, the year-over-rear relative change in revenue is denoted as:

$$\frac{\Delta VR}{VR} = \frac{\Delta(effective\ rate)}{effective\ rate} \times \frac{\Delta base}{base} \times \Delta\left(1 - \frac{VAT\ Gap}{VTTL}\right) \Big/ \left(1 - \frac{VAT\ Gap}{VTTL}\right)$$

where $\frac{\Delta(effective\ rate)}{effective\ rate}$ denotes change in effective rate, $\frac{\Delta base}{base}$ denotes change in base, and $\Delta\left(1 - \frac{VAT\ Gap}{VTTL}\right) \Big/ \left(1 - \frac{VAT\ Gap}{VTTL}\right)$ denotes change in VAT compliance.

III. Data Sources and Estimation Method

The "top-down" method that is utilised for VAT Gap estimation relies on national accounts figures. These figures are used to estimate the VAT liability generated by different sub-aggregates of the total economy. The VTTL is estimated as the sum of the liability from six main components: household, government, and NPISH final consumption; intermediate consumption; GFCF; and other, largely country-specific, adjustments.

In the "top-down" approach, VTTL is estimated using the following formula:

$$VTTL = \sum_{i=1}^{N} (rate_i \times Value_i) + \sum_{i=1}^{N} (rate_i \times propex_i \times IC\ Value_i) + \sum_{i=1}^{N} (rate_i \times propex_i \times GFCF\ Value_i) + net\ adjustments$$

Where:
Rate is the effective rate,
Value is the final consumption value,
IC Value is the value of intermediate consumption,
Propex is the percentage of output in a given sector that is exempt from VAT,
GFCF Value is the value of gross fixed capital formation, and
index *i* denotes sectors of the economy.

To summarise, VTTL is a product of the VAT rates and the propexes multiplied by the theoretical values of consumption and investment (plus country-specific net adjustments).

For the purpose of VAT Gap estimation, roughly 10,000 parameters are estimated for each year, including the effective rates for each 2-digit CPA (i.e. in the VTTL formula presented above) group of products and services and the percentage of output in a given sector that is exempt from VAT for each type of consumption (i.e. $propex_i$ in the VTTL formula presented above). For instance, for *Education services* (CPA no. 85) in Croatia, like for any other country and group of products and services, we estimated effective rates in household, government, and NPISH final consumption, as well as the percentage of output that is exempt from VAT. The main source of information is national accounts data and Own Resource Submissions (ORS), i.e. VAT statements provided by MS to the European Commission. In a number of specific cases where the ORS information was insufficient, additional data provided by MS was used. As these data are not official Eurostat publications, we decline responsibility for inaccuracies related to their quality.

A complete description of data and sources is shown in Table A1.

Table A1. Data Sources

	DESCRIPTION	PURPOSE	SOURCE	COMMENT
1	Household expenditure by CPA/COICOP category.	Estimation of effective rates for household final consumption for each 2-digit CPA category.	ORS / HBS[14]	...
2	The intermediate consumption of industries for which VAT on inputs cannot be deducted, pro-rata coefficients, alternatively share of exempt output.	Estimation of propexes.	ORS / assumptions common for all EU MS	...
3	Investment (gross fixed capital formation) of exempt sectors.	Estimation of VAT liability from investment.	ORS / Eurostat	Values forecasted two years ahead of available time series.
4	Government expenditure by CPA/COICOP category.	Estimation of effective rates for government final consumption for each 2-digit CPA category of products and services.	ORS	...
5	NPISH expenditure by CPA/ COICOP category.	Estimation of effective rates for NPISH final consumption for each 2-digit CPA category of products and services.	ORS	...
6	VTTL adjustment due to small business exemption, business expenditure on cars and fuel, and other country--specific adjustments.	Estimation of net adjustments.	ORS	In general, adjustments forecasted two years ahead of available time series.
7	Final household consumption, government final consumption, NPISH final consumption, and intermediate consumption.	Estimation of VTTL.	Eurostat	As national accounts figures do not always correspond to the tax base, two corrections to the base are applied: (1) adjustments for the self-supply of food and agricultural products and (2) adjustments for the intermediate consumption of construction work due to the treatment of construction activities abroad. If use tables are not available for a particular year or available use tables include confidential values, use tables are imputed using the RAS method.[15]
8	VAT revenue.	VAT revenue.	Eurostat	...

14 Household Budget Survey, Eurostat.

15 RAS method is an iterative proportional fitting procedure used in a situation when only row and column sums of a desired input-output table are known.

IV. Derivation of the Policy Gap

In this section of the Annex, we define the concepts used in Chapter IV and discuss some of the methodological considerations.

We begin with the **Notional Ideal Revenue** that, by definition, should indicate an upper limit of VAT revenue (i.e. the revenue levied at a uniform rate in the environment of perfect tax compliance). As shown in Figure A1, ideal revenue is larger than VTTL and subsequently larger than VAT collection. However, due to the existence of exemptions, it does not capture the entire VTTL and tax collection. If no exemptions were applied, neither intermediate consumption nor the GFCF of the business sector would be the base for computing VTTL.

The problem arises when deciding whether investment by the non-business sector should be a part of the VAT base. According to the OECD (2014)[16], Notional Ideal Revenue is defined as the standard rate of VAT times the aggregate net final consumption. Multiplying the standard rate and final consumption would yield, however, lower liability than in the case where a country applied no exemptions, no reduced rates, and was able to enforce all tax payments. In real life, VTTL is comprised partially from VAT liability from investment made by households, government, and NPISH. In the case of the non-inclusion of this investment to the base, VTTL would be partially extended beyond the ideal revenue despite "no exemptions" present in the system (see Figure A1 (c)).

Policymakers can see the upper limit of VAT revenue by considering all final use categories of households, non-profit, and government sectors. Thus, in this Report, Notional Ideal Revenue is defined as the standard rate of VAT times the aggregate net final and net GFCF of the household, non-profit, and government sectors, as recorded in the national accounts (interdependence among the various concepts presented is shown in Figure A1).[17]

The **Policy Gap** is defined as one minus the ratio of the "legal" tax liability (i.e. the chunk of the Notional Ideal Revenue that, in the counterfactual case of perfect tax compliance, is not collected due to the presence of exemptions and reduced rates). The Policy Gap is denoted by the following formula:

Policy Gap = (Notional Ideal Revenue – VTTL)/Notional Ideal Revenue

The Policy Gap could be further decomposed to account for the loss of revenue. Such components are the **Rate Gap** and the **Exemption Gap**, which capture the loss in VAT liability due to the application of reduced rates and the loss in liability due to the implementation of exemptions.

The Rate Gap is defined as the difference between the VTTL and what would be obtained in a counterfactual situation, in which the standard rate, instead of the reduced, parking, and zero rates,

16 OECD (2014), "VAT Revenue Ratio (VRR)", in Consumption Tax Trends 2014: VAT/GST and excise rates, trends and policy issues, OECD Publishing, Paris.

17 National accounts for most countries report final consumption on a gross (i.e. VAT-inclusive) basis. Net consumption is estimated on the basis of the gross consumption recorded in the use tables, from which VAT revenues are subtracted.

is applied to final consumption. Thus, the Rate Gap captures the loss in revenue that a particular country incurs by adopting multiple VAT rates instead of a single standard rate (Barbone et al., 2015).

The Exemption Gap is defined as the difference between the VTTL and what would be obtained in a counterfactual situation, in which the standard rate is applied to exempt products and services, and no restriction of the right to deduct applies.[18] Thus, the Exemption Gap captures the amount of revenue that might be lost because of exempted goods and services. Note that the Exemption Gap is composed of the loss in the VAT on the value added of exempt sectors, minus the VAT on their inputs, minus the VAT on GFCF inputs for these sectors. Thus, in principle, the Exemption Gap might be positive or negative (if the particular sector had negative value added, or if it had large GFCF expenditures relative to final consumption) (Barbone et al., 2015).

In algebraic terms, we have the following:

Definitions:

$T_i^{*,E} = \frac{VTTL_i^{*,E}}{C_i}$ – effective rate for group *i* of products in the case where the standard rate instead of the zero rate, parking rate, or reduced rate is applied (for final consumption and the GFCF of non-business activities).

$VTTL_i^{*,E}$ – liability from final consumption GFCF of non-business activities of group *i* of products, in the case of the standard rate instead of the zero rate, parking rate, or reduced rate is applied. Actual liability from intermediate consumption and GFCF of business activities is assumed.

$T_i^{*,R} = \frac{VTTL_i^{*,R}}{C_i}$ – effective rate for group *i* of products in the event where exempt products within the group are taxed at the standard rate.

$VTTL_i^{*,R}$ – liability from **final consumption** of group *i* when exempt products within the group are taxed at the standard rate. Actual liability from final consumption GFCF of non-business activities is assumed.

τ_s – statutory rate.

$i \in (1; 65)$ – sectors of the economy.

18 *The additive decomposition of the Policy Gap into the Exemption and Rate Gap presented in this Report differs from that in Keen (2013). Keen (2013) defines the Rate Gap as the loss from applying reduced and zero rates to the final consumption liability, measured as a percentage of the Notional Ideal Revenue. The Exemption Gap measures unrecovered VAT accumulated in the production process as a percentage, on the contrary, of final consumption liability. Due to these definitions, the Policy Gap can be split multiplicatively into gaps attributable to reduced rates and exemptions. Since the numerator of the "[1 – Rate Gap]" and denominator of the "[1 – Exemption Gap]" are equal, multiplication of these two components yields – VAT revenue as a percentage of Notional Ideal Revenue, which equals "[1 – Policy Gap]"* (Barbone et al., 2015).

Policy Gap:

$$1 - P = \left(\frac{\sum_{i=1}^{N} T_i C_i}{\tau_s \sum_{i=1}^{N} C_i}\right)\left(\frac{\sum_{i=1}^{N} T_i^* C_i}{\sum_{i=1}^{N} T_i C_i}\right) = \left(\frac{\sum_{i=1}^{N} T_i^* C_i}{\tau_s \sum_{i=1}^{N} C_i}\right)$$

Exemption Gap:

$$1 - P_E = \left(\frac{\sum_{i=1}^{N} T_i C_i}{\tau_s \sum_{i=1}^{N} C_i}\right)\left(\frac{\sum_{i=1}^{N} T_i^{*,E} C_i}{\sum_{i=1}^{N} T_i C_i}\right) = \left(\frac{\sum_{i=1}^{N} T_i^{*,E} C_i}{\tau_s \sum_{i=1}^{N} C_i}\right)$$

Rate Gap:

$$1 - P_R = \left(\frac{\sum_{i=1}^{N} T_i C_i}{\tau_s \sum_{i=1}^{N} C_i}\right)\left(\frac{\sum_{i=1}^{N} T_i^{*,R} C_i}{\sum_{i=1}^{N} T_i C_i}\right) = \left(\frac{\sum_{i=1}^{N} T_i^{*,R} C_i}{\tau_s \sum_{i=1}^{N} C_i}\right)$$

By definition we have:

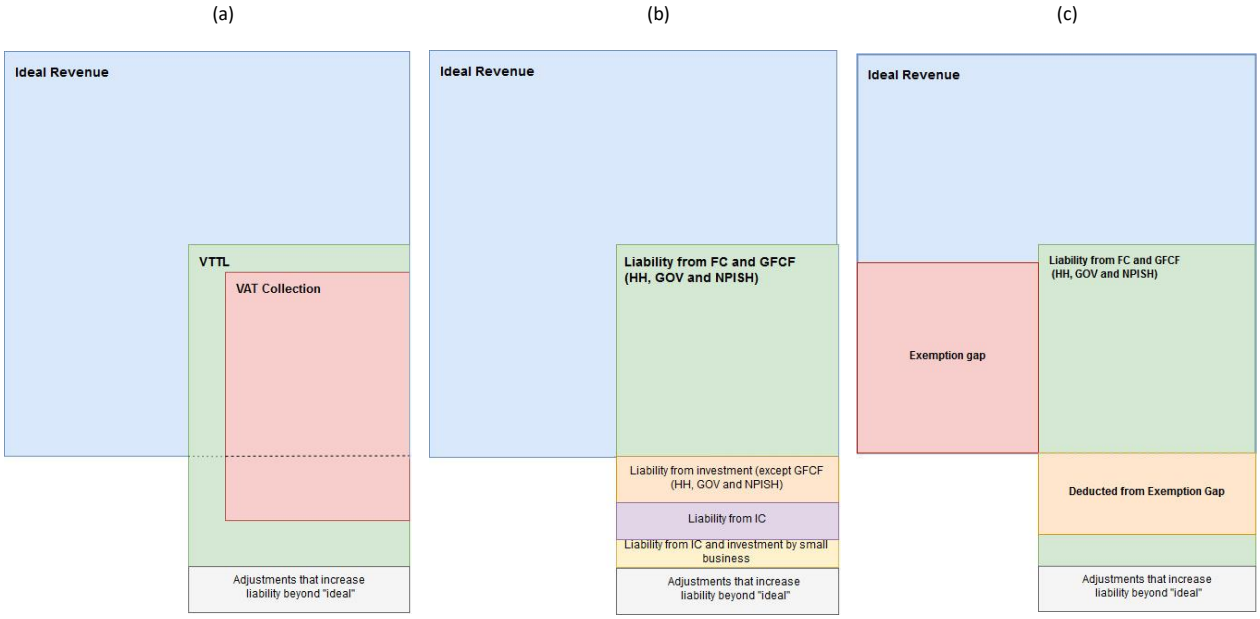
$$\begin{aligned}\tau_s \sum_{i=1}^{N} C_i &= \sum_{i=1}^{N} T_i^* C_i + \left(\tau_s \sum_{i=1}^{N} C_i - \sum_{i=1}^{N} T_i^* C_i\right) \\ &= \sum_{i=1}^{N} T_i^* C_i + \left(\tau_s \sum_{i=1}^{N} C_i - \sum_{i=1}^{N} T_i^{*,R} C_i\right) + \left(\tau_s \sum_{i=1}^{N} C_i - \sum_{i=1}^{N} T_i^{*,E} C_i\right)\end{aligned}$$

Thus:

$$\begin{aligned}P = 1 - \left(\frac{\sum_{i=1}^{N} T_i^* C_i}{\tau_s \sum_{i=1}^{N} C_i}\right) &= \left(\frac{\tau_s \sum_{i=1}^{N} C_i - \sum_{i=1}^{N} T_i^* C_i}{\tau_s \sum_{i=1}^{N} C_i}\right) = \left(\frac{2\tau_s \sum_{i=1}^{N} C_i - \sum_{i=1}^{N} T_i^{*,E} C_i - \sum_{i=1}^{N} T_i^{*,R} C_i}{\tau_s \sum_{i=1}^{N} C_i}\right) \\ &= P_R + P_E\end{aligned}$$

Using the above convention, one can decompose the Rate Gap and the Exemption Gap into the components indicating loss of the Notional Ideal Revenue due to the implementation of reduced rates and exemptions on specific goods and services. Such additive decomposition is carried out for the computation of, as defined by Barbone et al. (2015), the Actionable Exempt Gap, which excludes services and notional values that are unlikely to be taxed even in an ideal world.

Figure A1. Components of Ideal Revenue, VTTL, and VAT Collection



Source: *own.*

Annex B. Statistical Appendix

Table B1. VTTL (EUR million)

	2012	2013	2014	2015	2016
Belgium	31366	31212	30137	30906	31801
Bulgaria	4797	4659	4991	5117	5110
Czech Republic	14293	14491	13948	14903	15256
Denmark	27472	27687	27955	28546	28985
Germany	219031	223018	229735	236322	241463
Estonia	1724	1814	1911	1999	2118
Ireland	12187	11676	12675	13375	14436
Greece	19478	18807	17289	18243	20249
Spain	62924	69100	69637	71498	72557
France	164919	164004	170035	171547	175326
Croatia			5610	5941	6086
Italy	134955	134345	135427	136814	138945
Cyprus				1690	1746
Latvia	2071	2239	2207	2265	2290
Lithuania	3488	3614	3826	3880	4009
Luxembourg	3223	3545	3894	3523	3445
Hungary	11654	11554	11953	12611	12216
Malta	760	809	885	708	749
Netherlands	45971	47166	47414	49584	50581
Austria	26916	27744	27958	28529	29449
Poland	38091	37851	38802	39727	38483
Portugal	16588	16295	17045	17640	17554
Romania	17952	19192	19257	19747	17105
Slovenia	3183	3229	3473	3507	3604
Slovakia	6836	6844	7235	7664	7292
Finland	18960	20008	20125	20379	21401
Sweden	40550	40432	40080	41975	43236
United Kingdom	162670	159356	176322	204752	188906
EU-26 (2011–2013) EU-27 (2014) EU-28 (2015–2016)	1092059	1100691	1139826	1193392	1194398

Source: *own calculations.*

Table B2. Household VAT Liability (EUR million)

	2012	2013	2014	2015	2016
Belgium	17229	17586	17221	17572	18093
Bulgaria	3609	3451	3613	3707	3789
Czech Republic	9064	9303	8917	9333	9767
Denmark	15719	15992	16165	16530	16919
Germany	138335	139672	142430	145965	148972
Estonia	1202	1273	1338	1390	1459
Ireland	7495	7255	7486	7857	8164
Greece	13701	13498	12750	13508	15513
Spain	46291	50150	50920	52651	53713
France	96868	96883	100510	102187	105302
Croatia			4092	4205	4343
Italy	97495	95797	97232	99409	101204
Cyprus				1043	1070
Latvia	1634	1721	1759	1790	1862
Lithuania	2884	3020	3140	3177	3368
Luxembourg	1105	1129	1240	1320	1374
Hungary	8239	8221	8297	8564	8858
Malta	421	437	457	484	503
Netherlands	24745	25882	25363	26087	26636
Austria	18296	18984	18998	19224	19884
Poland	26020	26146	26878	27341	27187
Portugal	12371	12239	12818	13220	12953
Romania	11014	11227	11705	11855	10475
Slovenia	2285	2284	2442	2485	2587
Slovakia	5029	5101	5303	5397	5347
Finland	10513	11041	11074	11348	11680
Sweden	21310	21100	20669	21100	21517
United Kingdom	105249	104475	116419	137101	127127
EU-26 (2011–2013) EU-27 (2014) EU-28 (2015–2016)	698123	703867	729236	765850	769666

Source: *own calculations.*

Table B3. Intermediate Consumption and Government VAT Liability (EUR million)

	2012	2013	2014	2015	2016
Belgium	7716	7826	7498	7805	8056
Bulgaria	652	635	735	698	734
Czech Republic	3439	3501	3312	3535	3648
Denmark	7900	7793	7795	7868	7681
Germany	44029	45877	48769	50653	51155
Estonia	240	254	266	279	314
Ireland	3458	3231	3588	3718	3987
Greece	2669	2352	2185	2418	2503
Spain	10692	11206	11032	10841	11162
France	29784	30379	31310	31894	32320
Croatia			910	1086	1112
Italy	20343	20882	21097	20795	20917
Cyprus				512	515
Latvia	346	348	357	367	372
Lithuania	351	323	384	411	398
Luxembourg	791	851	905	1102	1078
Hungary	1990	1910	1961	2007	2036
Malta	293	320	364	131	163
Netherlands	12916	13565	13677	14027	13874
Austria	4663	4778	5060	5214	5296
Poland	7143	7060	7182	7655	7487
Portugal	2878	2833	2875	2941	3185
Romania	2908	2808	3050	3026	2570
Slovenia	490	510	542	552	628
Slovakia	1043	1006	1084	1187	1094
Finland	4401	4799	4951	4989	5255
Sweden	11958	12164	11911	12355	12797
United Kingdom	39578	37901	42234	48676	43781
EU-26 (2012–2013) EU-27 (2014) EU-28 (2015–2016)	222671	225112	235034	246742	244118

Source: *own calculations.*

Table B4. GFCF VAT Liability (EUR million)

	2012	2013	2014	2015	2016
Belgium	4895	4725	4739	4829	4948
Bulgaria	478	521	600	668	577
Czech Republic	1783	1690	1744	2048	1871
Denmark	3178	3179	3276	3402	3639
Germany	35350	36084	37176	38336	39948
Estonia	272	278	298	321	336
Ireland	1079	1031	1443	1629	2088
Greece	2853	2691	2114	2066	1947
Spain	5632	7353	7311	7601	7274
France	33496	31814	32831	32200	32638
Croatia			587	576	613
Italy	12770	13564	13305	13378	13615
Cyprus				115	152
Latvia	194	278	211	240	187
Lithuania	378	398	450	488	466
Luxembourg	317	306	351	392	409
Hungary	1169	1222	1506	1860	1168
Malta	45	50	63	88	77
Netherlands	7824	7205	7867	8936	9545
Austria	2480	2545	2585	2659	2795
Poland	3924	3647	4033	4169	3282
Portugal	981	887	1017	1106	1038
Romania	3374	4740	3821	4265	3547
Slovenia	303	334	401	394	315
Slovakia	745	725	869	1093	856
Finland	3570	3622	3498	3431	3794
Sweden	6407	6562	6861	7839	8241
United Kingdom	15088	13466	15202	17270	15860
EU-26 (2012–2013) EU-27 (2014) EU-28 (2015–2016)	148585	148917	154159	161399	161226

Source: *own calculations.*

Table B5. VAT Revenues (EUR million)

	2012	2013	2014	2015	2016
Belgium	26844	27250	27518	27578	28722
Bulgaria	3769	3898	3810	4059	4417
Czech Republic	11377	11694	11602	12382	13091
Denmark	24399	24320	24950	25493	26519
Germany	194034	197005	203081	211616	218784
Estonia	1508	1558	1711	1873	1974
Ireland	10219	10372	11521	11955	12826
Greece	13713	12593	12676	12885	14333
Spain	56652	60951	63643	68601	70591
France	142527	144490	148454	151680	154430
Croatia			5455	5690	6016
Italy	96170	93921	97071	101061	102957
Cyprus				1517	1664
Latvia	1570	1690	1787	1876	2032
Lithuania	2521	2611	2764	2888	3026
Luxembourg	3164	3438	3743	3442	3416
Hungary	9084	9073	9754	10669	10587
Malta	540	582	642	684	729
Netherlands	41699	42424	42708	44879	48557
Austria	24507	24895	25386	26247	27300
Poland	27783	27780	29317	30075	30479
Portugal	13995	13710	14682	15368	15770
Romania	11003	11710	11496	12939	10968
Slovenia	2888	3046	3155	3218	3315
Slovakia	4328	4696	5021	5420	5420
Finland	17987	18888	18948	18974	19694
Sweden	37834	39048	38846	40501	42770
United Kingdom	143405	142223	157478	182152	166866
EU-26 (2012–2013) EU-27 (2014) EU-28 (2015–2016)	923520	933866	977219	1035722	1047253

Source: *Eurostat*.

Table B6. VAT Gap (EUR million)

	2012	2013	2014	2015	2016
Belgium	4522	3962	2620	3329	3079
Bulgaria	1029	761	1181	1058	693
Czech Republic	2916	2796	2345	2521	2165
Denmark	3073	3367	3006	3054	2466
Germany	24997	26013	26654	24706	22679
Estonia	216	256	200	127	144
Ireland	1967	1304	1154	1419	1610
Greece	5765	6214	4613	5358	5916
Spain	6272	8149	5994	2897	1966
France	22392	19514	21581	19867	20896
Croatia			155	251	70
Italy	38785	40424	38356	35753	35988
Cyprus				174	83
Latvia	501	549	420	389	258
Lithuania	967	1002	1062	992	983
Luxembourg	59	107	151	80	29
Hungary	2569	2481	2199	1943	1629
Malta	220	227	243	24	20
Netherlands	4272	4742	4706	4705	2024
Austria	2409	2849	2572	2282	2149
Poland	10308	10071	9485	9652	8004
Portugal	2594	2586	2363	2272	1784
Romania	6949	7483	7760	6808	6137
Slovenia	295	183	318	289	290
Slovakia	2508	2147	2214	2243	1872
Finland	973	1120	1177	1405	1707
Sweden	2716	1384	1234	1474	465
United Kingdom	19264	17133	18844	22600	22040
EU-26 (2011–2013) EU-27 (2014) EU-28 (2015–2016)	168538	166824	162607	157672	147146

Source: *own calculations.*

Table B7. VAT Gap (percent of VTTL)

	2012	2013	2014	2015	2016
Belgium	14.42	12.69	8.69	10.77	9.68
Bulgaria	21.45	16.33	23.66	20.67	13.56
Czech Republic	20.40	19.30	16.81	16.92	14.19
Denmark	11.19	12.16	10.75	10.70	8.51
Germany	11.41	11.66	11.60	10.45	9.39
Estonia	12.54	14.10	10.44	6.33	6.78
Ireland	16.14	11.17	9.10	10.61	11.15
Greece	29.60	33.04	26.68	29.37	29.22
Spain	9.97	11.79	8.61	4.05	2.71
France	13.58	11.90	12.69	11.58	11.92
Croatia			2.76	4.22	1.15
Italy	28.74	30.09	28.32	26.13	25.90
Cyprus				10.28	4.73
Latvia	24.18	24.52	19.03	17.17	11.27
Lithuania	27.72	27.74	27.75	25.57	24.52
Luxembourg	1.82	3.02	3.87	2.28	0.85
Hungary	22.05	21.47	18.40	15.40	13.33
Malta	28.96	28.08	27.46	3.42	2.71
Netherlands	9.29	10.05	9.93	9.49	4.00
Austria	8.95	10.27	9.20	8.00	7.30
Poland	27.06	26.61	24.44	24.30	20.80
Portugal	15.63	15.87	13.86	12.88	10.16
Romania	38.71	38.99	40.30	34.48	35.88
Slovenia	9.28	5.67	9.16	8.24	8.04
Slovakia	36.69	31.38	30.60	29.27	25.68
Finland	5.13	5.60	5.85	6.89	7.98
Sweden	6.70	3.42	3.08	3.51	1.08
United Kingdom	11.84	10.75	10.69	11.04	11.67
EU-26 (2011–2013) EU-27 (2014) EU-28 (2015–2016)	15.43	15.16	14.27	13.21	12.32

Source: *own calculations.*

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