

What drives the VAT gap in the European Union?²

1. Introduction

Both developed and developing countries face a problem of VAT gap which is defined as a difference between the expected and actual VAT revenues (European Commission, EC). Consequences of a large VAT gap are severe for public and private sector. The tax gap is a challenge for the sustainability of public finance, both in revenue and expenditure sides. From the perspective of enterprises, unfair competition with firms committing tax evasion distorts the level playing field and may lead to an elimination of firms obeying the tax rules. Identification of determinants of the VAT gap may allow to create effective tools aiming to restrain this phenomenon. In practice, it means an increase in budget revenues, which can be then redistributed in favour of society and sound business environment. There is a feedback loop between those two dimensions: paying taxes by the entrepreneurs has a positive impact on the budget revenues which help then to satisfy the needs of citizens, including the entrepreneurs.

The aim of this analysis is to identify determinants of the VAT gap in the EU Member States to support the macroeconomic policy. Until 2015 an increase in the VAT gap had been observed and the appropriate measures to address the problem should be chosen based on the results of empirical research. The in-depth understanding of the mechanism of VAT gap formation enables to use tailored policy measures to restrain the scale of this phenomenon.

This paper includes the literature review in section 2. Section 3 describes the available data, methodology as well as results and sensitivity analysis. Section 4 summarizes and concludes.

¹ Ministry of Finance in Poland. The views expressed are those of the author and do not necessarily reflect those of the Ministry of Finance in Poland.

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2. Literature review

There is a consensus in the literature on determinants of the VAT gap which might be grouped into three categories: macroeconomic, demographic, institutional and related to the citizens' trust in the state.

Among the macroeconomic and demographic factors of the VAT gap formation, the key role is played by the economic condition described mainly as real GDP level *per capita*, share of shadow economy, openness of the economy as well as population size. The research results point out that more developed countries, with higher level of GDP *per capita*, are characterised by lower VAT gap³. Unregistered activity within the shadow economy definitely increases the VAT gap scale⁴. Challenges related to the assessment of the actual size of shadow economy limit the estimation precision of the potential losses for the budget. The results also indicate a positive impact of the border control on tax payment by the exporters⁵. The size of countries, measured by the number of inhabitants, has a negative influence on the VAT gap⁶. This conclusion is based largely on lack of inhabitants' trust that they would actually benefit from the redistribution of budget revenues. Besides, it is a matter of morality and probability of potential punishment – the probability of a control is lower in a large group of tax payers. In the case of European countries, the size of the VAT gap also depends on the membership in the EU and the euro area⁷. The euro area members seem to be more effective in limiting the scale of the VAT gap than the non-euro countries. This is related to a lower level of corruption as well as more effective and transparent public institutions in the common currency area. The dependence between the euro area membership and low VAT gap might be spurious but the

³ J. Aizenman, Y. Jinjirak, *The collection efficiency of the Value Added Tax: Theory and international evidence*, "Journal of International Trade & Economic Development" 2008, vol. 17(3), pp. 391–410.

⁴ HM Customs and Excise, *Measuring Tax Gaps 2011*; HM Customs and Excise, *Preliminary Estimate of the VAT Gap for 2011/2012*; H. Zidkova, *Determinants of VAT Gap on EU*, "Prague Economic Papers" 2014, vol. 4, pp. 514–530.

⁵ J. Aizenman, Y. Jinjirak, op.cit.; K. Matthews, *VAT Evasion and VAT Avoidance: Is there a European Laffer Curve for VAT?*, "International Review of Applied Economics" 2003, vol. 17(1), pp. 105–114.

⁶ A. Agha, J. Haughton, *Designing VAT Systems: Some Efficiency Considerations*, "The Review of Economics and Statistics" 1996, vol. 78, no. 2, pp. 303–308; Reckon LLP, *Study to Quantify and Analyze the VAT Gap in the EU-25 Member States*, Report commissioned by the European Commission, Directorate-General for Taxation and Customs Union, 2009.

⁷ CASE, *Study to quantify and analyse the VAT Gap in the EU-27 Member States*, 2013.

quality of institutions definitely lead to restrain the VAT gap scale also outside the euro area what has been proved in the empirical research.

Corruption is closely related to the institutional aspects of the effectiveness of tax collection, including VAT. The Corruption Perception Index published by Transparency International is a commonly used indicator of this factor. It allows to compare the quality of public institutions in particular countries from the perspective of transparency and vulnerability for potential corruption attempts. The perceived tendency to corruption affects the citizens' trust in public institutions which is reflected in the size of the VAT gap. In countries characterised by higher transparency of public institutions the VAT gap is lower⁸. It is worth mentioning that in the case of the euro area members the corruption perception is lower than in other European countries.

Among the institutional determinants of the VAT gap we can distinguish also the characteristics of tax systems like the standard VAT rate or the number of reduced VAT rates⁹. In both cases the analyses suggest a positive dependence between the standard VAT rate or the number of reduced VAT rates and the size of the VAT gap, i.e. the VAT gap is often larger in countries with higher standard VAT rate or larger number of reduced VAT rates. It is a result of the amount of tax revenues and the complexity of tax system. The large number of reduced VAT rates causes problems for tax payers to fill the tax declarations correctly. It may also encourage them to be more creative in terms of products classification based on the height of the VAT rate in order to reduce the tax payments. Scandinavian countries are an exception in this regard because high VAT rates are accompanied by advanced tax morale of the citizens.

Citizens' trust in the state implies an honest relationship between both players. Well-founded social norms related to the tax payment and strong objection against any form of tax evasion contribute to higher effectiveness of tax collection. The feeling of social justice, when citizens benefit from the redistribution of public revenues and do not observe severe inequalities, only boosts that effect. Both high level of social inequalities and at-risk-of-poverty rate lead to an increase in the VAT gap¹⁰.

In the literature a lot of attention is also paid to the effectiveness of tax administration. Apart from the tax design, like the standard VAT rate or the number

⁸ Reckon LLP, op.cit.

⁹ A. Agha, J. Haughton, op.cit.; ibidem.

¹⁰ E. Christie, M. Holzner, *What Explains Tax Evasion? An Empirical Assessment Based on European Data 2006*, wiiw Working Papers 40; Reckon LLP, op.cit.

of reduced VAT rates, there are other key elements that affect the effectiveness of tax collection: i) administrative costs of tax administration¹¹, ii) the socially perceived fairness of the tax system, iii) effectiveness of the legal system and iv) the punishment rate for tax frauds¹². An increase in the expenditure on tax administration (in relation to net revenues) may contribute to higher effectiveness of tax collection. Highly perceived effectiveness of the tax system as well as effectiveness of the legal system and high punishment rate for tax frauds help to restrain the scale of the VAT gap.

3. Econometric analysis

In this analysis we used data on the VAT gap scale in the EU Member States from the CASE Report¹³ prepared for the EC. Poland is characterised by a relatively high level of the VAT gap, 24.5% of the expected VAT revenues in 2015, exceeding the EU average by 10 percentage points. The dynamics analysis suggests that the problem of the VAT gap formation escalated during the crisis and has not significantly recovered in the aftermath. Determinants of the VAT gap may be thus more rooted in the tax-institutional system whose weaknesses came up during the turbulent times. Recovering from the crisis has not improved the situation significantly which only confirms the conjecture of the long term nature of the VAT gap determinants.

The VAT gap is defined as a difference between the expected (theoretical) and actual VAT revenues, expressed as a share of expected VAT revenues (*VAT Total Tax Liability*, VTTL):

$$VAT\ gap = \frac{\text{expected VAT revenues} - \text{actual VAT revenues}}{\text{expected VAT revenues}} \quad (1)$$

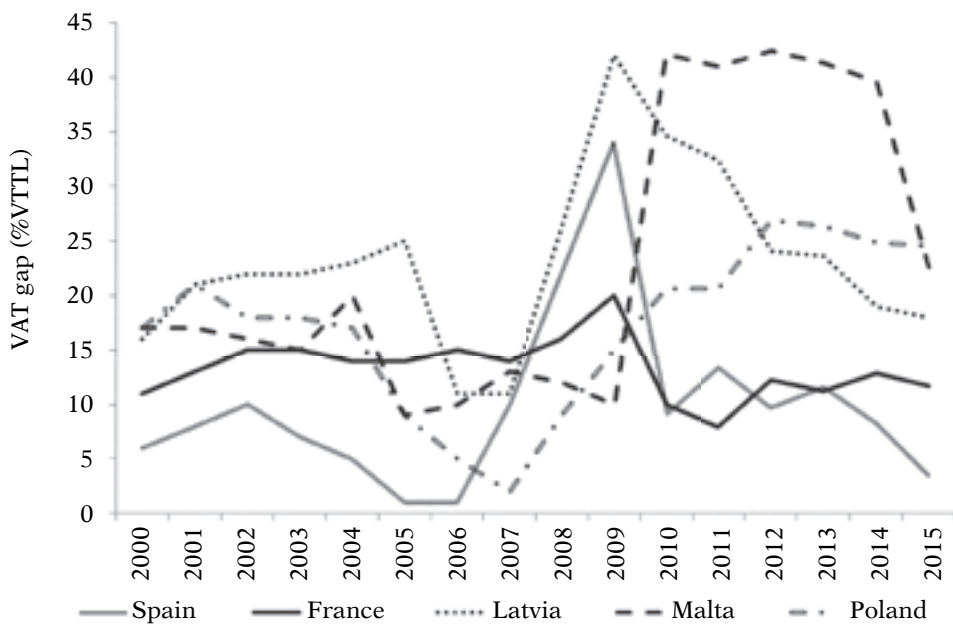
The assessed size of the VAT gap in the following editions of the CASE Report does not seem to be consistent. The values for particular countries and years in the overlapping periods differ significantly. The analysis of cut-off dates in the consecutive reports indicates structural changes in time series, which are

¹¹ A. Agha, J. Haughton, op.cit.

¹² These indicators are acquired from the *World Value Survey*. E. Christie, M. Holzner, op.cit.

¹³ CASE, *Study and Reports on the VAT Gap in the EU-28 Member States: 2017 Final Report*, 2017.

difficult to explain, e.g. Malta (see Graph 1.). Having in mind the methodological inconsistencies between the editions of the CASE Report and different values in the overlapping periods, we decided to use a dataset from one edition only, i.e. 2011–2015 (excluding Cyprus and Croatia). In this case, the analysis results are more reliable thanks to comparable data obtained in a consistent way. Using the assessment of the dependent variable instead of the exact values generates challenges related to the econometric modelling. However, other sources of the VAT gap data in all the EU Member States are not publicly available.



Graph 1. VAT gap level in selected EU economies in 2000–2015 (%VTTL)

Source: Based on CASE data.

Based on the literature review we analysed potential explanatory variables, classified into the following categories:

Macroeconomic and demographic factors:

- output gap, % GDP (OECD)
- GDP (Eurostat)
- population size (Eurostat)
- share of shadow economy, % GDP (World Bank)
- Gini index (World Bank)
- share of small firms /1–9 employees/ (OECD)

- trade exchange within/outside the EU, % GDP (Eurostat)
 - exports discrepancy, % exports (Comext)
 - share of cashless transactions (ECB)
- Institutional factors:
- quality of institutions /Corruption Perception Index/ (Transparency International)
- Factors related to the design of tax system and its effectiveness:
- weighted average VAT rate (CASE)
 - standard VAT rate (EC)
 - the lowest (non-zero) VAT rate (EC)
 - the number of VAT rates (EC)
 - spread of VAT rates /difference between the highest and the lowest VAT rate/ (EC)
 - collection cost /administrative costs for tax administration in relation to net revenue / (OECD)
 - complexity of tax forms /time to prepare and pay taxes in hours/ (World Bank)
 - IT expenditure /share of total IT expenditure in total revenue body revenue/ (OECD)
 - HR expenditure /share of total human resource management support functions in total expenditure/ (OECD)

The analysis of potential explanatory variables allowed to observe ambiguous, difficult to identify, dependencies between them and the dependent variable. A weak positive relation between the output gap and the VAT gap could be cautiously suggested but other macroeconomic or demographic variables do not represent a high correlation rate with the size of the VAT gap.

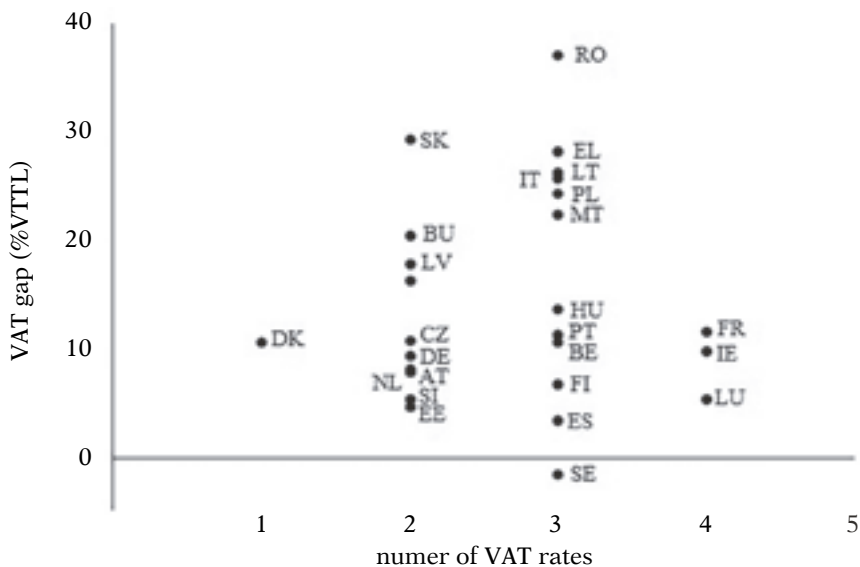
The potential impact of the quality and transparency of institutions as well as social trust in the state measured by the Corruption Perception Index (CPI) is more pronounced. Countries characterised by higher institutional culture report lower level of the VAT gap. The perceived tendency to corruption affects the citizens' trust in the tax bodies which contributes to lower VAT gap¹⁴. This effect is strengthened by the feeling of social justice stemming from the effective redistribution of tax revenues.

No clear relations were observed among the variables describing the design of tax system. The number of VAT rates or the value of standard VAT rate present an ambiguous impact on the VAT gap level. Based on the data from 2015, it is difficult to claim if the number of VAT rates actually influences the VAT

¹⁴ Reckon LLP, op.cit.

gap. Apart from the outliers (Denmark and Luxembourg), which do not suggest either if the lower number of VAT rates is more effective, the rest of countries report very diverse level of the VAT gap regardless of the number of VAT rates (see Graph 2.). In this context, the regularly repeated Council's recommendation to *limit the use of reduced VAT rates*¹⁵ is not easy to be justified. A similar conclusion can be formulated for the unclear relations between the value of standard VAT rate and the VAT gap.

A more clear negative relation seems to exist between the IT expenditure in tax administration and the size of the VAT gap. Investment in IT systems in tax administration improves the quality of data gathering which allows to carry out reliable analyses and in result to identify tax fraudsters more effectively.



Graph 2. Number of VAT rates vs. VAT gap level in 2015 (%VTTL)

Source: Based on data from CASE and the EC.

The positive implications of modern IT systems are observed especially in countries characterised by low VAT gap (NL, DK, UK, SE, AT, FI). Those countries bear high costs of IT systems maintenance regularly year by year or systematically raise them (AT). The other countries reporting low VAT gap

¹⁵ The Council of the European Union, *Council Recommendation of 11 July 2017 on the 2017 National Reform Programme of Poland and delivering a Council opinion on the 2017 Convergence Programme of Poland*, Official Journal of the European Union (2017/C 216/20).

(ES, SI, DE, BE, FR) do not invest significantly in IT systems, therefore this relation does not seem to be that obvious. Poland, in this respect, lags behind in terms of both the IT expenditure and the size of the VAT gap. Administrative costs of tax administration¹⁶ and social perception of the tax system's fairness¹⁷ play an important role in identifying determinants of the VAT gap. An increase in expenditure on tax administration may thus contribute to higher effectiveness of tax collection.

Some of the abovementioned variables are time-invariant (at least in the sample), which limits the range of available econometric methods. The VAT gap phenomenon is dynamic by nature but due to a short sample of data obtained in a consistent way, the appropriate dynamic analysis seems to be challenging. Therefore, having in mind all the limitations, we decided to use the random effects estimator which allows to include the time-invariant variables and explain the influence of differences between countries on the VAT gap level:

$$y_{it} = \mu + \mathbf{x}'_{it}\beta + v_{it} \quad i = 1, \dots, N; t = 1, \dots, T \quad (2)$$

$$v_{it} = \alpha_i + \varepsilon_{it}$$

The random variable v_{it} is a sum of random individual effects α_i and white noise ε_{it} . Due to other features of the random effects models, e.g. variance of individual effects not equal to zero, the model is estimated with the use of GLS which is more effective than OLS in this case¹⁸.

Carrying out the empirical analysis has been challenging as the sample is not long enough, the quality of data is not fully satisfying and dependencies between the variables have been difficult to identify. In many options of the specification the coefficients were not stable and their signs were not in line with the economic intuition. Besides, many potential explanatory variables were not statistically significant, especially those describing macroeconomic condition and design of the tax system.

Results of the analysis indicate thus an important role of the quality of institutions and effectiveness of tax administration in explaining the development of VAT gap (see Table 1.). The coefficient of the quality of institutions suggests a decrease in the VAT gap by 0.02 in result of an increase in the Corruption

¹⁶ A. Agha, J. Haughton, op.cit.

¹⁷ E. Christie, M. Holzner, op.cit.

¹⁸ B. Baltagi, *Econometric Analysis of Panel Data*, John Wiley & Sons Ltd, 2008.

Perception Index by a unit. Design of the tax system, i.e. the standard VAT rate, the number of VAT rates or their spread do not stand as key determinants in explaining the VAT gap phenomenon in the EU Member States. High weighted average VAT rate decreases the effectiveness of VAT collection but the other elements of tax system seem to be statistically insignificant. The results point out that adoption of the Council's recommendation to *limit the use of reduced VAT rates*¹⁹ may not necessarily lead to a decrease in the VAT gap. The effectiveness of VAT collection is more affected in a positive way by the quality and trust in institutions and investment in IT systems in tax administration which raises the effectiveness of tax collection as well as allows to identify potential tax frauds. The cost of collection seems to be significant too – the negative sign of its coefficient might be interpreted as the positive impact of effective spending on tax administration in order to minimise the scale of the VAT gap.

An adequate quality of institutions and social trust in the state may contribute to higher effectiveness of tax collection. Efficient tax administration characterized by a high level of digitalization and highly qualified personnel may result in minimizing the scale of tax frauds. On the other hand, the determinants of VAT gap described commonly in the literature as crucial in the analyses did not turn out to be significant in the empirical research. It stresses the need for an in-depth understanding of the VAT gap mechanism, which allows to choose the most adequate policy measures to restrain the size of this phenomenon. Systematic data collection, reliable research and interinstitutional cooperation in the area of tax fraud may significantly limit misbehaviours related to the tax law. Moreover, common cashless payments, electronic register of invoices and receipts as well as an increase in transparency of public institutions activities could substantially reduce the scale of the VAT gap in the EU Member States. The analysis of mechanisms building up the shadow economy, whose one of the elements is the VAT gap, indicates a reduction in the passive shadow economy by 0.87% GDP resulting from the obligatory electronic payments of pensions, wages and salaries. The obligation to operate POS terminals in all sectors where the passive²⁰ shadow economy has been identified could restrain the scale of shadow economy by additional 0.79% GDP²¹.

¹⁹ The Council of the European Union, op.cit.

²⁰ Passive shadow economy relates to the unreported cash transactions that can be beneficial for one side of the transaction only, i.e. the seller. The consumer is passive in this case.

²¹ EY, *Reducing the Shadow Economy through Electronic Payments 2016*.

Table 1. Results of estimations

Explanatory variables	Results of estimations				
	1	2	3	4	5
standard VAT rate			0.206736	0.2825	
weighted -av. VAT rate	1.81658***	1.3541***			1.33181**
quality of institutions	-0.018561**	-0.02022***	-0.023449***	0.024293***	-0.0261***
IT expenditure	0.369948**	0.394394***	-0.466471***	-0.393334***	0.398613***
HR expenditure	0.856378	0.764943	0.566831		0.196722
the lowest VAT rate	-0.733644				-0.557513
spread of VAT rates	-0.61323		-0.217891	-0.305962	-0.552886
number of VAT rates	0.003309		0.000609	0.026943	0.005222
collection cost					-4.04708***
cons.	0.208475	0.15573	0.352874**	0.288358**	0.35306**
R^2 within	0.3064	0.3003	0.2722	0.1406	0.4602
R^2 between	0.6045	0.5752	0.4572	0.5749	0.5870
R^2 overall	0.6218	0.5817	0.4763	0.5654	0.6131

*** p-value < 0.01 ** 0.01 ≤ p-value < 0.05 * 0.05 ≤ p-value < 0.1

Source: Author's estimation (Stata 14).

Having in mind the limited panel dataset used in this analysis, a complementary sensitivity analysis was carried out, aiming to verify the results stability to a modified sample or estimation method. The estimation has been repeated based on a cross-country sample for 2013, which is characterized by the lowest share of missing values among the most updated data (see Table 2.).

Table 2. Results of sensitivity analysis

Results of sensitivity analysis		
Explanatory variables	Coefficients	Standard Error
quality of institutions	-0.0833785 ***	0.0110293
IT expenditure	-0.4786322 **	0.1711279
HR expenditure	-1.774017 ***	0.5475973
complexity of tax forms	-0.0010431 ***	0.0001808
the lowest VAT rate	0.5948869 **	0.2524157
cons.	0.9820487 ***	0.100113
R ²	0.8723	
Adjusted R ²	0.8143	
RMSE	0.04138	
F(5, 11)	15.03	
Prob > F	0.0001	

*** p-value<0.01 ** 0.01 ≤ p-value<0.05 * 0.05 ≤ p-value<0,1

Source: Author's estimation (Stata 14).

The conclusions from this exercise are consistent with those obtained in the panel data analysis. The quality of institutions, IT expenditure and highly qualified tax officers are the key factors that may decrease the size of the VAT gap. In addition, the complexity of tax forms and the lowest (non-zero) VAT rate turn out to be statistically significant too. The complexity of tax forms may improve the comprehensiveness of data collection which in turn might increase the effectiveness of tax administration. Higher precision in this aspect may thus result in lower VAT gap. The use of reduced VAT rates may limit the scale of tax evasion especially in the case of low tax burden, e.g. primary goods, which again points out the need to reconsider the Council's recommendation regarding the limited use of reduced VAT rates.

4. Conclusions

Both developed and developing countries face a problem of the VAT gap. Consequences of this phenomenon are severe for public and private sector which stresses the need for an adequate diagnosis of its determinants as well as effective policy measures to minimise its scale. Restraining the size of the VAT gap results in higher budget revenues but, more importantly, in fair market competition and sound business environment.

According to the literature, the VAT gap sources can be of macroeconomic, demographic or institutional nature but they also relate to the citizens' trust in the state. Based on the panel analysis of the EU Member States (excluding Croatia and Cyprus) in 2011–2015 we found out that:

- design of the tax system, i.e. the number of VAT rates or their spread, is not a key determinant of the VAT gap which suggests that the Council's recommendation *to limit the use of reduced VAT rates* is quite difficult to justify. The reform of tax system implying lowering of the VAT rates or their spread might not necessarily contribute to a reduction of the VAT gap.
- IT expenditure in tax administration might improve the effectiveness of VAT collection. The attention should be also paid to higher effectiveness of tax administration in the context of reliable data collection allowing for comprehensive analyses whose implementation might increase the detection rate of tax frauds. Countries that invest largely in IT systems in tax administration report low levels of the VAT gap, e.g. Sweden, the Netherlands, Denmark, Great Britain, Austria or Finland.
- the quality and transparency of public institutions induce citizens' trust in the state also regarding the fairness of redistribution which in turn leads to higher effectiveness of tax collection. Countries characterised by high institutional culture do not face severe problems with the VAT gap.

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Determinanty luki VAT w Unii Europejskiej

Streszczenie

Państwa członkowskie Unii Europejskiej zmagają się z problemem efektywnej ściągальności podatków, zwłaszcza w zakresie podatku od towarów i usług (VAT). Oszacowanie skali unikania opodatkowania jest niełatwym zadaniem, z czego zapewne wynikał fakt dotychczasowego niepublikowania danych na ten temat. Celem niniejszej analizy jest identyfikacja czynników determinujących poziom luki VAT w krajach Unii Europejskiej dokonana na podstawie badań panelowych. Efektywność systemu

podatkowego oraz kondycja makroekonomiczna gospodarki mogą wpływać na wielkość luki podatku od towarów i usług, ale te aspekty nie wyjaśniają w pełni analizowanego zjawiska. Jakość instytucji oraz zaufanie społeczne do państwa mogą także przyczynić się do efektywniejszej ściągальności podatków. Jednocześnie jednak istotność liczby stawek VAT czy ich rozpiętości, czyli czynnik powszechnie uznawany za ważny w analizowaniu luki VAT, nie znalazła potwierdzenia w badaniu empirycznym, co podważa zasadność powtarzanej od lat rekomendacji w zakresie podjęcia przez Polskę działań w celu ograniczenia stosowania obniżonych stawek VAT. Dokładne zrozumienie mechanizmu powstawania luki podatkowej pozwala na dobór odpowiednich narzędzi polityki gospodarczej, które doprowadzą do zmniejszenia skali zjawiska. Systematyczne gromadzenie danych statystycznych umożliwiające prowadzenie rzetelnych, regularnych analiz oraz współpraca międzyinstytucjonalna w zakresie wykrywania oszustw podatkowych mogą znacząco wpłynąć na ograniczenie nadużyć w zakresie prawa podatkowego. Ponadto, popularyzacja transakcji bezgotówkowych, elektroniczny rejestr faktur i paragonów oraz zwiększenie przejrzystości działalności instytucji publicznych istotnie zmniejszyłyby poziom luki VAT.

Słowa kluczowe: luka VAT, szara strefa, instytucje, administracja podatkowa, dane panelowe