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The Impact of Some Variables on the VAT Gap in the Member States of the European Union Company**

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Abstract: *One of the most serious problems of fiscal character is the issue of the tax gap. The tax gap is defined as the amount of tax liability faced by taxpayers that is not paid on time. The tax gap comes from three main areas of non-compliance with the tax law – firstly, from underreporting of income, secondly, from underpayment of taxes, and thirdly, from non-filing of returns. The tax evasions in the area of value added tax create one of the largest groups of tax gaps. This article describes the current situation in the field of tax gap in selected countries of the European Union. The aim of this paper is to determine the dependence of the VAT gap on three variables: the Corruption Perception Index CPI, GDP growth rate and the basic VAT rate. The method of regression analysis was used,*

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which was performed on data in the years 2000–2011. Although it could be assumed that tax burden will affect the VAT gap the most, the highest dependence was shown in the case of Corruption Perception Index.

Introduction

Tax authorities, not only in the European Union, but also in other OECD developed economies, are currently facing major challenges with regard to tax gap problem (Ángeles Castro & Ramírez Camarillo, 2014). Potential returns that do not end at tax collectors of individual tax administrations, amount to one trillion euros per year (in the US 345 billion dollars, according to IRS data). Significant amounts of money currently ends up in tax havens, which in the period when most European countries have their budgets in deficit, is a major economic and political challenge. That is why the national economic statistics also focus on the calculation of tax gap. In this respect, it is important to quantify the theoretical amount of tax, from which then the tax gap is established.

Given that the VAT gap is the most important part of the tax gap, for purposes of the analysis in this article, this one is selected. The VAT gap is calculated as the difference between the theoretical VAT liability ascertained from the national accounts and the VAT revenues accrued by the financial authorities (Zidkova, 2014, p. 514).

There are two motivations for writing this article: the first one was to determine whether a generally accepted view of the positive relationship of the tax burden and tax gap of that tax type actually exists, and whether it is statistically significant. The second motivation was, by using the same method, to verify the relationship between the VAT gap and GDP growth, whose linkages were acknowledged e.g. in the study of the Center for Social and Economic Research (CASE, 2012), but not statistically verified. In addition to the two above-mentioned variables, also the links to the CPI were included in the analysis, because tax evasion and corruption are closely related. A partial aim was then to determine whether the results of this analysis correspond to the results shown in the above study. For these purposes, the same basis was used, and that the average values of the period 2000–2011.

The paper has three parts – theoretical, methodological, and strictly empirical one. The first part describes the theoretical approaches and ways of measuring tax gap and VAT gap through fiscal sustainability and VTTL model. The second part describes the methodology of the research, where the method of regression analysis was chosen for determining the VAT gap, depending on three variables – Corruption Perception Index, GDP

growth rate and the basic VAT rate. When examining the dependence, the data from 2001 to 2011 were used. The third part is devoted to the VAT gap in selected countries of the European Union and the application of the regression model for the member countries.

Theoretical Approach to the Tax Gap and VAT Gap

Her Majesty's Revenue and Customs defines the tax gap as the difference between the collected taxes and the tax which should be collected, so a theoretical liability (HMRC, 2013). Theoretical liability is a tax that would be paid if all persons and companies respected the tax law (Tyrie, 2012). Armstrong *et al.*, 2011, p. 395) defined the concept of the book-tax-gap as spread between aggregate financial statement income and aggregate taxable income.

According to Plumley (2005) or Warren & McManus (2007), there are three components of tax gap – non-lodgement (non-filing), under-reporting and under-payment. Hurst *et al.* (2014, p. 19) indicated that the self-employed systematically underreport their income in the U.S., and individual income represented over half of uncollected revenue (Branham, 2009, p. 1507).

Tax gap also covers evasion of participants in legal activities into the informal economy, which means the part of the economic activity that does not pass through official economic statistics (more about hidden – illegal – economy see: Giles, 1999). These participants are informal contractors, domestic workers and street vendors who do not report their income and not pay tax. On the other hand, the tax gap does not include unpaid taxes from people who work in the informal economy, which consists of illegal activities such as drug trafficking, illegal gambling and prostitution (Todler, 2013).

Tax gap financial flows can be divided into two categories – (legal) avoidance and (illegal) evasion (Gemmel & Hasseldine, 2014, p. 275). The first one is the legal avoidance, but inappropriate or irregular, because it is not permitted under rules and customs. This includes the avoidance of tax liabilities. To define tax avoidance is more difficult than to define the tax evasion, because in this case there is no legal basis. Tax evasion is characterized as an effort to minimize tax assessment without deliberate deception (which would be considered as tax evasion), but in contrary to the law. It is therefore an abuse of gaps and deficiencies in the tax system and other legislation in a way that was not foreseen by the law.

The other categories are unlawful flows. Here are mainly the tax evasions that minimize tax. Tax evasion may be either legal or illegal. Legal tax evasion is a condition where the taxpayer uses the shortcomings in the law in a way that was not the intention of the legislature. Illegal tax evasion are cases where the taxpayer receive a tax benefit contrary to the law, i.e. their violations. These tax evasion usually arise from a false tax statements denying tax to tax authority or stating false requirement for tax deduction.

The issue of tax evasion has been dealt with by many scientific publications, for example Chiarini *et al.* (2013) quantified the elasticity between tax evasion and average tax rate in Italy in the period 1980–2006, as well as Levaggi & Menoncin (2013). According to Di Lorenzo (2014), a lower tax rate on labour income enabling money to flow from households to companies through private consumption reduces incentives for tax evasion. Gillman & Kejak (2014) claimed that upward trend in good and human capital sectors gradually decreases tax evasion.

The tax gap is one of the most commonly used indicators of fiscal sustainability. The construction of this indicator is based on the same approach, first the level of sustainable fiscal variables is calculated, and then the gap is defined as the difference between sustainability and the current level of the primary deficit or tax rate. Sustainable level of fiscal variables ensures the convergence of the debt ratio to the final value and its calculation is governed by the terms of sustainability:

$$\lim_{T \rightarrow \infty} \left[\sum_{t=1}^T pd_t \left(\frac{1+r}{1+y} \right)^{-t} \right] = -b_0 \quad (1)$$

where:

pd is primary deficit, r is the interest rate, y represents the real GDP growth rate and b_0 is the initial debt ratio.

This condition says that the present discounted value of future primary surpluses should be equal to the initial value of the debt. Then the primary deficit may be expressed as:

$$pd^* = -b_0 \frac{r-y}{1+y} \quad \text{or with omission } (1+y): \quad pd^* = -b_0(r-y) \quad (2)$$

Calculation of the primary gap is then expressed by the following equation:

$$pd^* - pd_t = -b_t(r - y) - pd_t \quad (3)$$

where:

b_t represents ratio of debt to GDP.

In the calculation of the primary gap it is thus necessary to know the current primary deficit and debt, and it is necessary to draw assumptions of expected long-term average values of interest rates and the rate of real GDP growth. If the current primary deficit is higher than sustainable ($pd^* - pd_t < 0$), the ratio of debt to GDP will increase without any constraints and fiscal policy can be called unsustainable. Sustainable primary deficit can also be used as the target of government towards sustainable deficit. This is an attractive factor, since fiscal balance is usually the ultimate object of the interests of creators of economic policies. The primary difference is then scale of the adjustments that need to be returned to the level of fiscal balance and sustainable level. The primary deficit can be expressed as the difference between expenditures and revenues:

$$pd_t = g_t + h_t - \tau_t \quad (4)$$

where:

g is consumption (including investment), h are transfers and τ represents current tax rate. All variables are measured as a share of GDP. It is important to calculate the sustainable level of the tax ratio:

$$\tau^* = \frac{r - y}{1 + y} \cdot \left\{ \sum_{t=1}^{\infty} \left[(g_t + h_t) \cdot \left(\frac{1 + r}{1 + y} \right)^{-t} \right] + b_0 \right\} \quad (5)$$

By subtracting the current tax rate from sustainable levels, we get so called indicator of the tax gap:

$$tax_gap = \tau^* - \tau \quad (6)$$

If sustainable tax ratio (τ^*) is greater than the current tax rate (τ), which means that the tax gap is positive, the fiscal policy will have to be adjusted

to prevent excessive accumulation of debt. Indicator tax gap should not lead to the conclusion that the best way to correct the current policy is to raise taxes (Balcerzak *et al.*, 2016; Balcerzak & Rogalska, 2016). For example, Alvaiez-Martinez & Polo (2014) indicated the enormous difficulties of the government of Spain with closing the deficit gap by raising taxes. Gemmel & Hasseldine (2012) claimed that an extra dollar in tax revenue does not always reduce the tax gap by a dollar. This indicator only shows that the current tax rate is not high enough to finance future spending and debt.

Estimation of the VAT gap can be done through the model VTTL. The Vat Total Theoretical Liability (VTTL) as a model, and VAT gap derived from VTTL are general indicators. The basic objective of measurement is to determine the overall level of VAT gap, comparing the pure theoretical tax with real revenues from VAT. This difference is called the VAT gap. By subtracting net VAT revenues and net VTTL arises the VAT gap:

$$G_{VAT} = NR_{VAT} - VTTL_N \quad (8)$$

where:

G_{VAT} represents VAT gap, NR_{VAT} is the net revenue from VAT and $VTTL_N$ is the net VAT total theoretical liability. The percentage difference is further calculated by dividing the VAT gap and net VTTL:

$$D = \frac{G_{VAT}}{VTTL_N} \quad (9)$$

where D is the percentage difference.

Research Methodology

The aim of this paper is determine the dependence of VAT gap on three variables. The regression analysis was performed on data from the years 2000–2011, from which the arithmetic mean was then calculated. To implement regression analysis, three independent variables explaining one dependent variable were selected. The dependent variable in the model is VAT gap, expressed as a percentage of the VTTL. Values of VAT gap for individual member states were taken from the study of CASE (2012). The

exception is Cyprus, which was excluded from the analysis due to the revision of the national accounts.

The Corruption Perceptions Index (CPI) represents the area of socio-institutional factors. Its main task is to sort countries according to how corruption is perceived in the public sector. A country indicates the perceived level of public sector corruption on a scale of 0 to 10, where 0 means that a country is perceived as very corrupt, while 10 means that it is uncorrupt. This index is compiled annually by Transparency International to control factors relating to corruption in the public sector, which can directly affect the tax compliance of taxpayers. According Liu & Feng (2015, p. 57), countries with more complex tax system tend to be more corrupt than countries with less complex tax system. In the case of CPI (according to CASE, 2012) the expected impact is negative, which means that increasing value of corruption index (positive perception of corruption) decreases tax evasions. Regarding the results of this index within the European Union, the Nordic countries reach the highest values in twelve years, on average. Finland, with a value of approximately 9.51, then Denmark with 9.46, and Sweden with the mean value of 9.24. Conversely, the lowest measured value is reached by Romania, with an average value 3.23, then Bulgaria with the value around 3.82, and Latvia, which reaches the average value of 4.17.

Another selected variable is GDP growth rate, which was chosen as indicators in the area of economic determinants. The calculation of the annual growth rate of GDP volume allows comparison of economic development dynamics both over time and between economies. For measuring the growth rate of GDP, current prices compared to the prices from the previous year were used, and thus calculated volume changes are kept in the values of the reference year. The used data were taken from the Eurostat statistics and then averaged over twelve years. Also here the study of CASE (2012) expected negative impact, which means that the increase in economic growth reduces the VAT gap. Estonia reaches the greatest economic growth with an average value 4.76%, then there is Lithuania with 4.66%, and Slovakia with the value of the average growth of 4.43%. With regard to the countries with the lowest GDP growth rate, the worst results were achieved by Italy, with an average of 0.67%, Portugal with an average growth of 0.8%, and Denmark with value growth rate of 0.9%.

The basic VAT rate was chosen as the last independent variable, and represents tax factors. Regarding the expected impact, study of Reckon (2009) assumes positive impact on VAT gap, it means if the basic VAT rate increases, tax evasion grows. The basic VAT rate varies with the European Union member states in the monitored period, ranging from 15% in

Luxembourg to 23.7% in Hungary. Statistics of the four selected indicators are specifically listed in Table 1.

Table 1. The average values of variables in the years

Member state	CPI	GDP growth	Basic VAT rate	VAT gap, % of VTTL
Austria	8.07	1.82	20.00	11.08
Belgium	7.14	1.64	21.00	13.42
Bulgaria	3.82	4.08	20.00	16.08
Czech Republic	4.45	3.36	20.17	23.42
Denmark	9.46	0.90	25.00	9.75
Estonia	6.18	4.76	18.50	15.58
Finland	9.51	2.18	22.08	13.17
France	6.96	1.40	19.60	15.42
Germany	7.83	1.37	17.25	12.58
Greece	4.22	1.53	19.08	29.50
Hungary	5.00	2.16	23.75	26.42
Ireland	7.51	3.17	21.00	7.75
Italy	4.78	0.67	20.08	26.08
Latvia	4.17	4.23	18.83	23.92
Lithuania	4.73	4.66	18.58	34.67
Luxembourg	8.53	3.05	15.00	12.33
Malta	5.98	1.81	17.00	12.67
Netherlands	8.84	1.52	18.88	5.25
Poland	4.25	3.98	22.08	13.17
Portugal	6.29	0.80	19.83	8.67
Romania	3.23	3.93	19.83	41.92
Slovakia	4.19	4.43	20.17	28.83
Slovenia	6.11	2.72	19.50	6.92
Spain	6.71	2.17	16.00	11.75
Sweden	9.24	2.46	25.00	4.00
United Kingdom	8.28	1.85	17.29	12.67
EU-26 average	6.36	2.56	19.83	16.81

Source: own work based on Transparency International, Eurostat, European Commission (2015), CASE (2012).

The values of all variables were averaged for the reporting period 2000-2011 in order to obtain the same basis for each variable. Even if some sources (e.g. CASE, 2012) attributed the changes of the VAT rate to the crisis, as can be seen in European Commission (2015), these changes take place continuously over the years and can be rather attributed to the trend of unification of VAT rate in the countries of the European Union.

Regression analysis is carried out using the least squares method.

The basic equation for expressing simple linear function is the following equation.

$$y = \beta_0 + \beta_1 x + \varepsilon \quad (10)$$

where β_0 and β_1 are the values of the parameters of the regression line, ε is a random component. These values obtained estimates b_0 and b_1 , which are called the regression coefficients, and can be calculated using the least squares method. Formulas for the calculation are given in the following form:

$$b_1 = \frac{\overline{xy} - \bar{x} \cdot \bar{y}}{\overline{x^2} - \bar{x}^2} \quad \text{and} \quad b_0 = \bar{y} - b_1 \bar{x} \quad (11)$$

In the case of regression analysis an important requirement is to perform statistical test, which examines parameter β_1 separately, if they are not equal to zero. Null and alternative hypotheses are determined and tested at a significance level $\alpha = 0.05$. H_0 : Parameter β_1 are equal to zero. H_1 : Parameter β_1 are not equal to zero.

The VAT Gap in Selected EU Countries and the Application of the Regression Model

The VAT rates differ in the EU Member States, which enables tax evaders to look for profit from the gaps and incompatibilities between different national tax systems (Sharman, 2012, p. 17).

Estimated VAT gaps have very wide dispersion between countries, ranging from 21 million euros in Malta, to 36,134 million euros in Italy (in 2011). The average VAT gap in 2011 for the European Union countries equals to 20%, expressed as a percentage of the VAT total tax liability. The estimated total amount of VAT gap of EU-26 equals approximately 193 billion euros, or expressed as a percentage of GDP EU-26 in 2.1%. Data are shown in Table 2.

Table 2. Calculating value of the VAT Gap in the EU Member States in 2011

Member state	VTTL 2011 (in bill. Eur)	VAT gap (in mil. Eur)	VAT gap as % of VTTL	VAT gap as % of GDP
Austria	26 915	3 468	13	1.2
Belgium	30 991	4 970	16	1.3
Bulgary	3 956	604	15	1.6
Czech Republic	15 235	4 241	28	2.7
Denmark	26 436	2 566	10	1.1
Estonia	1 664	301	18	1.9
Finland	19 746	2831	14	1.5
France	172 739	32 233	19	1.6
Germany	216 830	26 910	12	1.0
Greece	24 790	9 763	39	4.7
Hungary	12 216	3 700	30	3.7
Ireland	10 890	1 108	10	0.7
Italy	134 691	36 134	27	2.3
Latvia	2 322	954	41	4.7
Lithuania	3 795	1 352	36	4.4
Luxembourg	3 242	551	17	1.3
Malta	541	21	4	0.3
Netherland	45 622	4 012	9	0.7
Poland	35 253	5 410	15	1.5
Portugal	16 999	2 764	16	1.6
Romania	21 760	10 348	48	7.9
Slovakia	7 484	2 773	37	4.0
Slovenia	3 375	326	10	0.9
Spain	71 744	15 197	21	1.4
Sweden	37 542	932	2	0.2
United Kingdom	150 064	19 487	13	1.1
EU-26 average	1 096 841	192 957	20	2.1

Source: own work based on CASE (2012).

As it was mentioned, in order to perform regression analysis three independent variables were selected, which explain one dependent variable. The dependent variable in the model is VAT gap, expressed as a percentage of VTTL. Calculations were made in EViews.

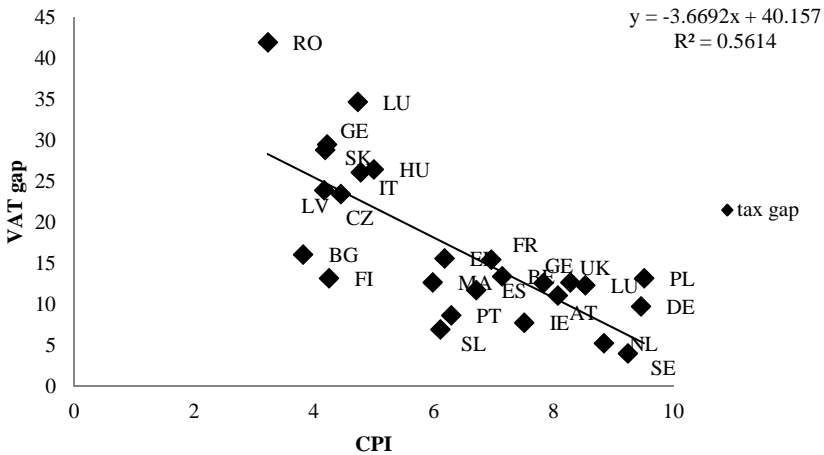
The Corruption Perception Index reached highest significance from three selected explanatory variables. Figure 1 below shows the dependence of the VAT gap and CPI. It shows that there is a relation between the VAT gap and Corruption Perception Index. The empirical model can be given as follow:

$$y = 40.16 - 3.67 x + \varepsilon \quad (12)$$

Basing on the obtained results, the negative relationship of examined variables is confirmed, therefore, when the value of CPI rises, the tax evasion decreases.

Some countries deviate from the established regression dependence-Romania is one of those countries. If we focus on the individual average values for Romania in both indicators in the years 2000–2011, as regards VAT gap, Romania reached the highest value, namely 41.9%, and vice versa in the case of Corruption Perceptions Index has the lowest value, in average 3.225. This is the highest level of corruption in examined countries of the European Union. Another deviating state is Lithuania. It ranks in terms of the indicator of VAT gap (in terms of size of this indicator) in the second place behind Romania, with an average of 34.6%. Lithuania is reaching the value of 4.72 of Corruption Perceptions Index, and ranks among the countries of the European Union with a very low level of its value, which points to a high level of corruption in this country.

Figure 1. Dependence of VAT Gap and Corruption Perception Index



Source: own calculation.

Sweden achieves the best result, with a low rate of VAT gap and high level of CPI, which indicates confidence in the field of corruption politics. According to the average values of Sweden from 2000 to 2011, the VAT gap stands at 4%, and the Corruption perception index is the third highest among the European Union countries, with the average value of 9.2, just

behind Finland and Denmark. The following Table 3 shows the concrete results of the regression analysis.

In the case of the test for significance of β_1 parameter, the p-value is less than tested significance level of 0.05, which means that the null hypothesis is rejected, and regression model is statistically significant.

Coefficient of determination (R-squared) indicates how much of the total variance of the dependent variable, i.e. VAT gap, is explained by the regression model. In this case it is about 56.14%.

Table 3. Output of regression analysis exploring the dependence of VAT gap and Corruption Perceptions Index

Regression statistics				
R-squared		56.14%		
Std. Error		6.47		
Observations		26		
ANOVA				
	Difference	SS	MS	Signif. F
Regression	1	1287.73	1287.73	~0,00
Residues	24	1006.02	41.91	
Total	25	2293.76		
Parameter	Coefficient	Std. Error	t-statistics	p-value
β_0	40.16	4.39	9.12	~0,00
β_1	-3.67	0.66	-5.54	~0,00

Source: own calculation.

The second examined variable is GDP growth and its impact on the emergence of VAT gap. In this case, there is a weak dependence, which is shown in Figure 2.

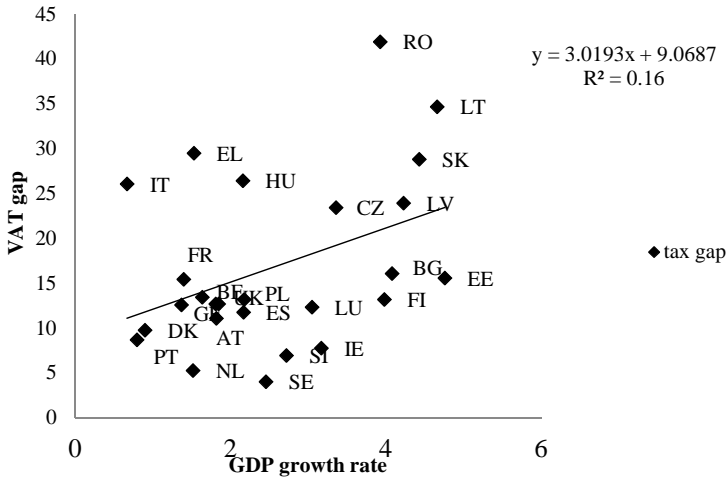
Equation of line of regression analysis has the form:

$$y = 9.07 + 3.02 x + \varepsilon \quad (13)$$

In that case, there are many countries that deviate from the established linear line. It is Romania, which has the highest level of VAT gap from EU countries, as mentioned above. In the case of GDP growth, Romania ranks among the countries of the European Union which have average high GDP growth rate in twelve years, of about 3.9%. Another deviating country is Slovakia. In the case, in terms of the size of the VAT gap Slovakia ranks among the countries with a high level of gap and reaches its average value of approximately 28.8%. However, the GDP growth rate of Slovakia reach-

es high values, the third highest among the EU countries, behind Estonia and Lithuania, with an average of approximately 4.4%. The lowest point is the result of Sweden, which is because of the lowest rate of VAT gap and the GDP growth rate of Sweden has an average value of approximately 2.4%.

Figure 2: Dependency relationship of VAT gap and GDP growth



Source: own calculation

Table 4 shows the results of the regression analyzes exploring the dependence of VAT gap and GDP growth.

Coefficient of determination shows that the conducted regression analysis can explain only 16% of VAT gap.

Also in this case in the test for significance of β_1 parameter p-value is lower than the significance level α ($0.03 < 0.05$). The null hypothesis is rejected. It is valid that parameter β_1 is statistically significant.

However, it does not confirm the expected effect that GDP growth on VAT gap. According to a regression, the expected impact that the VAT gap falls with an increase of GDP growth is not obtained.

Table 4. Output of the regression analyzes exploring the dependence of VAT gap and GDP growth

Regression statistics				
R-squared		16%		
Std. Error		8.95		
Obsevation		26		
ANOVA				
	Difference	SS	MS	Signific. F
Regression	1	367.05	367.05	0.04
Residues	24	1926.70	80.27	
Total	25	2293.76		
Parameter	Coefficient	Std. Error	t-statistics	p-value
β_0	9.07	4.02	2.25	0.03
β_1	3.02	1.41	2.13	0.04

Source: own calculation.

The last monitored variable is the the basic VAT rate and its impact on the VAT gap. Regarding this variable, the dependence is negligible here, almost zero, which implies that the amount of the basic VAT rate has no effect on the size of the VAT gap. Table 5 shows the results of regression analysis. In the case of the test for significance of β_1 parameter p-value is higher than the significance level α ($0.78 > 0.05$). This confirms the null hypothesis. The parameter β_1 is statistically insignificant.

Table 5. Output of regression analysis exploring the dependence of VAT gap and the basic VAT rate

Regression statistics				
R-squared		0.4%		
Std. Error		9.75		
Obsevation		26		
ANOVA				
	Difference	SS	MS	Signific. F
Regression	1	9.25	9.25	0.75
Residues	24	2284.51	95.18	
Total	25	2293.71		
Parameter	Coefficient	Std. Error	t-statistics	p-value
β_0	21.77	16.06	9.12	0.18
β_1	-0.25	0.80	-0.31	0.78

Source: own calculation.

Determination coefficient, which indicates what proportion of the total variance of the dependent variable is explained by the regression model, reaches here only 0.4%.

Conclusions

European Commission published in 2012 an action plan in the engagement against tax evasion in the European Union that proposes options for reducing and prevent tax evasion. Under this action plan, the Commission proposes several measures to reduce the tax gap, including the establishing the Forum of VAT. It is a dialogue between the representatives of large, medium and small enterprises and tax authorities, who can exchange their views on the functioning of VAT in the European Union. Another possibility is the introduction of a rapid response mechanism against VAT fraud, which would allow the Commission to react very quickly to VAT fraud and allow a member state deviate from the standard measures. In this regard, Hamemi (2014) claims that the collaboration between policymakers and citizens would be the best solution and the most effective way to reduce the tax gap, which to some extent is also confirmed by the conducted statistical research.

In the article, the influence of three selected independent variables on the VAT gap was analyzed. These were the Corruption Perception Index, GDP growth rate and the basic VAT rate. Of these three variables, the influence of the Corruption Perceptions Index and GDP growth rate was statistically confirmed. The basic VAT rate was statistically insignificant.

As a result, in comparison to previous research conducted by CASE, where the influence of all the three variables: the CPI, GDP growth, and the VAT rate on the VAT gap was confirmed (in the first both cases this relationship was negative, in the last one positive), the methods applied in this article confirm a significant link only between the VAT gap and the CPI, the other two variables affect the VAT gap insignificantly.

References

- Alvaiez-Martinez, M. T., & Polo, C. (2014). A General Equilibrium Evaluation of Tax Policies in Spain during the Great Recession. *Revista de Economía Aplicada*, 22(65).
- Ángeles Castro, G., & Ramírez Camarillo, D. B. (2014). Determinants of Tax Revenue in OECD Countries over the Period 2001–2011. *Contaduría y administración*, 59 (3). DOI: <http://dx.doi.org/10.1016/j.eswa.2014.02.010>.

- Armstrong, Ch. S., Blouin, J. L., & Larcker, D. F. (2011). The Incentives for Tax Planning. *Journal of Accounting and Economics*, 53. DOI: [Qhttp://dx.doi.org/10.1016/j.acceco.2011.04.001](http://dx.doi.org/10.1016/j.acceco.2011.04.001).
- Balcerzak, A. P., Pietrzak, M. B., & Rogalska, E. (2016). Fiscal Contractions in Eurozone in the years 1995-2012: Can non-Keynesian effects be helpful in future deleverage process?. In M. H. Bilgin, H. Danis, E. Demir, U. Can (Eds.). *Business Challenges in the Changing Economic Landscape – Vol. 1. Proceedings of the 14th Eurasia Business and Economics Society*. Springer International Publishing, pp. 483-496, DOI: [10.1007/978-3-319-22596-8_35](http://dx.doi.org/10.1007/978-3-319-22596-8_35).
- Balcerzak, A. P., & Rogalska, E. (2016). Non-Keynesian Effects of Fiscal Consolidations in Central Europe in the Years 2000-2013. In M. H. Bilgin, H. Danis, (Eds.). *Entrepreneurship, Business and Economics – Vol. 2. Proceedings of the 15th Eurasia Business and Economics Society*. Springer International Publishing, pp. 271-282, DOI: [10.1007/978-3-319-27573-4_18](http://dx.doi.org/10.1007/978-3-319-27573-4_18).
- Branham, E. (2009). Closing the Tax Gap: Encouraging Voluntary Compliance Through Mass-Media Publication of High-Profile Tax Issue. *Hastings Law Journal*, 60(6).
- CASE (2012). Study to Quantify and Analyse the VAT Gap in the EU-27 Member State: Final Report. Center for Social and Economic Research. Retrieved from http://ec.europa.eu/taxation_customs/resources/documents/common/publications/studies/vat-gap.pdf (15.01.2015).
- Chiarini, B., Marzano, E., & Schneider, F. (2013). Tax Rates and Tax Evasion: an Empirical Analysis of the Long-run Aspects in Italy. *European Journal of Law and Economics*, 35(2). DOI: <http://dx.doi.org/10.1007/s10657-011-9247-6>.
- Di Lorenzo, P. (2014). Insight on Tax Evasion Using a Monetary Circuit Model. *Metroeconomica*, 65(1). DOI: <http://dx.doi.org/10.1111/meca.12025>.
- European Commission (2015). VAT Rates Applied in the Member States of the European Union. Retrieved from http://ec.europa.eu/taxation_customs/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf (15.02.2015).
- Eurostat. GDP Growth. Retrieved from <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tipsna10&language=en> (15.02.2015).
- Gemmel, N., & Hasseldine, J. (2012). The Tax Gap: A Methodological Review. *Victoria University of Wellington School of Business Working Paper*, 09/2012.
- Gemmel, N., & Hasseldine, J. (2014). Taxpayers' Behavioural Responses and Measures of Tax Compliance 'Gaps': A Critique and a New Measure. *Fiscal Studies*, 35(3). DOI: <http://dx.doi.org/10.1111/j.1475-5890.2014.12031.x>.
- Giles, D. (1999). Measuring the Hidden Economy: Implications for Econometric Modelling. *Economic Journal*, 109(456).
- Gillman, M., & Kejak, M. (2014). Tax Evasion, Human Capital, and Productivity-Induced Tax Rate Reduction. *Journal of Human Capital*, 8 (1). DOI: <http://dx.doi.org/10.1086/675328>.
- Hamemi, M. (2014). A Simple Analysis of the Tax Gap Balkan Region. *Mediterranean Journal of Social Sciences*, 5(9). DOI: <http://dx.doi.org/10.5901/mjss.2014.v5n19p365>.

- HMRC. Methodological Annex for Measuring Tax Gaps (2013). HM Revenue & Customs. Retrieved from <http://www.hmrc.gov.uk/statistics/tax-gaps/mtg-annex2013.pdf> (10.01.2015).
- Hurst, E., Li, G., & Pugsley, B. (2014). Are Household Surveys Like Tax Forms? Evidence from Income Underreporting of the Self-Employed. *Review of Economics and Statistics*, 96(1). DOI: http://dx.doi.org/10.1162/REST_a_00363.
- Levaggi, R., & Menoncin, F. (2013). Optimal Dynamic Tax Evasion. *Journal of Economic Dynamics & Control*, 37(11). DOI: <http://dx.doi.org/10.1016/j.jedc.2013.06.007>.
- Liu, Y., & Feng, H. (2015). Tax Structure and Corruption: Cross-country Evidence. *Public Choice*, 162(1). DOI: <http://dx.doi.org/10.1007/s1127-014-0194-Y>.
- Plumley, A. (2005). Preliminary Update of the Tax Year 2001 Individual Income Tax Underreporting Gap Estimates. In *Paper Presented at the 2005 Internal Revenue Service Research Conference*. Washington DC: IRS.
- Reckon (2009). Study to Quantify and Analyse the VAT Gap in the EU-25 Member States. Retrieved from http://ec.europa.eu/taxation_customs/resources/documents/taxation/tax_cooperation/combating_tax_fraud/reckon_report_sep.pdf (10.02.2015).
- Sharman, J. C. (2012). Seeing Like the OECD on Tax. *New Political Economy*, 17(1). DOI: <http://dx.doi.org/10.1080/13563467.2011.569022>.
- Todler, E. (2007). What is the Tax Gap? Retrieved from http://www.urban.org/UploadedPDF/1001112_tax_gap.pdf (20.01.2015).
- Transparency International. Corruption Perceptions Index. Retrieved from <http://www.transparency.org/research/cpi/overview> (15.02.2015).
- Tyrie, A. (2012). *Closing the tax gap: HMRC's record at ensuring tax compliance: Twenty Ninth Report of Session 2010–2012*. London: The Stationery Office.
- Waren, N., & McManus, J. (2007). The Impact of Tax Gap on Future Tax Reforms. *Australian Economic Review*, 40(2). DOI: <http://dx.doi.org/10.1111/j.1467-8462.2007.00461.x>.
- Zidkova, H. (2014). Determinants of VAT gap in EU. *Prague Economic Papers*, 23(4).