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VAT (non)compliance in the EU: Damaging corruption and shadow economy spillovers vs. government effectiveness and efficiency

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Abstract

Iva Hasíková, Jan Hanousek: **VAT (non)compliance in the EU: Damaging corruption and shadow economy spillovers vs. government effectiveness and efficiency**

This paper analyses factors affecting VAT compliance using a panel of 22 European countries from 2000 to 2021. In particular, we studied the influence of the shadow economy, macroeconomic conditions, quality and efficiency of public institutions, and the control of corruption influencing VAT compliance. The GDP growth proxying the phases of the business cycle has a stable and positive effect on VAT compliance. Similarly, the impact of the shadow economy has been negative, statistically, and economically significant. Also, we observe a substantial impact of the government quality indicators on reducing the VAT gap.

We also examine the possible "import" of tax morale through foreign subsidiaries operating in the country, and the impact remains inconclusive. Likely positively induced VAT compliance is mitigated by a negative impact of possibly sizeable exports of foreign-owned subsidiaries. From the public administration perspective, we show that all factors that affect the shadow economy are almost at the same rate transferred into increasing VAT compliance, which could make the quest for policymakers more effective.

Key words

Value-added tax (VAT), VAT gap, Gross Value Added, Shadow Economy, Tax Collection, Policy and Governance, Economic sectors

JEL: H26, C33

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Introduction

Public revenues, optimal tax collection, and efficient policies are crucial pillars of any government. According to Eurostat (2025), around 60 % of total government revenue in the European Union comes from tax receipts excluding social security, while value-added tax represents nearly 30 %. In most countries, it is the most substantial component of tax revenue. However, it is threatened by tax evasion. According to the European Commission (2024) (hereafter "EC"), the tax loss due to tax evasion reached 89 billion euros in 2022. This evaded revenue represents nearly 8 % of collected VAT revenue.[1]

VAT compliance is influenced by several economic, social, or political factors and has attracted the interest of several authors, e.g. (Agha & Haughton, 1996; Králik & Szász, 2023; Pluskota, 2022). Despite the importance of VAT collection, existing studies have not analyzed the evasive factors of VAT (non)compliance. Some studies used the share of particular sectors in the GDP to confirm the expected (and by definition) embedded significant effects on the VAT gap (Cevik et al., 2019). Another group of papers analyzed a single country and a specific set of sectors (Christou et al., 2021). Despite numerous existing studies, they lack public-economic angles and miss policy-relevant, economy-wide, and sectoral factors. Therefore, a deeper analysis of the VAT gap is still lacking.

This paper aims to provide a comprehensive new analysis of the VAT gap by presenting a strongly balanced panel data set from 22 European countries from 2000 to 2021. The data set contains country*industries observations over time. The panel data structure allows us to control for unobserved time-invariant heterogeneity and idiosyncratic time effects. Our analysis goes beyond a simple sectoral analysis, identifying significant sectors for the estimated VAT gap. Instead, our goal is to identify and quantify the impacts of several yet unresearched factors, including foreign ownership of companies in each country/sector, the extent of the shadow economy, the quality of public institutions, governmental effectiveness, and the wealth of each country's population.

From the above-mentioned, three main research questions arise:

Does the size of the shadow economy and variation in macroeconomic factors affect VAT (non)compliance and the role of individual sectors in the extent of the VAT gap?

Does the quality of public institutions, government efficiency, regulatory quality, and extent of corruption affect VAT (non)compliance and the role of individual sectors in the extent of the VAT gap?

[1] Those numbers are mostly viewed as lower bound estimates. To provide another perspective, this evaded revenue means a loss of 2,000 euros for every second of the year 2022.

Does the share of foreign ownership in the analyzed sectors affect VAT (non-)compliance? In particular, does the increasing share of foreign ownership from countries with low corruption positively impact VAT compliance?

The next part of the paper is devoted to the literature review. The data and methods are presented in the next section, followed by the results, discussion, and conclusion.

1 Review of the literature and development of the hypothesis

Taxes are the primary source of public revenue, so tax evasion and shadow economy activities are among the most challenging obstacles public administration faces. Policymakers have intensively tried to minimize the extent of tax evasion and the shadow economy, primarily by increasing the efficiency of tax collection through increased scrutiny, control, and punishment. However, Alm et al. (1992) have mentioned another angle by asking, 'Why do people pay tax?' instead of 'Why do they evade?' According to Mascagni (2018), collecting taxes through aggressive deterrence and coercion is more expensive than encouraging taxpayers to cooperate with the tax administration. Thus, fiscal exchange as a taxpayer's perception of what the public sector provides from 'his' taxes should be at the forefront of policymakers' attention. The interference of tax morale and people's perception of the goods and services provided by the public sector has been documented in numerous studies. For example, a fiscal exchange nudge in the form of a tax bill celebrating realized public works increased payment rates of Argentine tax delinquents by about 20 to 40 % (Schächtele et al., 2023). A similar experiment was reported in Norway (Bott et al., 2020) and in Latvia (Saulitis & Chapkovski, 2024).[2]

Nevertheless, the fiscal exchange motives involve essential considerations about the quality of the public institution's environment and the level of public services and goods the government offers. Society's willingness to tax itself depends on good government institutions, which are represented by low corruption and government accountability (Bird et al., 2008). Hanousek & Palda (2004) showed that governments could significantly increase tax revenue if they increase the perceived quality of services. The above can be confirmed by Morrow et al. (2022). Their results show that tax compliance

[2] Norwegian taxpayers received a letter from tax authorities with basic information on reporting foreign income, moral suasion, or the perceived detection probability added to this letter. According to the results, ethical and detection letters play a significant role in shaping taxpayer behavior. Anyway, only the detection letter has long-term effects on tax compliance (Bott et al., 2020). Latvian taxpayers received messages ranged from normative appeals to probabilities and nudges. The immediate result was an increase in compliance; however, this trend diminishes over time. The study results indicate no significant long-term differences between various types of messages (Saulitis & Chapkovski, 2024).

is much higher in countries with higher institutional quality and corruption control (measured by WGI). Chauvet and Ferry (2021) highlight the need for a high institutional quality to transform tax revenues into growth-enhancing public goods. This leads us to our first hypothesis:

Hypothesis H1*: Good, efficient government policies and a low corruption environment lead to higher VAT compliance.*

Compared to other taxes, VAT has one advantage: its neutrality, which is ensured because the tax burden is shifted to the end of the value chain, as close to the consumer as possible (Cnossen, 1998). This tax setup supports some 'self-enforcement' because revenues (output VAT) and costs (input VAT) can consist of third-party and self-reported components (Carrillo et al., 2017). It assumes that businesses are incentivized to request suppliers' receipts because they can deduct input costs from their VAT bills (Agha & Haughton, 1996). This incentive builds a paper trail that indicates the preventive deterrence effect (Pomeranz, 2015). If VAT is not entirely 'self-enforcing,' then it is at least 'self-correcting,' according to Keen and Smith (2006). If, for some reason, the supply to a registered trader escapes VAT, this missing VAT will be recovered at the next stage in the VAT charged by that trader on his sales, as in such a case, there will be no credit to set off against his liability.

Whether the "paper trail" works or not, either way, it ends if the dealer (VAT payer) sells to the final consumer or to a link in the chain that is a non-VAT payer, who cannot report this input VAT, so does not need the receipt at all. In this case, the trader can sell without a VAT invoice or with a fake one, as described in Fedeli and Forte (2011).[3] This leads to VAT and income tax evasion, and the whole business is thus in the shadow economy. We expect a high correlation with the country's VAT non-compliance, which motivates us to formulate the second hypothesis concerning the negative spillover effect of the shadow economy.

Hypothesis H2: *The scope of income tax evasion proxied by the shadow economy extent has a negative spillover effect on VAT non-compliance*.

In addition to Hypothesis 1, wealthier countries also have more developed financial systems, lower use of cash payments, and lower instrumental reasons for VAT avoidance and evasion. Moreover, several studies (Elgin, 2012; Owolabi et al., 2022) noted that shadow activities increase during economic downturns. Therefore, we formulate the following hypothesis.

[3] To secure the end of the paper trail, some countries have implemented receipt-based VAT lotteries to improve tax collection; in this type of lottery, VAT receipts or invoices serve as a lottery ticket that allows the consumer to win a prize (for more details, see Wilks et al. (2019) and Burger & Schoeman (2021)).

Hypothesis H3: *The country's income level and the upside of the business cycle have a positive spillover effect on the firm's VAT compliance and consequently decrease the VAT gap.*

Let us elaborate more on the spillover effects of Hypothesis 1&2. Could foreign firms from countries with low corruption, higher tax morale, and efficient governmental policies bring better tax compliance to other countries through their subsidiary operations? Are the culture and values of low-corruption countries strong enough to spill over to high- or medium-corruption countries through FDI? This proposition is built on previous culture value research by Fisman & Miguel (2007), according to which entities tend to hang on to their culture and values regardless of where they operate[4]. It has also been pointed out that antibribery laws, such as the British Bribery Act (Ministry of Justice, 2012), made management and owners of particular firms responsible and accountable for the bribery practices of their foreign subsidiaries, including large customers and suppliers. Such regulation lowers the attitude of foreign-owned subsidiaries about illegal activities, and based on their share, we should observe an increase in VAT tax compliance. Therefore, we formulate the final hypothesis.

Hypothesis H4: *The share of the sectoral output of foreign-owned firms from low-corruption countries positively influences VAT compliance via culture and management values spillovers, consequently decreasing the VAT gap.*

The quantification of the VAT collection problem caught the attention of many academics and institutions, who have developed two general ways. *C efficiency* indicates the shift of VAT away from a perfectly enforceable tax levied at a uniform rate on all consumption. C efficiency can be decomposed into a policy gap (reflecting the effects of rate differentiation and exemption) and a compliance gap (reflecting imperfect compliance and implementation) (Cnossen, 2022; Keen, 2013). The other way is the VAT gap, the difference between the total tax liability of VAT (hereinafter 'VTTL') is estimated and compared with the actual revenue collected (Poniatowski et al., 2023). There are several methods to assess the VAT gap.

The commonly used division is the *bottom-up* and *top-down* approach. The former approach processes operational information from audits and other activities to estimate unpaid VAT. On the contrary, the latter approach uses information on consumption disaggregated by commodity and national account data (Keen, 2013). Using Poland data on VAT collection, Jonski and Gajewski (2022) proposed a method to distinguish between informality, honest errors, and VAT fraud. They conclude that about one-third

[4] Fisman and Miguel (2007) exploit the increase in parking violation enforcement in New York, the seat of diplomacy officials from 149 countries worldwide. According to the study, the number of parking violations strongly correlates with existing home country corruption measures.

of the Polish VAT gap can be attributed to VAT fraud schemes; shadow economy activities and honest errors cause the rest. A significant concern about the method is their identification of fraud, separation from shadow economy activities, and cross-industry relationship, as their analysis also neglected input/output tables (relationship between upstream and downstream industries).[5]

The VAT efficiency problems, VAT gap quantification, or sectoral decomposition as determinants of the VAT gap caught the attention of many authors before (Alognon et al., 2020; Castro & Camarillo, 2014; Piancastelli & Thirlwall, 2021; Poniatowski et al., 2020). However, our analysis goes beyond previous studies, and our presented hypotheses address aspects no one has considered.

2 Methodology

The research process panel data containing information for different periods for separate cross-sectional units. Panel data allows us to control (unobserved) individual country heterogeneity, for example, characteristics that do not change over time but vary across entities (cultural factors, differences in business practices across companies, etc.). These characteristics may or may not impact the outcome or predictor variables. To control for them, this study will use country-fixed effects (hereinafter "Country FE"), which absorb all unobserved country-level heterogeneity (Amin & Qin, 2024). The Country FE regression model has *n* different intercepts, one for each country. A set of binaries (dummy variables), respectively, their coefficients, represent these intercepts and absorb/eliminate all time-invariant potentially even unobserved factors.

Such estimation models are often called the least-squares dummy variable (LSDV) technique. (Zulfikar, 2018). To avoid the dummy variable trap, the number of dummy variables must be one less than the number of countries in Eq. 1.

$$Y_{it} = \alpha_0 + \sum_{k=1}^{I-1} \alpha_k D_{k.it} + \boldsymbol{\beta}_{gov\_ind}\boldsymbol{X}_{gov\_ind.it} + \boldsymbol{\beta}_{shad\_ec}\boldsymbol{X}_{shad\_ec.it} + \boldsymbol{\beta}_{gdp\_dev}\boldsymbol{X}_{gdp\_dev.it} + \boldsymbol{\beta}_{FDI}\boldsymbol{X}_{FDI.it} + \gamma_{1,it}W_{1,it} + \cdots + \gamma_m W_{m,it} + \alpha_i + u_{it} \quad (1)$$

[5] Jonski & Gajewski (2022) proposed a simple extension to the top-down approach to the VAT gap estimation. VAT revenue is the difference between VAT collected from taxpayers and VAT reclaims returned to them. Their central assumption is that in a world with no VAT fraud, no shadow economy activities, and no honest errors, the VAT collected series, and VAT reclaims series should move in tandem. However, VAT fraud decreases the VAT revenue by increasing the amount of unlawful VAT reclaims. Also, looking only at the aggregate data at (one) industry level, there is no clear identification/separation of fraud and shadow economy activities, as their growth jointly drives the decline in collected VAT, they likely move together and interact.

Eq. 1 expresses the Country FE regression model using the LSDV technique, where *i* = 1…, *n*; *t* = 1…, T. The variable $D_{k.it}$ represents country dummies.

$\boldsymbol{X}_{gov\_ind.it}$ is a set of control variables that proxied government policies and level of corruption control, coefficients $\boldsymbol{\beta}_{gov\_ind}$ will help us to test hypothesis H1. $\boldsymbol{X}_{shad\_ec.it}$ represents shadow economy activities as another control variable, its coefficient $\boldsymbol{\beta}_{shad\_ec}$ will test hypothesis H2 regarding the spillovers of income tax evasion. $\boldsymbol{X}_{gdp\_dev.it}$ is the set of control variables indicating the spillovers of the country's income level and the business cycle, which we hypothesized in H3, coefficients $\boldsymbol{\beta}_{gdp\_dev}$ will be used to reject or confirm hypothesis H3. $\boldsymbol{X}_{FDI.it}$ is the last set of control variables using aggregated sectoral data from Amadeus and Orbis (more details in the next section). Aggregated data on the foreign investor's share of sales indicates the spillovers of culture and values of the firm's management established in low-corruption countries. Their presence and influence (hypothesis H4) will be confirmed or rejected based on the coefficients $\boldsymbol{\beta}_{FDI}$. γ_1 is a coefficient of the first regressor $W_{1,it}$; variable W represents the share of sectors on total GVA and u_{it} is the residual, which combines cross-section and time series.

We employed a fixed-effect estimation technique (the LSDV) following the outcome of the Hausmann test and other diagnostics. Details are available upon request or in the online Appendix.

3 Data

The data for this analysis combines several sources (Eurostat and World Bank Group databases, EC reports, and the author's sectoral data construction using firm-level data from Amadeus and Orbis). The primary data covers 22 European countries from 2000 to 2021.[6]

VAT gap estimates are an initial source of data for this research. The VAT gaps used in this study were calculated by the Center for Social and Economic Research (hereinafter, "CASE"), a consulting partner supervised by the EC.[7] We will refer to this set of studies as EC and CASE reports. Although the team of researchers working on the VAT gap calculations varied throughout the period under review, the same method of VAT gap calculations was used in each report. A top-down approach is used in the CE and CASE reports, precisely the consumption-side method. This method estimates the total theoretical VAT liability (VTTL) as the sum of the liability from the following components: final consumption of households, governments, and non-profit institutions serving households (NPISH), intermediate

[6] Included countries: Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden

[7] Source of the primary data: (Barbone et al., 2013; Poniatowski et al., 2016; Poniatowski et al., 2019; Poniatowski et al., 2023; Poniatowski et al., 2020).

consumption, and gross fixed capital formation. The consumption-side method allows us to consider country-specific tax regulations such as small business exemptions, non-deductible business expenses, etc. This advantage of the technique and its availability for all countries during the period under review are the main reasons we work with EC and CASE reports. The latest reports contain VAT gap calculations over a more extended period (at least 5 years), so two or more reports cover the period from 2010 to 2021. We verified the consistency of each observation, comparing the gaps reported in several reports. Based on this check, we excluded inconsistent data.

Figure 1 contains estimates of the average VAT gap for each country from 2000 to 2021. For northern and western countries, for example, Sweden, Netherlands, Ireland, Denmark, France, and Belgium, it is typical to have a lower average VAT gap, and the dispersion of the observations is small, indicating a stable and persistent VAT gap. However, the average VAT gap of southern and eastern countries, e.g., Bulgaria, Poland, the Czech Republic, Slovakia, Greece, and Italy, is higher, and the dispersion of the observations is higher. The highest average VAT gap is estimated for Romania.

Figure 1 Average VAT gap in European Union member states

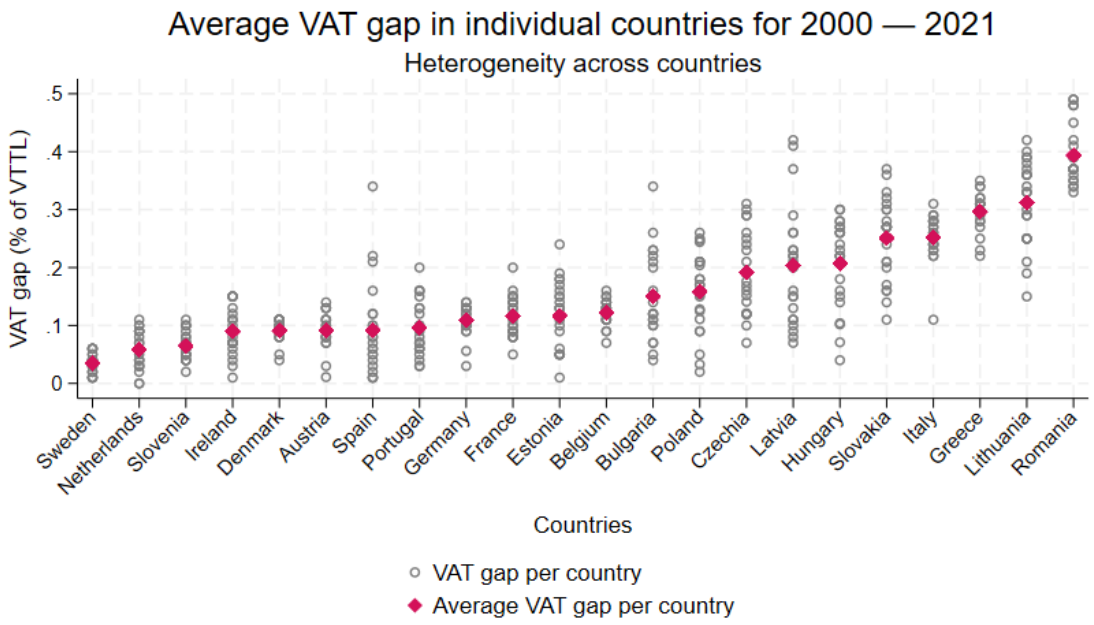


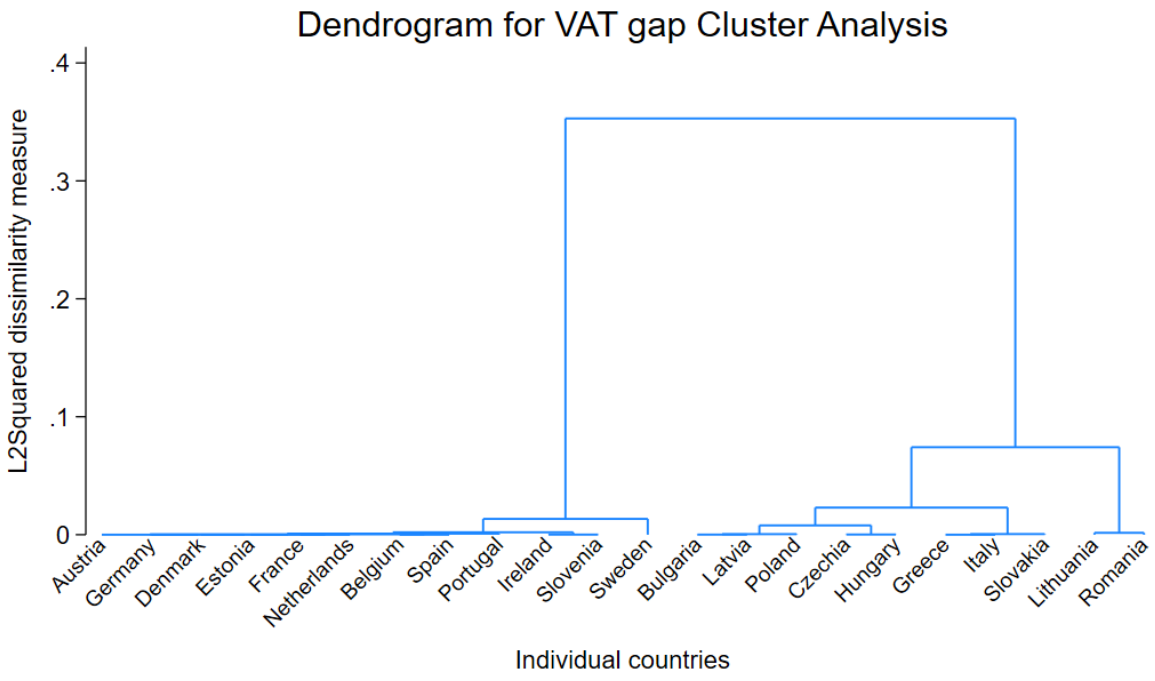
Figure 1 shows heterogeneity across countries. Countries are sorted from the lowest average VAT gap to the highest. It contains the average VAT gap in individual countries and observations of the VAT gap per country from which the average is calculated. The VAT gap is calculated as a percentage share of VAT's total theoretical liability. The graph was compiled from the primary data, where the percentage share of the VAT gap on VAT's total theoretical liability is divided by 100. Source: Own elaboration based on EC and CASE reports

VAT gap cluster analysis confirms those mentioned above. Figure 2 contains the cluster analysis dendrogram of the average VAT gap. According to the results, the observations of the average VAT gap are divided into three main groups.[8]

Figure 3 contains another dendrogram to show hierarchical relationships according to the country's GDP per capita in 2014. The clustering according to the level of average VAT gap in Figure 2 is similar to the clustering according to the GDP per capita in 2014 in Figure 3.[9]

Figure 2 Dendrogram for average VAT gap Cluster analysis

Figure 2 shows a dendrogram for Ward's linkage cluster analysis. The VAT gap (y-axis) measures the dissimilarity of countries. Squared Euclidean distance is used to measure similarity or dissimilarity. VAT gap cluster analysis divided countries into three main groups. Source: Own elaboration based on EC and CASE reports.

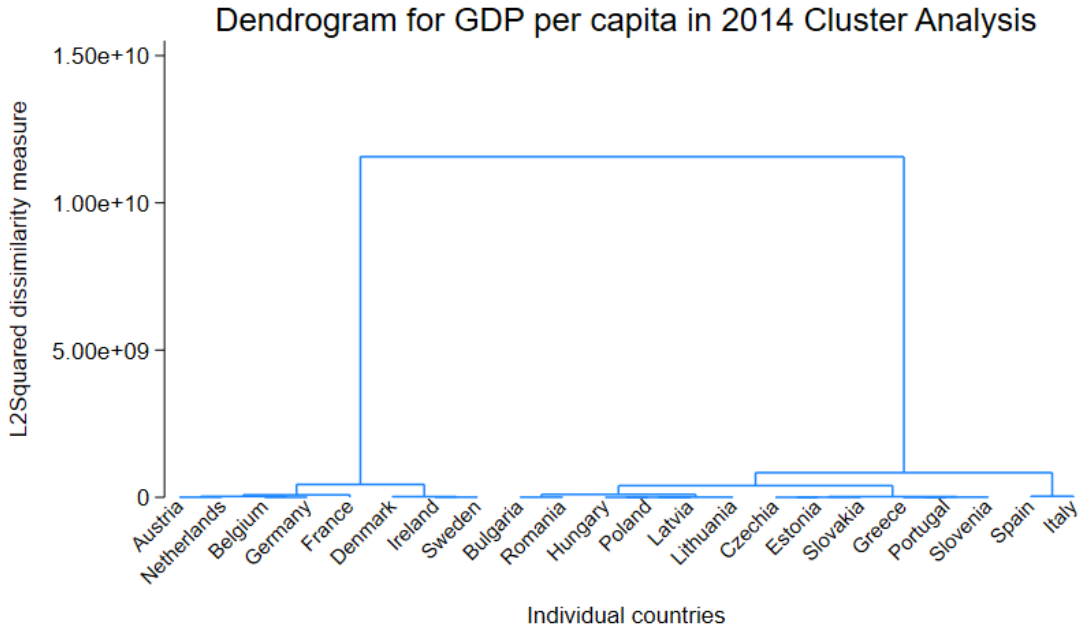


[8] The *Low VAT gap group* is the largest, comprising 12 countries; next to the northern and western countries are Spain, Portugal, Estonia, and Slovenia. The *medium VAT gap group* comprises the Czech Republic, Bulgaria, Hungary, Poland, Slovakia, Greece, Italy, and Latvia. Only two countries, Lithuania and Romania, were clustered into the *high VAT gap group*.

[9] For the clustering by GDP per capita, we wanted to choose a year in the middle of the period under review, which is at the peak of the financial crisis after 2008; for this reason, we chose 2014, when the main post-crisis turbulence had already subsided. According to the GDP per capita, the cluster analysis divided countries into three groups. *The highest GDP per capita group* comprises Austria, Netherlands, Belgium, Germany, France, Denmark, Ireland, and Sweden. *The lowest GDP per capita group* consists of only two countries, Spain and Italy. The rest of the countries were clustered into *the medium GDP per capita group*.

Figure 3 Dendrogram for GDP per capita in 2014 Cluster Analysis

Figure 3 shows a dendrogram for Ward's linkage cluster analysis. The GDP per capita in 2014 (y-axis) measures the dissimilarity of countries. Squared Euclidean distance is used to measure similarity or dissimilarity. The cluster analysis divided countries into three groups; however, the third group contains only two countries, Spain and Italy. Source: Own elaboration based on World Bank (2024)



We used the NACE Revision 2 classification for clustering industrial sectors, which divides sectors into 21 sections, 88 divisions, 272 groups, and 615 classes. In the analysis, we process the higher aggregation level consisting of 21 industries, using letters labeled A to U. Sections M and N are usually reported together as one figure, similar to sectors R to U. This modification means 17 sectors for our study. For each industrial sector, we collected data about the share of each sector's gross value added to the total GVA.

This study uses a relatively wide range of control variables. In Eq. (1), we specify four sets of variables for testing hypotheses H1 to H4. $\boldsymbol{X}_{gov\_ind.it}$ represent the World Governance Indicators (WGI). These variables will be used to proxy the quality and efficiency of governance and the level of corruption control (Kaufmann & Kraay, 2023), which could positively affect VAT compliance, as described in hypothesis H1.[10] As a second set of variables, $\boldsymbol{X}_{shad\_ec.it}$, the shadow economy will be used to proxy income tax evasion[11]. This will help us to test hypothesis H2 regarding the influence of income tax

[10] We use the following indicators: Control of corruption, Government effectiveness, Political stability and absence of violence/terrorism, Regulatory quality, and Rule of law. The indexes range between -2.5 to 2.5; the index means the higher, the better. (See Appendix for details of data description)

[11] These data were collected from Schnieder's (2022) research, where the author calculated VAT gaps in 30 European countries from 2003 to 2022. This study covered most of the examined period, but the first 3 years had to be covered by one of the previous authors' research (Hassan & Schneider, 2016), covering the period from

evasion on VAT compliance. $\boldsymbol{X}_{gdp\_dev.it}$ consists of GDP growth, GDP per capita proxy business cycle and country income level. These variables should capture the country's income level and the business cycle phase, which could influence VAT compliance as described in hypothesis H3.

The previous set of variables used existing indexes, estimates, or macroeconomic variables. The final group $\boldsymbol{X}_{FDI.it}$ aims to proxy the presence of foreign investors in the particular country*sector. We used firm-level data from Orbis Historical and Amadeus to compute the turnover shares of foreign investors in each country's sector. We intended to capture the spillover effect of culture and management values from countries with a low level of corruption. These control variables will help us to test the positive influence of FDI from low-corruption countries on VAT compliance through their subsidiaries in a foreign country, as described in hypothesis H4. First, for 2007-2022, we used Orbis Historical, covering firm financial information and ownership structures worldwide. For the earlier period, 2000-2006, we used linked annual versions of the Amadeus database (pan-European version of Orbis); for each sector, we processed data on sales of firms controlled by foreign entities; from these, we selected sales of firms owned (controlled by foreign "honest" entities[12]. As the next step, we compute the share of foreign sales (foreign honest sales) on the total sales of each sector. We then multiplied all these sectoral shares on the VAT collection to proxy the impact of FDI presence. We repeated the procedure outlined in Eq. 2 for each sector and then for foreign honest sales.

$$X_{3,it} = foreign\ sales\ in\ sector\ A / total\ sales\ in\ sector\ A * 100 * GDP\ in\ sector\ A \qquad (2)$$

Table 1 contains descriptive statistics. The indicators were calculated from the primary data (for more details about characteristics of variables, units of measure, or data sources, see appendix). Descriptive statistics revealed significant differences between European countries regarding their VAT gap, the share of shadow economy activities, and GDP per capita. To provide a better idea, the GDP per capita in 25 % of the wealthiest countries did not go under nearly 41,610 USD, while in 25 % of the poorest countries, their GDP per capita reached at most nearly 13,750 USD. The relatively high standard deviation shows significant cross-country differences and development during the period examined in all control variables.

1999 to 2013. This means that two studies jointly cover the period studied, and based on the cross-check, we excluded inconsistent data.

[12] For sales, we used operational revenue (variable *opre*). Low corruption countries were selected using the Corruption Perception Index provided by Transparency International. As honest entities, we defined entities established in countries with the lowest estimated corruption: Australia, Austria, Canada, Belgium, Denmark, Finland, Germany, Great Britain, Hong Kong, Iceland, Ireland, Japan, Netherlands, New Zealand, Norway, Singapore, Sweden, Switzerland, the United States of America.

The sectors with the largest share of GVA are manufacturing (C), with a mean of 17.9 %, and the trade sector (G), with a mean of 12.5 %. The rest of the sector's share of GVA is below 10 %.

Descriptive statistics of industrial sectors (excluding sector C: Manufacturing) and some service sectors (O: Public administration, P: Education, Q: Human health, R-U: Arts, entertainment) indicate their relatively stable development during the examined period and across countries. On the other hand, some significant differences can be observed in the agricultural (A) and manufacturing (C) sectors. Therefore, these two sectors, among others, are included in Table 2, which describes the evolution of selected variables in countries clustered into three groups according to the cluster analysis of the average VAT gap in five time periods.[13]

In addition to sectors, the VAT gap, shadow economy, GDP growth, and GDP per capita were selected to provide different perspectives on the primary data. The sectors are sorted from the largest share of GVA in the first period to the smallest. This sorting method can help observe patterns in changes in economic decomposition.

[13] For descriptive statistics in Table 2, we chose these periods: 2000–2003 (the period before the entry of 10 new countries, 8 of which are included in this study), 2004–2008 (the period before the financial crisis in Europe), 2009–2013 (the period of financial crisis and subsequent turbulence), 2014-2019 (post-financial and pre-COVID crisis period), and 2020 – 2021 (COVID crisis period).

Table 1 Descriptive statistics. Full sample, selected variables

This table shows descriptive statistics for all variables. Data for the research was collected from 22 countries from 2000 to 2021. The analysis is processed with 484 observations for each variable except the VAT gap (480 observations) and Shadow economy (456 observations). Several observations must be omitted due to their unreliability. Used abbreviations: StdDev denotes standard deviation, and p25 (p75) stands for 25% (75%) quartile. The VAT gap is the percentage share of the total tax liability. WGI variables are indexes taking values between -2.5 and 2.5, meaning the higher, the better. The shadow economy represents a percentage share of informal GDP. GDP growth is a change in GDP percentage points compared to previous years. Each sector is defined by its percentage share of total gross value added.

VARIABLES	Mean	StdDev	p25	Median	p75
VAT gap	15.8	10.6	8.00	12.7	23
Control of corruption	0.929	0.772	0.299	0.814	1.527
Government Effectiveness	1.033	0.605	0.617	1	1.554
Political Stability and Absence of Violence/Terrorism	0.732	0.381	0.479	0.797	0.988
Rule of law	1.036	0.592	0.582	1.014	1.570
Regulatory Quality	1.135	0.424	0.832	1.109	1.486
Shadow economy	19.60	7.18	13.90	19.20	24.70
GDP growth	2.46	3.84	0.95	2.48	4.38
GDP per capita (in thousands of USD)	27.50	17.52	13.7	23.1	41.61
sector A: Agriculture, forestry, fishing	3.10	1.96	1.90	2.60	4.00
sector B: Mining and quarrying	0.80	0.83	0.30	0.50	1.10
sector C: Manufacturing	17.90	4.84	14.40	18.00	21.60
sector D: Electricity supply	2.40	0.89	1.80	2.30	3.00
sector E: Water supply	0.92	0.21	0.70	0.90	1.10
sector F: Construction	6.08	1.82	5.00	5.90	7.00
sector G: Wholesale and retail trade	12.50	2.34	10.80	12.10	13.50
sector H: Transportation	6.09	1.96	4.80	5.60	6.70
sector I: Accommodation and food service activities	2.50	1.48	1.50	1.90	2.70
sector J: Information and communication	4.85	1.62	3.90	4.60	5.20
sector K: Financial and insurance activities	4.74	1.53	3.90	4.50	5.30
sector L: Real estate activities	9.60	2.55	7.90	9.40	11.20
sector M-N: Professional activities	8.66	2.70	6.80	8.35	10.00
sector O: Public administration	6.66	1.38	5.80	6.50	7.65
sector P: Education	5.01	0.90	4.40	5.00	5.60
sector Q: Human health	5.73	2.26	4,00	5.25	7.00
sector R-U: Arts, entertainment	2.83	0.71	2.30	2.80	3.20

In countries clustered in the low VAT gap group, the VAT gap was only 5 % from 2020 to 2021. It reached at most 11.8 % in the post-financial crisis period. GDP growth is stable in “calm” no-crisis periods. Despite the crisis, GDP per capita is increasing, while the extent of shadow economy activities is reducing. The share of selected sectors remains stable throughout the period.

Countries in the medium VAT gap group show a different pattern. The average VAT gap decreased from nearly 25 % in the first period to 9 % in the last.[14] GDP growth was seriously hit by the consequences of the financial crisis in 2008, but otherwise, it has been increasing. GDP per capita increased significantly, while the shadow economy remains stable. If we look at sectoral decomposition, we can notice some slight changes in the economy of countries in the medium VAT gap group. The share of the agricultural (A), manufacturing (C), construction (F), and trade (G) sectors decreased slightly in favor of the developing financial (K), real estate (L), and professional (M-N) service sectors.

Only two countries are included in the high VAT gap group, namely Lithuania and Romania. Although their average VAT gap has decreased throughout the period (except 2009–2013), it remains the highest in Europe. GDP growth fluctuated due to the financial crisis and other marginal events. GDP per capita and shadow economy activities developed similarly to those in the low VAT gap group but less intensively. In the high VAT gap group, a similar (but way more significant) change in sectoral decomposition can be observed as in the medium VAT gap group. In the first period, 2000–2003, the share of the agriculture sector was one of the most significant, but in the last period, it decreased by approximately 5 percentage points. The share of the agricultural sector (A) and partly manufacturing sector (C) decreased in favor of the professional service sector (M-N); its share is increasing period by period.

GDP growth and GDP per capita proxy the business cycle development and the country's income level, respectively. These variables will be used to capture potential interaction with VAT (non)compliance described in hypothesis H3, which indicates all groups. The low and high VAT gap groups also indicate positive spillovers of the decreasing shadow economy described in hypothesis H2.

[14] It is appropriate to mention that the medium VAT gap group consists of 8 countries, 6 of which joined the EU in 2004.

Table 2 Descriptive statistics. Grouping by VAT (non)compliance, period averages

Countries are divided into three groups according to the cluster analysis of the VAT gap. The low VAT gap group is comprised mainly of northern and western European countries. Most southern and eastern European countries belong to the medium VAT gap group, where their VAT gap is higher and fluctuates. The high VAT gap group consists only of two countries. For more details on the grouping, see Figure 2 and related footnotes). VAT gap as a percentage share of VAT total tax liability, shadow economy (percentage of GDP), GDP growth expressed as an annual change of GDP in percentage points, GDP per capita in thousands of USD, and sectors with significant or developing percentage share of gross value added. For these variables, mean values were calculated for five different periods.

VARIABLES	2000 –2003	2004 –2008	2009 –2013	2014 –2019	2020 –2021
	Mean				
Low VAT gap group					
VAT gap	9.00	9.37	11.8	7.76	5.15
Shadow economy	17.40	17.40	15.90	14.10	13.70
GDP growth	2.85	2.95	-0.2	2.94	1.47
GDP per capita (in thousands of USD)	23.05	37.6	41.12	42.13	47.72
sector C: Manufacturing	19.30	17.70	16.30	17.60	17.50
sector G: Wholesale and retail trade	11.9	12.00	11.90	11.80	11.80
sector L: Real estate activities	8.74	9.03	9.48	9.67	9.88
sector M-N: Professional activities	8.55	9.42	10.1	11.00	11.4
sector F: Construction	6.26	6.98	5.6	5.14	5.43
sector H: Transportation	5.42	5.32	5.28	5.19	4.66
sector K: Financial and insurance activities	5.26	5.54	5.71	5.03	4.85
sector A: Agriculture, forestry, fishing	2.81	2.25	2.07	2.04	1.95
Medium VAT gap group					
VAT gap	24.60	19.90	26.60	18.9	9.33
Shadow economy	27.80	24.70	23.10	20.80	21.20
GDP growth	3.98	4.87	-0.07	2.84	0.88
GDP per capita (in thousands of USD)	8.53	16.12	18.27	17.97	20.6
sector C: Manufacturing	18.30	18.00	16.80	17.80	17.10
sector G: Wholesale and retail trade	13.40	13.30	13.00	12.70	12.80
sector L: Real estate activities	9.45	9.74	11.00	11.00	11.70
sector H: Transportation	7.31	6.80	6.44	6.51	5.76
sector M-N: Professional activities	6.54	6.88	7.39	7.96	8.20
sector F: Construction	6.12	6.96	6.17	5.24	5.21
sector A: Agriculture, forestry, fishing	4.86	3.78	3.33	3.38	3.29
sector K: Financial and insurance activities	3.74	4.45	4.68	4.49	4.31
High VAT gap group					
VAT gap	38.00	35.80	40.9	31.10	27.00
Shadow economy	33.50	31.80	29.10	25.80	26.10
GDP growth	5.41	7.51	-0.30	4.10	2.07
GDP per capita (in thousands of USD)	3.10	8.37	11.2	13.86	18.14
sector C: Manufacturing	21.10	21.50	22.20	20.30	17.50
sector G: Wholesale and retail trade	13.80	13.90	12.50	13.80	14.90
sector A: Agriculture, forestry, fishing	9.32	6.71	4.90	4.33	4.40
sector H: Transportation	7.85	8.83	9.51	9.47	8.95
sector L: Real estate activities	7.21	7.29	7.86	7.89	7.53
sector F: Construction	6.41	9.43	7.61	6.90	7.18
sector M-N: Professional activities	3.58	4.63	5.83	7.38	7.70
sector K: Financial and insurance activities	2.71	2.53	2.74	2.64	2.95

4 Results

Table 3 contains the partial analysis results; we consider three aspects: government effectiveness and control of corruption and shadow economy in columns (1) and (4), and macroeconomic variables in columns (2) and (5). In models in columns (3) and (6), we consider both aspects. In columns (4)-(6), we expanded the analysis by adding the industrial sector shares.

According to the results in Panel A of Table 3, we can confirm or reject some of the hypotheses built in Section 2. Hypothesis *H1* concerns positive spillovers of good government policy on VAT compliance and its ability to decrease the VAT gap. In contrast, hypothesis H2 suggests that income tax evasion proxied by shadow economy activities has a negative effect on VAT compliance. According to model 1, both hypotheses can be confirmed.

Among WGI indicators, only control of corruption, political stability, and absence of violence are significant. Both have negative coefficients, indicating their ability to increase VAT compliance. The share of shadow economy activities is substantial in all models; it has a positive coefficient in all models, so it decreases VAT compliance. The coefficient and its size are worth mentioning. In models in columns (1)-(3) without sectoral shares loading, the increase of shadow economy activities by one percentage point causes the increase of shadow economy about more than one percentage point, the estimated elasticities in means also indicate harmful spillover from the shadow economy to VAT non-compliance[15]. Next, we augmented the models, and in columns (4)-(6), we added sectoral share loading, which proxied economic structure (productive vs. service-oriented). After this model adjustment for a particular country's economic structure, the impact of shadow economy spillovers has been partially absorbed across the sectors, and we observe a smaller shadow economy's coefficient and its smaller ceteris paribus impact.

In hypothesis *H3*, we propose that the upside of the business cycle and the high country's income level are associated with positive VAT compliance. We can confirm this hypothesis according to the results of Panel A in Table 3. In all models, GDP growth and GDP per capita have a negative effect on the VAT gap and, thus, a positive effect on VAT compliance. However, there is a difference in coefficients; the GDP growth variable has a more substantial coefficient. The increase in GDP growth by 1 percent is associated with a decrease in the VAT gap of about 2,37 % (mean elasticities calculation is based on the coefficient in Model 1).

[15] The change in the dependent variable, if the independent variable change about 1 unit of measure, was calculated according to the formula: $change = coefficient \times mean\_y/mean\_x$. Means of variables were taken from the descriptive statistics in table 1.

Coefficients of WGI and macroeconomic variables are stable throughout all modifications of the models.

Table 3 Partial results of Eq.(1): Impact of the government effectiveness, shadow economy, and macroeconomic conditions on VAT (non)compliance.

In this table, we present the partial analysis results of Eq. (1). We consider a) the shadow economy spillovers, b) the impact of five leading indicators (factors) of the WGI used to measure government effectiveness, business environment, and regulatory and legal setting for each country in a given year, and c) primary macroeconomic variables proxying phase of the business cycle and country wealth. In columns (4)-(6), we expanded the analysis by adding the industrial sector shares to control for each country's particular production/service structure.
Panel A contains the results for the main external country-level factors; Panel B shows the coefficients of sectoral loadings. The VAT gap is calculated as the difference between potential VAT revenue and actual collected VAT revenue. Positive coefficients increase the VAT gap and thus reduce VAT compliance; negative coefficients do the opposite. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

Panel A. Results for the main external country-level factors

	(1)	(2)	(3)	(4)	(5)	(6)
Control of corruption:	-0.050**		-0.040**	-0.042**		-0.032*
	(0.021)		(0.020)	(0.020)		(0.019)
Government Effectiveness:	0.010		0.020	-0.029		-0.029
	(0.020)		(0.020)	(0.019)		(0.019)
Political Stability and Absence of Violence	-0.043***		-0.030**	-0.038***		-0.022*
	(0.014)		(0.014)	(0.013)		(0.012)
Rule of law:	0.041		0.009	0.115***		0.100***
	(0.027)		(0.027)	(0.028)		(0.026)
Regulatory Quality:	0.026		0.028	-0.000		-0.003
	(0.022)		(0.021)	(0.022)		(0.021)
Shadow economy (%)	0.837***		0.908***	0.333*		0.469***
	(0.117)		(0.134)	(0.170)		(0.168)
GDP growth		-0.370***	-0.387***		-0.473***	-0.455***
		(0.069)	(0.070)		(0.069)	(0.068)
GDP per capita		-0.001***	0.000		0.002***	0.002***
		(0.000)	(0.000)		(0.000)	(0.001)
Constant	0.022	0.144***	0.008	-1.747***	-1.126***	-1.411**
	(0.041)	(0.018)	(0.047)	(0.579)	(0.419)	(0.550)
Country FE	yes	yes	yes	yes	yes	yes
Sectoral shares	no	no	no	yes	yes	yes
R^2	0.761	0.756	0.778	0.831	0.835	0.850
Adjusted R^2	0.746	0.744	0.763	0.812	0.820	0.833
N, observations	452	480	452	452	480	452

Panel B. Results on the impact of sectoral loading.

This Panel adds the detailed estimation and coefficients of particular sector loadings for columns (4)-(6) of the Panel A estimation.

	(4)	(5)	(6)
A: Agriculture, forestry, fishing	1.769***	2.414***	2.146***
	(0.487)	(0.642)	(0.607)
B: Mining and quarrying	1.313*	2.054**	0.923
	(0.775)	(0.892)	(0.863)
C: Manufacturing	1.137***	1.458**	1.337**
	(0.432)	(0.593)	(0.561)
D: Electricity supply	4.214***	5.599***	5.019***
	(0.610)	(0.752)	(0.717)
E: Water supply	5.144**	8.947***	6.759***
	(2.138)	(2.346)	(2.246)
F: Construction	0.765*	1.474***	0.894*
	(0.438)	(0.565)	(0.540)
G: Wholesale and retail trade	1.346***	1.587**	1.383**
	(0.464)	(0.614)	(0.580)
H: Transportation	1.959***	2.609***	2.193***
	(0.489)	(0.649)	(0.616)
I: Accommodation and food service activities	1.720**	1.904**	2.215***
	(0.686)	(0.865)	(0.820)
J: Information and communication	0.628	2.203***	1.231*
	(0.537)	(0.664)	(0.648)
K: Financial and insurance activities	1.299**	1.889***	1.497**
	(0.569)	(0.721)	(0.685)
L: Real estate activities	0.332	0.888	0.245
	(0.455)	(0.626)	(0.599)
M-N: Professional activities	0.891	1.886**	1.117
	(0.588)	(0.732)	(0.703)
O: Public administration	1.058	1.366	0.952
	(0.690)	(0.829)	(0.793)
P: Education	2.436**	3.188***	1.831*
	(0.949)	(1.110)	(1.068)
Q: Human health	-1.959***	-1.285*	-1.424*
	(0.606)	(0.773)	(0.730)
R-U: Arts, entertainment	3.646***	4.110***	4.495***
	(0.986)	(1.162)	(1.111)

Panel B presents the detailed results of sectoral shares loading for columns (4)-(6) of the Panel A estimation of our country-industry analysis. Sectors E: Water supply and D: Electricity supply have the most substantial coefficients. The coefficients of these two sectors are significantly higher than those

of the remaining sectors in all three models. According to Table 1, which contains descriptive statistics, these two sectors' share of GVA has a relatively low impact, 2 % for sector D and less than 1 % for sector E.

The manufacturing (C) and trade (G) sectors have a share of GVA of more than 10 %, but their coefficients are comparatively substantial. All sectors have a positive effect on the VAT gap, except the human health (Q) sector; however, this sector is not significant.

Table 4 adds the effect of the FDI on VAT compliance analysis. In Panel A, we used sectoral shares of sales of foreign and honest subsidiaries as sectoral shares loading. In columns (1)-(2), we added a share of sales of foreign subsidiaries; in columns (3)-(4), from foreign subsidiaries, we selected only those whose parent companies are established in low CPI-measured countries. In columns (1) and (3), we used macroeconomic variables, and WGI indicators were added beside them in columns (2) and (4).

In Panel A, we can observe one quite interesting change regarding WGI. In column (4), where we have added a share of sales of "honest" subsidiaries, indicators of the rule of law and regulatory quality are significant and more substantial[16]. The transparent and good regulatory framework, government efficiency, and low corruption are usually highly correlated with FDI entry, especially from low-corruption countries. As a result, the rule of law and regulatory quality are the only significant WGI variables, as the FDI presence absorbs other effects, such as corruption.

Consistently across all models, the shadow economy has a significant and harmful impact on VAT compliance. Similarly to Table 3, macroeconomic variables are statistically significant, with a positive effect on VAT compliance throughout all modifications we have made in Panel A of Table 4.

The composition of variables is the same as in Panel A, however, we augmented this analysis for total foreign and "honest" sales share in Panel B. In this panel, we can clearly observe the substantial effect of the rule of law. Political stability is also significant, except in column (2). Similar to Table 3, once we control for FDI share in particular sectors, or sectoral shares on VAT collection, the impact of the Shadow economy is mitigated by the structure of the economy, and the coefficient on the shadow economy "*per se*" is still substantially negative, yet smaller than without these controls.

[16] *Rule of law* estimates perceptions of the quality of contract enforcement, property rights, the police, and the courts. *Regulatory quality* estimates the perception of the government's ability to formulate and implement policies and regulations to promote private sector development. All indicators are bounded between -2.5 and 2.5. higher values mean better quality.

Table 4. Partial results of Eq.(1): Effects of the FDI on VAT (non)compliance.

In this table, we present the complete estimation of Eq. (1). We augmented the Table 3 specification (leading indicators of governance effectiveness, extent of shadow economy, and macroeconomic factors) for the possible impact of FDI on VAT (non)compliance. Various specifications use two categories of FDI: general (foreign) and FDI from countries with low corruption levels, measured by CPI ("honest"). Panel A employs sectoral shares of sales of foreign (and "honest") subsidiaries. In Panel B, we used foreign subsidiaries' total share of sales to measure FDI influence on VAT compliance. The VAT gap is calculated as the difference between potential VAT revenue and actual collected VAT revenue. Positive coefficients increase the VAT gap and thus reduce VAT compliance; negative coefficients do the opposite. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

Panel A. Using sectoral shares of sales of foreign and investors with low CPI (honest)

	(1)	(2)	(3)	(4)
Control of corruption:		-0.019		-0.039
		(0.023)		(0.026)
Government Effectiveness:		0.028		0.039
		(0.020)		(0.025)
Political Stability and Absence of Violence		-0.017		0.007
		(0.015)		(0.017)
Rule of law:		0.063*		0.091***
		(0.032)		(0.033)
Regulatory Quality:		0.032		0.063**
		(0.023)		(0.026)
Shadow economy (%)		1.159***		0.701***
		(0.196)		(0.202)
GDP growth	-0.457***	-0.396***	-0.419***	-0.371***
	(0.080)	(0.077)	(0.088)	(0.084)
GDP per capita	-0.001	0.000	-0.002***	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)
Constant	0.142***	-0.168***	0.180***	-0.202***
	(0.025)	(0.056)	(0.025)	(0.062)
Country FE	yes	yes	yes	yes
Sectoral shares (loading)	foreign	foreign	honest	honest
R^2	0.791	0.822	0.840	0.872
Adjusted R^2	0.768	0.797	0.819	0.850
N, observations	376	354	265	252

To complete the analysis of the effects of the FDI on VAT compliance, we present Panel C of Table 4. The composition of variables is the same as in Table 3 (government effectiveness in columns (1) and (4), macroeconomic variables in columns (2) and (5), and both of them in columns (3) and (6)). Still, we added total foreign and hones sales shares. The impact of foreign and honest subsidiaries on the VAT collection is positive and statistically significant, yet small in economic significance. We speculate that

these results reflect two aspects – likely positively induced VAT compliance and negative impact of possibly sizeable exports of foreign-owned subsidiaries[17].

Table 4 (continues). Partial results of Eq.(1): Effects of the FDI on VAT (non)compliance.

Panel B. Using sectoral shares of sales of foreign and investors with low CPI (honest)
In Panel B, we used foreign subsidiaries' total share of sales to measure FDI influence on VAT compliance (again, in the general category foreign and low-CPI, i.e., "honest").

	(1)	(2)	(3)	(4)
Foreign sales share	0.001***	0.001*		
	(0.000)	(0.000)		
Honest sales share			0.002***	0.001**
			(0.001)	(0.001)
Control of corruption:	-0.026	-0.025	-0.028	-0.025
	(0.020)	(0.019)	(0.020)	(0.019)
Government Effectiveness:	-0.024	-0.027	-0.017	-0.024
	(0.019)	(0.019)	(0.019)	(0.019)
Political Stability and Absence of Violence	-0.039***	-0.024*	-0.038***	-0.025**
	(0.013)	(0.013)	(0.013)	(0.013)
Rule of law:	0.091***	0.090***	0.092***	0.090***
	(0.028)	(0.027)	(0.028)	(0.027)
Regulatory Quality:	-0.006	-0.006	-0.007	-0.006
	(0.022)	(0.021)	(0.022)	(0.021)
Shadow economy (%)	0.522***	0.540***	0.519***	0.532***
	(0.176)	(0.172)	(0.174)	(0.170)
GDP growth		-0.429***		-0.430***
		(0.070)		(0.069)
GDP per capita		0.001***		0.001**
		(0.001)		(0.001)
Constant	-1.367**	-1.234**	-1.352**	-1.188**
	(0.581)	(0.558)	(0.579)	(0.558)
Country FE	yes	yes	yes	yes
Sectoral shares (loading)	foreign	foreign	honest	honest
R^2	0.836	0.851	0.836	0.851
Adjusted R^2	0.817	0.833	0.818	0.834
N, observations	452	452	452	452

[17] To explain the negative impact of FDI presence captured by estimates of total shares of foreign subsidiaries, we should mention one „disadvantage" of VAT, it is the zero-export rate. This feature has also been proven to be the most attractive to deliberate criminal attacks (Keen & Smith, 2006). In view of this, the intracommunity acquisitions of goods and supply of services within the single EU market create the perfect conditions for over-declaration of the actual export value. Braml and Felbermayr (2022) speculate that VAT fraud is related to a large share of the EU's trade surplus (the difference between intra-EU exports and imports). Missing trader frauds also take advantage of cross-border trade (Braml & Felbermayr, 2022; Fedeli & Forte, 2011).

Table 4 (continues). Partial results of Eq.(1): Effects of the FDI on VAT (non)compliance.

Panel C. Using sectoral shares of sales of foreign and investors with low CPI (honest)

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign sales share	0.001***	-0.000	0.001*			
	(0.000)	(0.000)	(0.000)			
Honest sales share				0.002***	0.000	0.002***
				(0.000)	(0.001)	(0.001)
Control of corruption:	-0.036*		-0.030	-0.039*		-0.028
	(0.021)		(0.021)	(0.021)		(0.020)
Government Effectiveness:	0.019		0.022	0.028		0.028
	(0.020)		(0.020)	(0.020)		(0.020)
Political Stability and Absence of Violence	-0.041***		-0.032**	-0.039***		-0.033**
	(0.014)		(0.014)	(0.014)		(0.014)
Rule of law:	0.015		-0.004	0.014		-0.009
	(0.028)		(0.028)	(0.028)		(0.027)
Regulatory Quality:	0.025		0.029	0.022		0.028
	(0.022)		(0.021)	(0.022)		(0.021)
Shadow economy (%)	1.110***		1.034***	1.141***		1.064***
	(0.150)		(0.151)	(0.139)		(0.140)
GDP growth		-0.396***	-0.358***		-0.361***	-0.345***
		(0.071)	(0.071)		(0.070)	(0.070)
GDP per capita		-0.001	0.000		-0.001***	-0.001
		(0.000)	(0.001)		(0.000)	(0.001)
Constant	-0.013	0.133***	0.007	-0.029	0.149***	0.012
	(0.042)	(0.020)	(0.047)	(0.042)	(0.020)	(0.047)
Country FE	yes	yes	yes	yes	yes	yes
Sectoral shares	no	no	no	no	no	no
R^2	0.766	0.757	0.780	0.769	0.756	0.784
Adjusted R^2	0.750	0.744	0.764	0.754	0.744	0.769
N, observations	452	480	452	452	480	452

Conclusions

This paper aims to shed light on factors affecting VAT compliance using a panel of European countries over a 22-year time span. We formulated three main research questions; to answer them, we developed four hypotheses. The first research question concerned the influence of the shadow economy and macroeconomic conditions on VAT collection. Macroeconomic variables, in particular the GDP growth proxying the phases of the business cycle, have a positive effect on VAT compliance. This effect remains stable across all considered specifications. Similarly, the impact of the shadow economy has been negative, statistically, and economically significant in all specifications. While the impact of the shadow economy varies across the models and additional explanatory variables, it

remains very substantial and important. It suggests that about a one percent increase in the shadow economy is transferred by the same portion into VAT non-compliance, which carries several implications for policymakers. First, the negative impact of the informal economic sector on income tax and social security collection is further magnified by the harmful spillover to VAT non-compliance. Second, the successful reduction of the shadow economy could have a multiplier effect through indirect tax collection.

The second research question was related to the quality and efficiency of public institutions and the control of corruption influencing VAT compliance. We observe a substantial impact of the government quality indicators on reducing the VAT gap. Across all specifications, the control of corruption and political stability indexes have a positive effect on VAT compliance. Of course, other indexes also become statistically significant in reducing the VAT gap in particular specifications. Again, these results resonate with the existing literature on tax morale, tax evasion, and the quality of government services. From the public administration perspective, we show that all factors that could have moderate shadow economy activities are almost at the same rate transferred into increasing VAT compliance, which makes the quest for policymakers more effective.

The third research question was related to the possible "import" of tax morale through foreign subsidiaries operating in the country. To what extent does the share of foreign ownership in the analyzed sectors affect VAT (non-)compliance? In particular, does the increasing share of foreign ownership from countries with low corruption positively impact VAT compliance? We used pan-European and worldwide firm-level databases such as ORBIS Global and Amadeus to quantify the share of foreign and "honest" investors in sales in the given country (industry). We considered various specifications, using sectoral loading (share) of foreign subsidiaries to the total share of foreign subsidiaries on country sales and possibly VAT collection. We observed that the impact of foreign and honest subsidiaries on the VAT collection is positive and statistically significant, yet small in economic significance. We speculate that these results reflect two aspects – likely positively induced VAT compliance and negative impact of possibly sizeable exports of foreign-owned subsidiaries. The impact of foreign trade flows is our suggestion for further research.

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