EDUCORETAX
Volume 4 No.1, 2024

DETERMINANTS OF THE VAT GAP IN THE EUROPEAN UNION: AN EMPIRICAL EVIDENCE WITH CORRUPTION CONTROL AS A MODERATING VARIABLE

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Abstract
The aim of this study was to determine the effect of Shadow Economy, Economic Growth, Trade Openness, and Corruption Control on VAT Gap. Additionally, this study aims to examine the moderating effect of Corruption Control on the relationship between independent variables and the dependent variable. The study was conducted using panel data regression with Panel-Corrected Standard Errors (PCSE) model in 25 European Union countries for the 2003-2020 period. The research findings indicate that all independent variables simultaneously have a significant impact on VAT Gap. Partially, Shadow Economy has a positive effect on VAT Gap, while Economic Growth has a negative effect on VAT Gap. However, Trade Openness and Corruption Control do not significantly affect VAT Gap. Corruption Control only moderates the relationship between Shadow Economy and VAT Gap negatively. This suggests that effective corruption control measures in EU countries can reduce the negative impact of Shadow Economy on VAT revenue. Based on this research, policymakers are expected to implement comprehensive monitoring and auditing practices, simplify business regulations, and enhance education and support to mitigate the potential loss of value-added tax (VAT).
Keywords: Corruption, Economic Growth, Shadow Economy, Trade, VAT Gap

INTRODUCTION

The increasingly complex dynamics of the economy are driving every country to achieve sustainable economic growth (Navarro et al., 2014). To accomplish this goal, each country strives to optimize its revenue, especially through taxation from various economic sectors. Tax revenue is a crucial source of income for the government in the context of national development and the provision of public services (Arvin et al., 2021; Omodero et al., 2021; Wiguna & Wijaya, 2023). For these reasons, governments worldwide endeavor to collect taxes optimally.

However, in the pursuit of optimal tax collection, there are challenges, one of which is the VAT Gap. This condition refers to the difference between the potential tax revenue and the actual tax revenue collected (Poniatowski et al., 2020). The VAT Gap represents the percentage of lost value-added tax (VAT) or tax on goods and services that should have been received by the government. The Taxation and Customs Union of the European Commission (2022) has identified several factors contributing to the VAT Gap, including tax fraud, tax avoidance, tax evasion, cash flow/financial obstacles, as well as calculation and administrative errors.

Countries within the European Union (EU) pay special attention to the issue of VAT Gap within their regions. Therefore, the Directorate-General for Taxation and Customs Union of the EU routinely monitors the VAT Gap every year. Monitoring the VAT Gap is crucial for several reasons. Firstly, the VAT Gap serves as a measure of national tax collection performance in VAT collection. Secondly, the revenue loss due to the VAT Gap can have a negative impact on government spending. Thirdly, monitoring the VAT Gap can help develop better targets for future policy recommendations. In its report, the European Commission (2022) revealed that EU member states lose €93 billion in VAT revenue annually. This means that the EU loses €3,000 every second. Figure 1 shows the VAT Gap in EU countries in 2020.

Tax violations are a major issue leading to the existence of the VAT Gap (Gajewski & Jonski, 2022). Entities intentionally fail to report their economic activities or report inaccurately to the government to evade taxation. Economic activities that are not reported to or not recorded

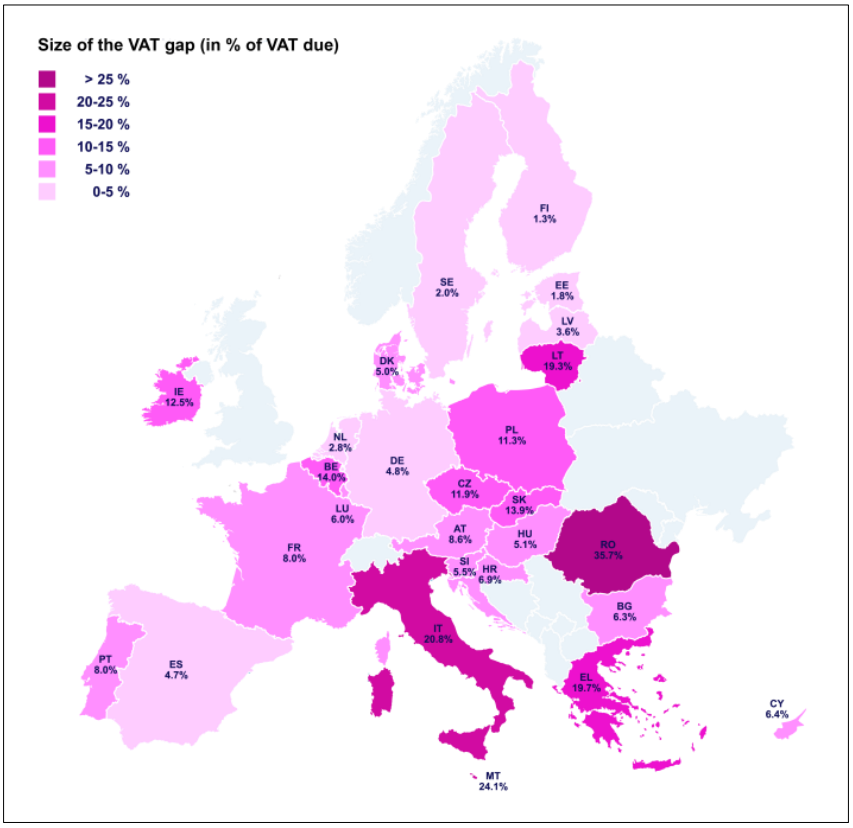

Figure 1 Size of VAT Gap in UE Countries in 2020

Source: European Commission (2022)

by the government are known as the Shadow Economy (Bashlakova & Bashlakov, 2021; Younas et al., 2022). OECD (2002) identified several forms of the Shadow Economy, including underground production, illegal production, informal sector production, household production for final use, and production that is missed due to recording errors. Generally, the larger the share of the Shadow Economy in the economy, the greater the risk of tax revenue loss (VAT Gap).

To address the potential tax revenue loss due to the VAT Gap, a country will aim to boost economic growth as a tax base expansion strategy (Karnowski & Rzońca, 2021). Economic growth represents an increase in economic activity that raises income, profits, and ultimately tax payments. Economic growth also signifies an increase in local and international transactions, which, in turn, increases tax revenue from value-added tax (VAT) (Surbakti & Wijaya, 2023). Therefore, economic growth can mitigate the negative effects of potential tax revenue loss caused by the VAT Gap (Lešnik et al., 2018).

However, efforts to address the VAT Gap through economic growth also pose their own challenges. Economic growth (GDP growth) directs a country toward international trade (Ji et al., 2022; Rahman, 2021). International trade (Trade Openness) increases opportunities for tax violations due to the complexity and scale of trade transactions (Kitsios et al., 2020). Moreover, parties involved in international trade may make reporting errors in their imports and exports (Bussy, 2020). This leads to underreported transaction values, resulting in a reduced VAT assessment base.

In line with the previous discussion, the increase in the VAT Gap is also caused by tax violations. Entities subject to taxation seek to reduce the value of transactions subject to income tax or VAT deliberately. An enterprise does this by bribing government officials to manipulate the tax audit results (Alm et al., 2016; Hamaguchi, 2020; Pacini, 2012). This highlights the

importance of corruption control for governments in addressing the VAT Gap (Olexová et al., 2022).

Several previous studies have shown how the Shadow Economy, Economic Growth, Trade Openness, and Corruption Control relate to the VAT Gap. Zídková (2014) found that the Shadow Economy has a positive impact, while Trade Openness has a negative impact on the VAT Gap. However, further research by Zidkova & Pavel (2016) revealed that the Shadow Economy, Economic Growth, and Trade Openness do not affect the VAT Gap. On the other hand, research conducted by Majerová (2016) showed different results, with Economic Growth having a positive impact on the VAT Gap. This indicates that previous research has not reached a definite conclusion regarding the influence of the Shadow Economy, Economic Growth, and Trade Openness on the VAT Gap.

The determinants of the VAT Gap are of interest in optimizing tax revenue, especially from the VAT sector. Previous studies have also yielded different results regarding the influence of the Shadow Economy, Economic Growth, Trade Openness, and Corruption Control on the VAT Gap. Through this research, the author intends to analyze the impact of the Shadow Economy, Economic Growth, Trade Openness, and Corruption Control on the VAT Gap using the latest available data. Additionally, this research aims to analyze the influence of Corruption Control on the relationship between the Shadow Economy, Economic Growth, and Trade Openness with the VAT Gap. The results of this research can provide insights into the policies that stakeholders can implement to reduce the VAT Gap.

LITERATURE REVIEW

Theoretical Foundation

Jensen & Meckling (1976) presented the agency theory, which explains the relationship between capital owners (principals) and agents (managers) within an entity or company. In this theory, principals and capital owners have different objectives, often leading to potential issues. Capital owners tend to focus on long-term profits for the sustainability of the company, while managers prioritize achieving short-term targets to enhance their personal gains. As a result, managers as agents may attempt to increase company profits by illegally reducing tax expenses (tax evasion), which sometimes conflicts with the long-term goals of the owners.

Bubanic et al. (2018) extended the agency theory into the concept of tax avoidance. Their research suggests that the government acts as the principal, while entities or taxpayers act as agents. The presence of asymmetric information between the government and entities leads to tax avoidance actions. This occurs because the government does not have full access to all taxpayer information (unreported or unrecorded). Consequently, agency costs arise due to the government's efforts to prevent or reduce tax avoidance activities. These agency costs include the implementation costs of tax regulations, monitoring and enforcement costs, as well as the costs associated with lost tax revenue (tax revenue gap) and its impact on economic policies.

Previous Research

Previous research has extensively examined the empirical impact of Shadow Economy, Economic Growth, Trade Openness, and Corruption Control on the VAT Gap. However, these studies have yet to reach a clear conclusion regarding the relationship between these variables. Table 1 displays several previous studies that have investigated the influence of Shadow Economy, Economic Growth, and Trade Openness on the VAT Gap.

Table 1 Previous Research

Author	Sample	Method	Variable	Result
Zídková (2014)	European Union	Cross-Section	Final Consumption as a percentage of GDP	+

	2002 and 2006		*VAT Revenue as a Percentage of GDP*	-
			Standard VAT Rate	+
			Proportion of Shadow Economy to GDP	+
			Proportion of International Trade to GDP	-
Pastusiak et al. (2022)	European Union 2000-2018	GMM Model	Economic Growth	-
			Proportion of International Trade to GDP	X
			Corruption Control	X
			Government Effectiveness	-
Majerová (2016)	European Union 2000-2011	Panel Data	Economic Growth	+
			Corruption Perception Index	-
			VAT Rate	X
Zidkova & Pavel (2016)	European Union 2000-2011	Panel Data	GDP Growth	X
			Proportion of Shadow Economy to GDP	X
			Corruption Perception Index	X
			Final Consumption as a percentage of GDP	+
Bikas & Malikonytė (2020)	Lithuania 2006-2016	Cross-Section	*Corruption Index*	+
			Government Expenditure	+
			Number of Company Bankruptcies Each Year	-
			Turnover of Small and Medium-sized Enterprises	-
Pluskota (2022)	European Union and Poland 2000-2018	GMM Modal	Economic Growth	-
			International Trade	-
			Consumption	-
			Corruption Index	-

Source: Compiled from various sources

Hypothesis

Based on the theoretical foundation and previous research findings, the following hypotheses are obtained:

H_1 : Shadow Economy has a positive impact on the VAT Gap;
H_2 : Economic Growth has a negative impact on the VAT Gap;
H_3 : Trade Openness has a positive impact on the VAT Gap;
H_4 : Corruption Control has a negative impact on the VAT Gap.;
H_5 : Corruption Control weakens the influence of Shadow Economy on the VAT Gap;

H_6 : Corruption Control strengthens the influence of Economic Growth on the VAT Gap; and
H_7 : Corruption Control weakens the influence of Trade Openness on the VAT Gap.

METHODS

The research was conducted using data from 25 out of 27 countries that are part of the European Union (EU) over an 18-year period from 2003 to 2020. Croatia and Cyprus were not included in the study due to data gaps. The research employed a quantitative method, which involves the collection and analysis of data to draw conclusions based on statistical analysis (Neumayer & Plümper, 2017).

The study used secondary data from sources such as the World Bank Open Data, European Commission, and Schneider (2022). The dependent, independent, and moderating variables used in the research are explained in Table 2.

Table 2 Research Variables

Independent Variables	**Interpretation**	**Unit**	**Data Scale**	**Source**
VAT Gap	The difference between the expected VAT and the actual collected amount	Percentage	Ratio	European Commission
Independent Variables	**Interpretation**	**Unit**	**Data Scale**	**Source**
Shadow Economy	The proportion of the Shadow Economy in the economy	Percentage	Ratio	Schneider (2022)
Economic Growth	Gross Domestic Product (GDP) growth	Percentage	Ratio	World Bank
Trade Openness	The proportion of exports and imports in the economy (GDP)	Percentage	Ratio	World Bank
Moderating Variable	**Interpretation**	**Unit**	**Data Scale**	**Source**
Corruption Control	The level of corruption control	Index	Ratio	World Bank

Source: Various sources, Compiled by the Author

The analysis was conducted using the Multiple Linear Regression method with Panel/Longitudinal Data type. Panel Data Model is data that involves observations of multiple entities (cross-section) over a certain period of time (time series) (Croissant & Millo, 2019). Testing was carried out to examine the influence of Shadow Economy, Economic Growth, and Trade Openness on the VAT Gap in 25 EU countries with Corruption Control as a moderator. Regression analysis was performed using the StataMP 17 application. The regression equation is as follows:

$$Y_{it} = \alpha + \beta_1 SE + \beta_2 EG + \beta_3 SoT + \beta_4 CORR + \beta_5 SECorr + \beta_6 EGCorr + \beta_7 SoTCorr + \varepsilon$$

$Y = VAT\ Gap\ (Percent)$
$\alpha = Constant$
$\beta = Regression\ Coefficient$
$SE = Shadow\ Economy\ (Percent)$
$EG = Economic\ Growth\ (Percent)$
$SoT = Share\ of\ Trade\ (Percent)$
$CORR = Corruption\ Control$
$SECorr = Shadow\ Economy\ with\ CORR\ Moderation$

$EGCorr = Economic\ Growth\ CORR\ Moderation$
$SoTCorr = Share\ of\ Trade\ with\ CORR\ Moderation$
$\varepsilon = Residual$

RESULT AND DISCUSSION

Before conducting the regression, the research begins with a descriptive statistical analysis of each research variable. This is done to provide a descriptive explanation of the research variables and to assist in explaining the research findings (Guetterman, 2019). The descriptive statistics for this study include the number of observations, minimum value, maximum value, mean, and standard deviation for each variable during the years 2003-2020. Table 3 presents the results of the descriptive statistical analysis of variables for 25 EU countries over an 18-year period, totaling 450 data points.

Table 2 Results of The Descriptive Statistical Analysis of Variables

Variable	n	Minimum	Maximum	Mean	Std. Deviation
VAT Gap	450	-0,90	45,20	15,43	9,38
Shadow Economy	450	6,10	35,90	19,06	7,11
Economic Growth	450	-14,83	24,37	2,01	3,95
Trade Openness	450	45,41	377,84	123,40	66,50
Corruption Control	450	-0,4	2,45	1,02	0,79
T					18
N					450

Source: Compiled by the Author

The VAT Gap in countries within the European Union (EU) has an average value of 15.43%. The highest percentage of VAT Gap was recorded in Romania in 2009, while the lowest percentage was in Portugal in 2005. The EU's economy comprises the Shadow Economy, with an average of 19.06%, with the lowest value in Austria in 2019 and the highest in Bulgaria in 2003. The economies of EU member states experienced an average growth rate of 2.01% from 2003 to 2020. The highest Economic Growth was in Ireland in 2015, while the lowest was in Lithuania in 2009.

Trade Openness indicates the proportion of international trade (total exports and imports) to Gross Domestic Product. On average, EU countries have a Trade Openness value of 123.40%, with the highest value in Luxembourg in 2019 and the lowest in Italy in 2009. This indicates that countries in the European region are actively engaged in international trade, both in terms of exports and imports. Corruption Control in the EU region also shows favorable values, with an average index of 1.02. Denmark had the highest and almost maximum positive Corruption Control index in 2006, while Romania had the lowest index in 2003.

Table 3 Results of Panel Data Regression Model Testing

Comparison of Panel Data Models	Testing Methodology	Prob	Selected Model
PLS and FE	Chow Test	0,0000	FE
PLS and RE	Lagrange Multiplier (LM) Test	0,0000	RE
FE and RE	Hausman Test	0,2890	RE

Source: Compiled by the Author

Table 4 shows the tests conducted to determine the best panel data model for panel data regression. Model comparisons were made using the Chow test to select between the Partial

Least Square (PLS) or Fixed Effect (FE) models, the Lagrange Multiplier (LM) test to choose between the Partial Least Square (PLS) or Random Effect (RE) models, and the Hausman test to select between the Fixed Effect (FE) or Random Effect (RE) models. Based on these tests, the Random Effect (RE) model was found to be the best model. Model testing was then continued with the Gauss-Markov test, also known as the classical assumption test.

Table 5 Classical Assumption Test

Classical Assumption Test	Testing	Prob
Normality	Skewness and Kurtosis Tests	0,0042
Multicollinearity	Variance Inflation Factor	7,49
Heteroskedasticity	Breusch–Pagan/Cook–Weisberg Test	0,0000
Autocorrelation	Wooldridge Test	0.0000

Source: Compiled by the Author

Table 5 shows the results of the Gauss-Markov test or classical assumption testing in the regression model. Classical assumption testing is conducted to ensure that the resulting linear regression model is unbiased and reliable (Best Linear Unbiased Estimation/BLUE). A linear regression model is considered to pass classical assumption testing if the significance value (probability) is greater than the value of $\alpha = 0.05$ for tests of normality, heteroskedasticity, and autocorrelation, and less than 10 for multicollinearity.

Based on the classical assumption testing presented in Table 5, the linear regression model does not meet the tests for normality, heteroskedasticity, and autocorrelation. According to the Central Limit Theorem, a large population of data will tend towards a normal distribution (Kwak & Kim, 2017). Based on this theory, the regression model can be considered to be normally distributed, and the Skewness and Kurtosis tests can be disregarded. Sihombing (2022) suggests that to address the issues of heteroskedasticity and autocorrelation simultaneously, the Panel-Corrected Standard Error (PCSE) model can be used.

Table 6 Results of Panel Data Regression with PCSE

Variable	Coefficient	z	Prob>|z|
Cons	10,5454	3,59	***0,000
Shadow Economy	0,4814	4,79	***0,000
Economic Growth	-0,2589	-1,69	*0,092
Trade Openness	0,0184	1,50	0,133
Corruption Control	-1,8165	-0,95	0,344
Moderate Corruption on Shadow Economy	-0,2795	-3,91	***0,000
Moderate Corruption on Economic Growth	0,1117	1,32	0,186
Moderate Corruption on Trade Openness	-0,0008	-0,11	0,912
R-squared			0,5133
Prob > chi2			0,0000

significance level: *) α=10%; **) α=5%; ***) α=1%

Source: Compiled by the Author

Table 6 shows the results of panel data regression using the Panel-Corrected Standard Error (PCSE) method. Based on the regression results, the independent variables together (simultaneously) influence the dependent variable, VAT Gap. This is indicated by the significance level (Prob>chi2) being less than the alpha value (α=5%; accept H1). The Goodness of Fit test, represented by the Overall R-square value, indicates that the dependent

variable (VAT Gap) is influenced by 51.33% by the independent variables. The remaining 48.67% is influenced by other factors outside the scope of this research.

In the partial testing of independent variables, as indicated by the significance level (Prob > |z|) or z-test, Shadow Economy and Economic Growth show significant and opposite effects. Shadow Economy has a positive effect on increasing VAT Gap with a 99% confidence level, while Economic Growth has a negative effect on VAT Gap revenue with a 90% confidence level. However, different results are shown by Trade Openness and Corruption Control, which do not have a significant impact on VAT Gap. The moderation of the independent variables indicates that Corruption Control only affects the relationship between Shadow Economy and VAT Gap. Meanwhile, the moderation of Corruption Control on Economic Growth and Trade Openness does not have a significant influence on the relationship between these variables and VAT Gap.

The positive effect of Shadow Economy on VAT Gap indicates that an increase in the proportion of Shadow Economy in the economy will increase the potential loss of VAT that the government can collect (VAT Gap). This is in line with previous research conducted by Neog & Gaur (2021) and Zídková (2014). Shadow Economy refers to economic activities that are not reported or recorded by the government (Medina & Schneider, 2019). The emergence of Shadow Economy is one of the consequences of tax avoidance efforts by economic entities (Schneider et al., 2015). According to Agency Theory, economic entities will try to increase profits, especially for company managers (agents), and one way to do that is by paying lower taxes through tax evasion (Hasan et al., 2021). Therefore, an entity may intentionally not report its economic activities or actual profits to minimize tax liability, ultimately increasing VAT Gap as Shadow Economy grows in the economy.

However, the emergence of Shadow Economy in the economy is not only caused by tax avoidance efforts. The informal economic sector in the Shadow Economy is also due to the inability of entities, especially small enterprises, to report or record their economic activities (Bednarski, 2019; Buszko, 2017). Additionally, Shadow Economy also refers to economic activities conducted by households used for final consumption (OECD, 2002). This definition indicates that such activities do not add economic value and do not generate profits for the entities producing them. Tax authorities must pay special attention to the issue of Shadow Economy. Strategic steps that governments can take to reduce the proportion of Shadow Economy include comprehensive monitoring and auditing, simplifying business regulations, and increasing counseling and support (Buszko, 2017; Kovalenko et al., 2022). Monitoring and audits can be conducted on entities intentionally concealing their economic activities, while counseling and support can be provided to entities that lack the capacity to report or record their economic activities. Furthermore, governments can improve business regulations to encourage economic entities to move out of the informal sector through legalization and entry into the formal sector (Borzenko, 2021).

The negative impact of Economic Growth on VAT Gap indicates that economic growth will reduce the potential VAT that cannot be collected by the government. Based on the research results, a 1% economic growth will reduce VAT Gap by -0.25%. This is in line with previous research by (Pastusiak et al., 2022) but not in line with the studies by (Majerová, 2016) and (Zidkova & Pavel, 2016). Economic Growth indirectly affects VAT Gap. Economic growth indicates an increase in economic activities/transactions that add value (Andreescu, 2021). This will then increase the tax base and revenue from value-added tax (VAT) (Karnowski & Rzońca, 2021). Increased VAT revenue will reduce the difference between actual tax revenue and potential VAT revenue, indicating a decrease in VAT Gap.

In order to address VAT Gap through Economic Growth, governments are expected to formulate policies that promote economic growth. One step that can be taken is to simplify

bureaucracy and business regulations (Contractor et al., 2020; Saidi et al., 2020). Through these policies, the government can attract Foreign Direct Investment (FDI) for domestic investment. FDI will catalyze economic growth through market expansion and company or entity activities (Gaspareniene et al., 2022). This will certainly increase economic activities/transactions that add value and can be subject to VAT. Moreover, economic growth (through investment) also refers to the improvement of the economy for society due to the creation of new job opportunities and increased income (Latif et al., 2018). Directly, this will increase consumption (purchasing power) among the public, as per the consumption theory introduced by Keynes (Alp & Seven, 2019; Boug et al., 2021). The increase in final consumption will also increase taxes on the consumption of goods and services, which is part of VAT (Akhmadeev et al., 2017; Dahri et al., 2019).

Based on the research results, Trade Openness does not affect VAT Gap. This result is in line with previous research by Pastusiak et al. (2022) but not with the study conducted by Zídková (2014). This indicates that international trade conducted by European Union countries does not affect the potential loss of VAT. The same result is also shown by Corruption Control, which does not significantly affect VAT Gap. This research result is in line with previous research by Pastusiak et al. (2022) but not with the studies conducted by Bikas & Malikonytė (2020) and Majerová (2016).

As a moderating variable, Corruption Control has a significant negative impact on the relationship between Shadow Economy and VAT Gap. This indicates that effective Corruption Control in EU countries can reduce the negative impact of Shadow Economy on VAT revenue. This result is consistent with the Corruption Control data held by EU countries, which show an average corruption control index of 1.02, with the highest index nearing the maximum of 2.4. This indicates that corruption control in EU countries is already good enough and can minimize the impact of Shadow Economy. Effective corruption control reduces opportunities for entities in the informal sector to engage in bribery for tax evasion (Payne & Saunoris, 2020).

CONCLUSION

Optimizing tax revenue is an essential step that a country must take to achieve sustainable economic growth. VAT Gap poses a challenge in the effort to achieve optimal tax collection due to potential revenue losses from VAT. Therefore, determining the determinants of VAT Gap is crucial in optimizing tax revenue. This can serve as the basis for policy making by stakeholders in a country to reduce the size of VAT Gap in the economy.

Based on the research results, it can be concluded that, simultaneously, Shadow Economy, Economic Growth, and Trade Openness significantly influence VAT Gap. However, in partial terms, only Shadow Economy and Economic Growth significantly affect VAT Gap with opposite directions. Shadow Economy has a positive effect on VAT Gap, meaning that an increase in Shadow Economy in the economy will increase the potential tax loss from the VAT perspective. The increase in Shadow Economy in the economy is not only due to tax avoidance efforts but also due to the inability of entities to report and/or record economic activities. Policymakers are expected to implement comprehensive monitoring and auditing, simplify business regulations, and increase counseling and support to reduce the proportion of Shadow Economy in the economy.

Other research results show that Economic Growth has a negative effect on VAT Gap, meaning that economic growth reduces VAT Gap. Creating a favorable business environment is one of the steps that governments can take to attract investment for economic growth. Investment will increase opportunities for market expansion and economic activities, which will increase the tax base and VAT revenue. Corruption Control can moderate the relationship

between Shadow Economy and VAT Gap negatively. This indicates that effective corruption control in EU countries can reduce the negative impact of Shadow Economy on tax revenue.

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