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Article

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What are Effective Measures against Vat Evasion? Evidence from the Czech Republic[1]

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Abstract

VAT is one of the most important tax revenues of the European states, yet it suffers from excessive tax evasion. Carousel frauds that abuse the current VAT treatment of cross-border supplies of goods in the EU represent the most serious type of VAT evasion. Almost all EU Member States have implemented anti-fraud measures. This paper discusses the effectiveness of such measures as introduced in the Czech Republic. The analysis of quarterly time series of VAT revenues from 1999 to 2016 showed that from all the anti-fraud measures, tightening of the rules for unreliable payers introduced at the beginning of 2013 proves in our models to be the most robust. A significant, positive effect has also been identified for the adoption of the reverse charge mechanism on scrap and emission allowances, as well as for the implementation of the VAT control statement. On the other hand, our analysis did not confirm that the so-called protective orders do increase VAT revenues. The total annual increase in tax collected as a result of implementing the above-mentioned measures was according to the model around CZK 51 billion by the end of 2015. This is 14.5% of the total annual VAT revenues.

Keywords: *Carousel Fraud, Czech Republic, Tax Evasion, VAT*

JEL Classification: H26

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Introduction

Value added tax (VAT) is after social security contributions the most important source of public budgets in the majority of EU countries and its importance is gradually rising. According to the Eurostat data, the EU ratio of VAT revenues to GDP stood in 2006 at 6.8%, ten years later (in 2016) it was 7%. Over the past two decades, VAT discussions in the EU focused mainly on its sensitivity to tax evasion. According to some estimates (see literature below), the so-called carousel frauds cause VAT dropouts amounting to up to dozens of per cent in potential revenues. Measures against such aggressive tax fraud are being discussed and implemented, from minor adjustments to the collection process and the involvement of computerization all the way to significant changes in the VAT concept.

The Czech Republic is no exception in both being affected by VAT evasion and seeking ways to combat it. The VAT gap in the Czech Republic is estimated at 20% of the total VAT revenues (CASE, 2017). With the aim of suppressing VAT evasion and lowering the VAT gap, the Czech Republic has implemented several measures, especially during the last eight years. The number of measures taken against VAT evasion puts the Czech Republic at the top among the EU countries when it comes to the intensity of the fight against carousel frauds. However, the efficiency of these measures is often debated at the political and ideological level. The negative aspects of these measures are often emphasized, such as the increase in transaction costs of the tax system and reduced legal certainty of the tax payers which is one of the important features characterising the optimal tax system (Cullis and Jones, 2009). According to the index designed by Tran-Nam and Evans (2014), the complexity of the tax system increases. When it comes to the effect of such measures on public budgets, no consensus has been reached yet. So far, no quantitative studies that would estimate the impacts of these measures using proper scientific methods have been published. Our motivation for this paper is to fill this gap. The aim of the presented paper is to estimate the impacts of the measures implemented against VAT evasion on VAT revenues in the Czech Republic and thus to answer the question to what extent are these measures effective.

The paper is divided into five parts. Firstly, we describe the main types of the VAT evasion with a particular focus on carousel frauds. Within the second part, we summarize possible ways of measuring the extent of the VAT evasion and present conclusions of the leading field studies. We follow with a description of the importance of VAT within the Czech Republic's tax mix and in the third part we present measures that have been adopted against the VAT evasion. Data, methodology and models used for our estimates are presented in the fourth part of the paper. We conclude with a discussion of our findings, conclusions, and economic and political recommendations.

1. VAT and Its Link to Tax Evasion

The core principle of the VAT collection process – tax collection throughout the chain of transactions between participating companies – is considered a very effective one. The tax is paid by partial payments within each stage of the production and distribution chain and this principle should ensure the self-policing character of VAT (e.g. Bodin et al., 2001 or Tait, 1988). At the same time, the concept of VAT allows for its use within the European Single Market, as it does not cause distortions when the destination principle applies. On the other hand, the correct functioning of VAT requires a highly effective tax authority, and in the context of international trade also effective co-operation of tax authorities among the different Member States. Absence of such an effective network of tax authorities allows for significant VAT evasion.

VAT evasion can be divided into two groups: simple and sophisticated. Simple types of tax evasion include e.g. a misuse of tax rates, such as false application of the reduced rate or an exemption when the standard tax rate should have been applied. Furthermore, there are cases of unlawful claims of the input VAT related to private consumption, concealment of transactions and avoidance of the output VAT payment, failure to register for VAT by the means of artificially reducing the volume of sales and thus remaining below the threshold turnover that triggers obligatory VAT registration (Tait, 1988). These simple types of VAT evasion, although breaching the applicable law, are not as dangerous as the sophisticated types of VAT evasion, especially the so-called carousel frauds. The reason being that any simple VAT evasion is still based on real transactions. For example, a simple concealment of the realized income cannot exceed the true demand.

Another simple type of VAT evasion is the so-called diversion fraud that misuses the exemption from VAT allowed for goods supplied to another Member State or outside the EU. The supplier pretends to dispatch the goods to another Member State, but instead he diverts them to a local market and sells the products within his own Member State. As he does not have to add any output VAT due to the falsely reported VAT exemption on the supply of goods to another member State, he can sell the goods to local customers without VAT at a somewhat reduced price. However, all this must be done without any VAT documents and the purchasers (provided they are registered as VAT payers) obviously cannot deduct any input VAT. The goods thus enter the shadow economy. Demand for these goods must be real and these goods must physically exist, not just appear recorded on paper. Therefore, the scale of such evasion cannot be unlimited as in the case of carousel frauds. Diversion fraud may occur also with exports outside the EU. However, this is more difficult as each export is documented and verified by the customs authorities.

There are far more dangerous and significant variants of tax evasion which are represented by several types of more sophisticated techniques. The most significant are the so-called carousel frauds. Their existence relates to the European Single Market. They are considered the most aggressive type of VAT evasion when it comes to their potential scale and dynamics. Due to their volume, carousel frauds are sometimes labelled as criminal attacks on the VAT system. Fraudulent transactions are enabled by a combination of VAT exemption of the cross-border supply of goods and an accumulation of high input and output tax obligation within one particular subject (company) sourcing goods from another Member State. However, tax evasion occurs at the level of local supply, following the purchase of goods from another Member State. The principle is that the VAT payer who purchases goods cross the border sells the same goods to a local VAT payer. The supplier charges the output VAT on this local sale and the purchaser claims it back. The problem is that the supplier (i.e. the subject that acquired the goods from another Member State) goes missing and does not comply with the obligation to pay the output VAT to the tax authorities. The tax authorities thus incur a loss if they refund the input VAT to the purchaser since they have not collected it from the supplier in the first place. One of the first detected carousel fraud cases was judged by the European Court of Justice as early as in 2003 (European Court of Justice, C-354/03, C-355/03 and C-484/03). Transactions can be fictitious on a large scale to reach the large claimed input VAT, which is not being paid to the tax authority by the previous company within the chain. Fraudsters usually trade in small-sized goods or even in services (emission allowances being one of the cases from the past). Those goods are sometimes not even moved from one place to another. They are just recorded on tax invoices and end up with the same trader who originally sold them. That is why these frauds are called carousel. Therefore, tax authorities may potentially sustain an unlimited tax loss. Details of carousel frauds are described e.g. in Keen and Smith (2007).

Another type of a sophisticated VAT evasion is the so-called chain fraud, where the cross-border transaction does not have to take place at all. The principle is that the price of goods or services is artificially inflated at one stage of the chain. This happens most frequently with services (e.g. advertising services). Then the VAT payer who charged the multiplied price goes missing and does not pay the output VAT to the tax authorities despite the fact that he collected this VAT from the purchaser in the price of the services or goods sold. Provided the tax administrator refunds the input VAT claimed by this purchaser, the state budget inevitably incurs a loss. As a result, tax officers often question the entitlement to deduct the input VAT on the side of the purchaser and impose various

verification procedures and postpone its reimbursement until they are satisfied that the supplier had truly paid the output VAT due.

Both carousel and chain fraud misuse the principle of VAT collection in partial payments. They abuse the fact that VAT is collected by the VAT payers on behalf of the tax authority and each VAT payer is entitled to deduct the input VAT that was incurred on its purchases. The tax authority acts as a specific clearing house, receiving VAT from suppliers and forwarding it to purchasers. Provided the VAT on a particular transaction has not been paid by the supplier, the state budget sustains a loss. The system should be self-policing, meaning that each VAT payer has some input tax paid on its purchases to claim and thus he is motivated to file his VAT return through which he also reports and pays the output VAT due. However, this self-policing nature is breached in cross-border transactions where the acquirer (purchaser) of goods from another EU Member State does not effectively pay the input tax on the purchased goods (tax liability and tax deductions cumulate in his tax return). Therefore, the incentive to file the VAT return is missing.

2. Scope of VAT Evasion and Measures against It

VAT evasion is often approximated by the VAT gap, which refers to the difference between the theoretical VAT liability that should have been collected by the state and the real VAT received by public budgets. The VAT gap represents not only evasion caused by the carousel fraud already mentioned above, but also tax evasion arising within the shadow economy, mainly from concealed sales and possibly various errors as well as unpaid taxes due to insolvency.

VAT evasion is regularly assessed by studies prepared for the European Commission (CASE, 2017). The latest report puts the amount of the 2015 VAT gap for the 28 European Member States at EUR 151.5 billion. In relative terms, the share of the VAT gap decreased to 12.8% of the theoretical VAT liability from 14.1% in 2014. The smallest VAT gaps were observed in Spain (3.52%), and Croatia (3.92%). The largest VAT gaps were registered in Romania (37.18%), Slovakia (29.39%) and Greece (28.27%). Overall, half the EU-27 Member States recorded a VAT gap below 10.8%.

The European Commission study surveyed methods adopted by individual EU Member States in order to estimate the VAT gap (European Commission, 2016). Some EU Member States such as the United Kingdom (HMRC, 2016), Sweden (Hansson and Wallberg, 2008), Slovakia (Novysedlák and Palkovičová, 2012), Germany (Chang, Gebauer and Parsche, 2003; Parsche, 2008), and Italy (Chiarini, Marzano and Schneider, 2009; D'Agosto, Marigliani and Pisani, 2014)

publish estimates of the VAT gap. In other Member States, the VAT gap is calculated by the respective national statistical offices, for example in France. For some Member States, e.g. Estonia and Finland, these calculations were made and published by the International Monetary Fund (Thackray and Ueda, 2014; Thackray, Hutton and Kapoor, 2015). For the Czech Republic, Moravec, Hinke and Kaňka (2018) summarised the VAT gap estimates published in recent years and commented on the methods used for their processing. However, most European countries keep their VAT gap estimates for their own internal purposes and do not make them public.

The main method used for VAT gap estimates is the Top-down method using data from national accounts, specifically from the supply-use tables. The Top-down method further splits into two respective types. The first type estimates the VAT gap from data on the final consumption of households and intermediate consumption of the public sector and other sectors exempt from the tax. This method is called the Demand method and it has been adopted by e.g. Reckon (2009) and CASE (2017).

The second type of Top-down method uses information on the production for all sectors in the given economy, comparing their VAT due on production with the deductible input VAT. This methodology is used by the IMF, e.g. Thackray, Hutton and Kapoor (2015) and referred to as the Supply method. Several tax authorities (Estonia, Slovenia and UK) also estimate the VAT gap by the Bottom-up approach based on the analysis of the tax return data, tax audits or surveys and administration data (European Commission, 2016).

Apart from the sheer volume of VAT evasion, tax policy makers are also interested in its corresponding factors. Recent studies researching the effects of various factors related to the scope of the VAT gap have provided some interesting results. D'agosto, Marigliani and Pisani (2014) focused on the VAT gap in Italy and processed data on 20 regions from 2007 − 2010. Their results indicate that the VAT gap is positively correlated with the business cycle and tax moral of the geographic area.

CASE (2013) estimated the regression model using data on 27 countries for the period 2000 – 2011. The results show that rising unemployment is related to the higher VAT gap. In countries with lower levels of tax morale a positive effect of the standard VAT rate was observed, meaning the VAT gap rises with an increase in the rate. Another study that also focused on 25 EU countries in the 2000 – 2006 period found a positive link between administrative costs associated with VAT collection and the VAT gap (Barbone, Bird and Vázquez-Caro, 2012). For the Czech Republic, Zídková and Pavel (2016) explored various factors influencing the VAT gap.

Studies focusing on VAT tax evasion do not solely rely on the VAT gap as the dependent variable. For example, Agha and Haughton (1996) used the self-made compliance rate for 17 OECD countries in 1987 based on the final consumption of individual goods and services and the VAT rate. According to their results, the higher the VAT rate and the higher the number of tax rates, the lower the level of compliance with tax obligations. Christie and Holzner (2006) focused on the VAT losses in 25 European countries in 2000 – 2003 and concluded that higher weighted average VAT rates are related to higher VAT losses.

Governments are looking for ways to suppress VAT evasion and the corresponding measures have been applied in recent times with the Czech Republic being no exception. The most common measure against sophisticated VAT evasion (carousel and chain frauds) is the specific (or optional) reverse charge applied on certain commodities, implemented across all the EU Member States (European Commission, 2014).

However, the optional reverse charge mechanism is not a viable option. Its critics argue that the carousel fraud could shift towards other commodities or other states that have not yet implemented such a measure (PWC, 2007). Therefore, within the EU, new methods of VAT collection are currently under discussion. Slemrod (2008) mentions that it is relevant who remits the tax to the tax authorities. New VAT collection methods are discussed in the EU with regard to their efficiency on one hand and their strength against VAT fraud on the other. An alternative most preferred by the European Commission is a new VAT treatment of cross-border supplies of goods. These would no longer be exempt from VAT and thus the carousel fraud would no longer be so advantageous (European Commission, 2017).

In the meantime, many Member States seek to implement effective measures without changing the whole system. Although the VAT system is seen as self-enforcing and resistant against tax evasion due to the paper trail (Pomeranz, 2015) it needs apparently more profound (digital-based) tracking the transactions. A growing number of Member States introduced temporary measures such as extended data reporting to the tax authorities, usually electronic reports or online transmitted data related to the ongoing transactions that are sent in a unified electronic format to tax officers.

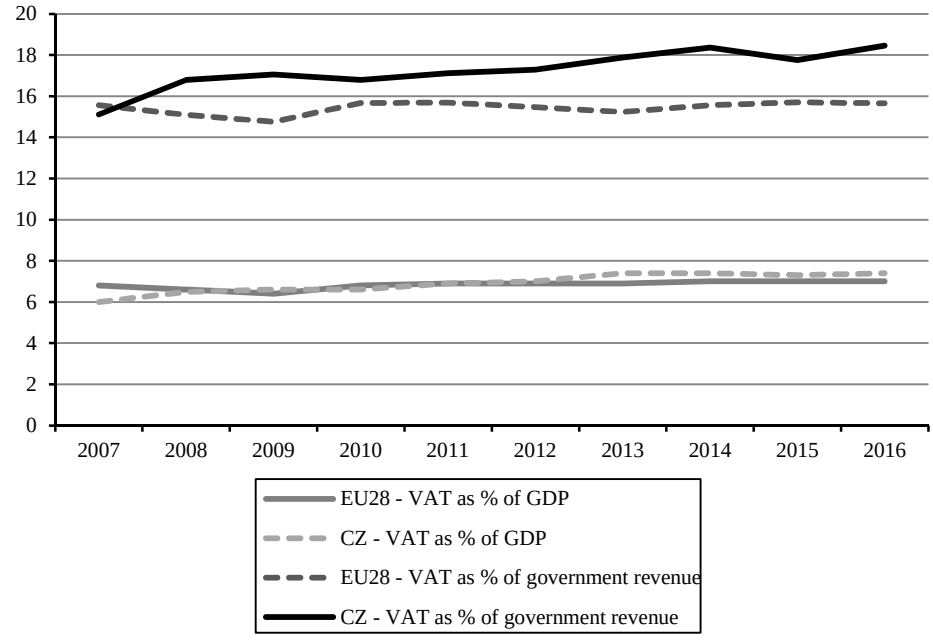
Apparently 13 European countries had implemented such anti-fraud VAT reporting by September 2017 (Hallam, 2017). Also, a split payment method where the purchaser pays the VAT directly to the tax authorities instead of to its supplier is being introduced e.g. in Poland (TPA, 2017). The United Kingdom is now discussing split payments and joint liability for VAT to be paid by oversees e-shops (Krikorian-Slade, 2017).

3. Importance of VAT in the Czech Republic and Measures Taken against VAT Evasion

The importance of VAT for the tax mix of the Czech Republic has been for a long time gradually rising. In 2007, the share of VAT revenue on total public revenues was 15%; in 2016 it stood at 18%. Compared to the EU average, the VAT revenue to GDP ratio is similar, but its importance within the national tax mix is significantly higher vis-à-vis the EU average (see Figure 1). The 2008 tax reform played in this context an important role, as the reduction in rates of both personal and corporate income taxes was compensated by an increase in the reduced VAT rate from 5 to 9%. In subsequent years, the increase in VAT rates helped the struggling public budgets through the period of economic decline and stagnation between 2010 and 2013 and during the introduction of the second pillar of the pension system in 2012, respectively.

F i g u r e 1

Importance of VAT in the Czech Republic and EU Countries in 2007 – 2016, (%)



Source: Eurostat.

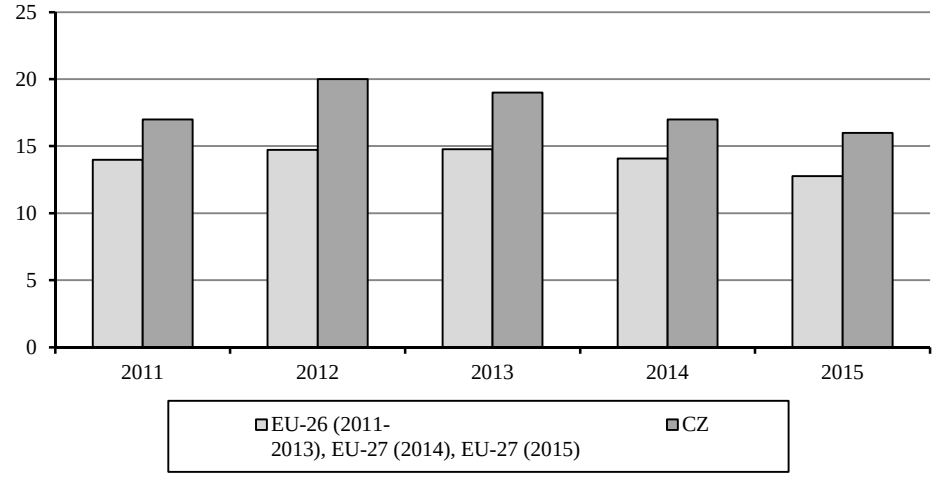
As VAT is significantly represented in the Czech tax mix, VAT evasion naturally affects public budgets more than in the case of the majority of other EU Member States. This is also mirrored in the higher VAT gap for the Czech Republic, estimated by CASE (2017) study on average at almost 18% for 2011 – 2015.

The average figure for the EU is lower by approximately three percentage points (see Figure 2). The decreasing trend can be observed from 2013, this fact is interpreted as the result of anti-evasion tax measures. However, a similar trend is evident also in the EU average and thus conclusions on the efficiency of measures adopted by the Czech Republic cannot be confirmed solely based on this observation.

In the Czech Republic, the VAT gap of CZK 80 billion was estimated also by the General Financial Directorate (2015). The Czech Supreme Audit Office (2015) estimated the VAT gap to be CZK 105 billion in 2013, which represents approximately 26% of the theoretical VAT liability.

F i g u r e 2

VAT Gap Estimates for the Czech Republic and EU Countries in 2011 – 2015, (in %)



Source: CASE (2017).

The Czech Republic has started to combat VAT evasion with the reverse charge mechanism, i.e. using a specific VAT regime under which the duty to pay the output VAT is shifted onto the purchaser. This prevents situations where the supplier does not pay the output tax to the tax authorities and the purchaser asks for its refund. Under the reverse charge mechanism, the purchaser pays to its supplier for goods or services the price excluding VAT. The corresponding VAT is reported in his tax return as the output tax on the supply received. This procedure is exactly reverse to the standard mechanism where the output tax is reported by the supplier only on its sold supplies. The purchaser also deducts the input tax incurred on the purchase in its tax return. The input tax is equal to the amount declared as the output tax on the very same purchase. He cannot deduct

the input VAT unless he reports the output VAT on the supply purchased under the reverse charge mechanism. Therefore, the tax on that transaction cannot disappear (the responsibility for its channelling to the state budget does not rest with the supplier as in the case of the standard VAT mechanism). The reverse charge mechanism was first applied on gold in 2006 and gradually extended to other commodities. Application of the reverse charge mechanism in the Czech Republic is presented in Table 1.

T a b l e 1

Application of the Reverse Charge Mechanism in the Czech Republic

Date of application (since)	Commodity included
1 January 2006	Gold
1 April 2011	Emission allowances, scrap and waste.
1 December 2012	Grain, technical crops, metals, mobile phones, tablets, notebooks, integrated circuits.
1 February 2016	Electricity, gas and certificates to electricity supplied to trader.
1 October 2016	Services of electronic communication for further sales.
1 July 2017	Sale of immovable property under execution, transfer of goods that served as a guarantee, the hiring out of labour in construction.

Source: VAT Act, different wording.

In 2011, the purchaser guaranty for unpaid tax by the supplier was introduced. This anti-fraud measure aims to assist the tax authorities in retrieving VAT that should have been paid with respect to the transaction in question but was not paid because the given supplier was fraudulent. The purchaser has to pay the VAT on such a transaction, although normally (when not considering the reverse charge system) he is in such a case not required to pay the output VAT. He has paid the VAT in the price of goods or services to the supplier who failed to transmit it to the tax authorities. Thus, under the regime of guaranty he would pay the VAT twice. This is the reason why purchasers are very careful to check whether their suppliers are reliable and fulfil all the conditions mandated by the tax authorities so that they do not act as guarantors.

The guaranty for non-paid VAT was first applied in a general indefinite way starting from 1 April 2011. It applied only when the purchaser, based on circumstances of the transactions, should have known that the supplier would not pay the tax. However, such vague wording of the guaranty rule allowed for disproportionate uncertainty. As of 1 January 2013, other criterions have been added to the rule, such as that the supplier has been considered an unreliable payer, funds (in excess of CZK 540,000) have been sent to other than a public bank account, the transaction has been made to a foreign account, the supplier of fuels is not registered with the distributors' list. And yet another guaranty is imposed on an authorized recipient of excisable goods from another Member State.

Since 1 January 2015, tax authorities used the guarantee for VAT more frequently as the registers of unreliable payers and the list of public accounts for mandatory payments were compiled. To eliminate refund of the input VAT before the tax authorities are able to discover that fraudulent tax payers did not pay the output VAT, an obligatory monthly tax period following the registration has been introduced.

After two years of registration, it is possible to move to a quarterly tax period. Also, more emphasis is given to the information provided within the registration process with special attention paid to the true seat of the company. The latest rule regarding the guaranty of VAT has applied since 1 July 2017 and concerns payments carried out in virtual currency.

The VAT Control Statement has been implemented since 1 January 2016 to allow for on-line checks across all transactions among the taxpayers. All taxable persons registered for VAT in the Czech Republic are obliged to submit a VAT Control Statement. The tax authorities are able to find out very quickly whether the input VAT claimed by the tax payer was or was not reported and paid by its supplier. Thus, they do not refund VAT that has not been paid within the previous stage of the VAT chain. The VAT Control Statement is strictly required and non-compliance is penalized; from CZK 1,000 (approx. 4% of the average wage in the CR) for the failure to file the Control Statement to CZK 50,000 (approx. 200% of the average wage in the CR) for a repeated failure after being challenged by the tax authority.

As the tax authority continued to combat tax evasion, strict tax audits of claimed input VAT have been carried out since 2015. Whenever there has been a suspicion of tax evasion within the chain of transactions, these claims have not been reimbursed to the tax payers. With the same motivation to suppress VAT evasion, the so-called protective order has been introduced within the VAT system. It allows for securing the tax before it is due if there is a suspicion that the tax would not be later paid in full. The tax authority started to apply this regulation strongly in 2015 – 2016 and executed the property of tax payers prior to authorization of the VAT underpayment.

The possibility to pay VAT directly to the tax authority instead of paying it to the supplier within the price of its supply has been introduced. Purchasers that are in doubt of the reliability of their suppliers can use this method; so far, however, it has not been widely adopted.

Apart from the anti-fraud measures already discussed, the Czech Republic is also using instruments aimed against the simple types of VAT and income tax evasion. One such example is the electronic evidence of cash revenues by businesses which was partly implemented in the Czech Republic as of 1 December

2016. This new obligation to electronically report to the tax authority each individual cash receipt is focused on hidden sales. It is one of the measures aimed against cash payments that enable the shadow economy. We did not include this measure into our model due to the lack of data, since the date of its implementation is quite recent.

4. Data and Methodology

Our methodology is based on the assumption that the implemented changes cannot be considered as endogenous because they are different types of reforms, these were analysed by Romer and Romer (2010). This is because the problems with huge VAT gap are of a long-term nature and the implemented changes are therefore not a direct response to the fluctuation of some of the relevant variables.

The data set used for our econometric analyses comprises of three groups of variables. Firstly, data from national accounts; secondly, parameters of the given tax system; and thirdly, measures taken against the tax evasion. Table 2 presents the data sources of variables in detail; we assume a positive effect on VAT revenues for all the explanatory variables. All data are quarterly, from Q1/1999 to Q4/2016.

The first group of variables are those that make up the VAT base. The VAT base comprises all consumption and investment expenses where the purchaser is not allowed to claim the input VAT. These are consumption expenses of households, non-finance investments of the government and households, intermediate consumption of the government and financial corporations.

The second group of variables are based on parameters of the VAT system. Among this group we include the standard and reduced VAT rates and a dummy variable capturing the shift of a significant number of items (almost all the services) from the reduced to the standard VAT rate in 2004, when the Czech Republic entered the EU.

Empirical analysis presented in this paper focuses mainly on the third group of these variables that are related to the implementation of the measures adopted against VAT evasion. Included are also dummy variables which take on the value of one since implementation of the given measure. Other variables within this group capture the intensity of the specific measure via the number of their applications within the relevant period.

In the group with control variables (the first group), all the time series taken from national accounts include a significant seasonal trend. For the seasonal adjustment we adopted the X13-ARIMA method (U.S. Census Bureau, 2017).

We also ran Augmented Dickey-Fuller tests (ADF tests) (Dickey and Fuller, 1979) with the results summarised in Table 3. According to these results, all the time series are non-stationary, type I(1).

T a b l e 2

Variables – Description and Sources

Variable	Description	Data source
VATrev	Dependent variable – VAT revenue	National accounts, code D.211 – value added type taxes (VAT)
Tax system		
CEhous	Consumption expenses of households	National accounts, P.3 – Final consumption expenditure; sector S.14 – Households
IEhous	Household expenses on non-finance investments	National accounts, P.51g – Gross fixed capital formation; sector S.14 – Households
IEgov	Governmental expenses on non-finance investments	National accounts, P.51g – Gross fixed capital formation; sector S.13 – General government
ICgov	Intermediate consumption of governmental sector	National accounts, P.2 – Intermediate consumption; sector S.13 – General government
ICfin	Intermediate consumption of financial corporations	National accounts, P.2 – Intermediate consumption; sector S.12 – Financial corporation
Parameters of tax		
BR	Standard VAT rate	VAT Act
RR	Reduced VAT rate	VAT Act
SM	Dummy variable – Significant shift of items from reduced to standard rate related to entrance of the CR to the EU in 2004	VAT Act
Measures against tax evasion		
RCHgold	Dummy variable – application of the reverse charge mechanism on gold I/2006	VAT Act
RCHsea	Dummy variable – application of the reverse charge mechanism on scrap and emission allowances Q2/2012*	VAT Act
RCHcw	Dummy variable – application of the reverse charge mechanism on construction work Q1/2012	VAT Act
GUT (I-II)	Phases of tightening rules for guarantee for unpaid VAT – Q1/2013, Q1/2015	VAT Act
CS	Dummy variable – implementation of the VAT control statement Q1/2016**	VAT Act
UP	Number of new records in the Register of unreliable tax payers	Register of unreliable tax payers
HC	Extent of use of protective orders, in two variations – number (HCn) and volume (HCv)	Reports on activities of the Czech Tax Authority and Custom Agency for 1999–2016

Note: * at the same time, the first phase of the guarantee for unpaid tax was implemented, ** at the same time, the reverse charge mechanism on immovable property and electricity, as well as tightening of rules for voluntary registration to VAT, were implemented.

Source: National Account, VAT Act.

T a b l e 3

Unit Root Test of the Seasonally Adjusted Time Series and the First Differences

I/1999 – IV/2016	Seasonal adjusted time series		First differences	
	t_{ADF}	Prob.	t_{ADF}	Prob.
VATrev	–2.7706	0.2129	–9.1952	0.0000
CEhous	–0.7236	0.8335	–6.4809	0.0000
IEhous	–1.5611	0.4945	–9.4884	0.0000
IEgov	–0.6567	0.4292	–14.3249	0.0000
ICgov	2.2346	0.9936	–10.9963	0.0000
ICfin	1.6550	0.9753	–12.2161	0.0000
BR	–1.7567	0.3987	–5.8327	0.0000
RR	–2.1777	0.4942	–8.3066	0.0000
UP	3.8537	0.9997	–6.3728	0.0006
HCn	0.4648	0.8125	–5.2808	0.0000
HCv	–1.2708	0.6381	–3.7415	0.0003

Source: Own calculations.

Furthermore, we tested whether the time series are cointegrated or whether their mutual relationship is only ostensible. Distinction between cointegration regression and spurious regression was tested using the test of cointegration (Engle and Granger, 1987) based on the analysis of residuals of the statistical regression model $Y_t = \boldsymbol{\beta}' \boldsymbol{X}_t + a_t$. The ADF test was applied on estimated residuals $\hat{a}_t$ with the result t_{ADF} = -4.1343, Prob. = 0.0001. Thus we concluded that $\hat{a}_t$ are stationary, type I(0), and the time series are thus cointegrated. Based on the analysed problem, we included VAT revenues as an endogenous variable and other time series as exogenous.

With the aim to determine the effect of newly implemented measures against the tax evasion, we have prepared the following regression model of the time series that includes both the control variables $\boldsymbol{X}$ (variables estimating the VAT base and VAT parameters) and the group of variables $\boldsymbol{Z}$ associated with measures taken against the tax evasion. The ADL model (Hendry, Pagan and Sargan, 1984) is as follows:

$$Y_t = c + \sum_{j=1}^{q} \alpha_j Y_{t-j} + \sum_{j=1}^{q} \beta_{ij} (B^{j-1}) X_{it} + \sum_{j=1}^{q} \delta_{ij} (B^{j-1}) Z_{it} + a_t$$

where α_j represents the coefficient of the lagged dependent variable, β_{ij} are parameters of exogenous control variables $\boldsymbol{X}$, δ_{ij} are parameters of exogenous variables $\boldsymbol{Z}$ and $\boldsymbol{B}$ is the lag operator, where $B^j y_t = y_t$.

Furthermore, we have created two models. In the first model, we used a delayed variable VATrev as an endogenous variable. In the second model, this variable is not present; however, the coefficient of the constant is statistically significant.

The results of both models are presented in Table 4 in their reduced form, meaning that only statistically significant variables were included. Both models were tested and it was proved that their unsystematic component has the characteristics of a white noise (Breusch and Godfrey, 1986; Jarque and Bera, 1980; Darnell, 1994). The explanatory power of both models, measured by adj R-square coefficients, is very similar.

T a b l e 4

Results of the Estimated Models, Dependent Variable is *VATrev*

Variable		**Model 1**		**Model 2**	
		Coeff.	Prob.	Coeff.	Prob.
X variables	*C*			–2 8121.51	0.0001
	VATrev(–1)	0.2276	0.0442		
	CEhous	0.0396	0.0435	0.0895	0.0000
	IEhous(–1)	0.1953	0.0230	0.1927	0.0133
	IEgov(–4)	0.0640	0.0002	0.0591	0.0002
	BR(–4)	270.8331	0.0107	1 219.6220	0.0000
	RR	594.4891	0.0008	568.8415	0.0002
	SM	7 410.6870	0.0000	9 215.5170	0.0000
Z variables	*UP*	3.1119	0.0006	2.9929	0.0001
	RCHsea	2 948.0560	0.0033	2 403.0870	0.0082
	GUT(I)	4 293.5360	0.0000	4 497.0880	0.0000
	CS(–2)	2 594.8550	0.0262	2 860.3190	0.0056
Diagnostics tests		Stat.	Prob.	Stat.	Prob.
Breusch-Godfrey Serial Correl. LM Test		0.3998	0.6724	1.1088	0.3372
Heteroskedasticity Test		62.0154	0.1003	1.1978	0.2778
Jarque-Bera Test		1.5433	0.4623	1.3684	0.5045
R-square		0.9951		0.9960	
Adj R-square		0.9943		0.9953	

Source: Own calculations.

The statistical significance of dummy variables expressing the VAT changes shown in the model can be caused by other factors than the changes in the VAT collection parameters.

To avoid possible incorrect interpretation, it is necessary to proceed with further analysis. As VAT revenue time series without the implemented changes is not available, we have used the Chow Breakpoint test (Chow, 1960) to test structural changes in explained time series VATrev for statistically significant dummy variables (SM, RCHsea, GUT I and CS). This approach allows the identification of potential structural parameter changes of the explained variable in the year of the implementation of the respective measure. According to the Chow Breakpoint test, changes in the time series in all analyzed periods were identified (see Table 5). It means, that our approach with the changes represented by dummy variables, is correct. These dummy variables can be used for quantification of the measures taken on the VAT revenues.

T a b l e 5

Results of the Chow Breakpoint Test for Dummy Variables

Variable	Break date	F-statistics	Prob.
SM	Q2/2004	11.5887	0.0000
RCHsea	Q2/2011	6.1940	0.0034
GUT I	Q1/2013	4.8336	0.0109
CS	Q1/2016	6.2672	0.0032

Note: Null Hypothesis: No breaks at specified breakpoints.

Source: Own calculations.

Model 1 can be transformed into an Error Correction Model (Engle and Granger, 1987) that captures the retentive relation among the analysed variables. Recalculated parameters are long-term multipliers and the reaction speed of the system is 0.7724.

$$\widehat{VATrev}_t = 0.051\text{CEhous}_t + 0.253\text{IEhous}_t + 0.083\text{IEgov}_t + 350.631\text{BR}_t + 769.649\text{RR}_t + 9594.166SM_t + 4.0289UP_t + 3816.669RCHsea_t + + 5558.58\text{GUT}(1)_t + 3358.58\text{CS}_t .$$

In both models, the households' consumption and investment of households and the government proved statistically significant, with a positive dependence as expected with respect to theoretical assumptions about the model. The same is true for parameters of the tax system (tax rates and the shift of items between tax rates in 2004).

Not all the measures adopted against tax evasion have been tested as being statistically significant. The models found no statistical significance for the adopted reverse charge mechanism on gold and construction works, for the second phase of tightening rules of the guarantee for unpaid tax, and for both volume and number of protective orders.

Other measures seem to have a highly positive effect on VAT revenues. For both models resulted in a more robust tightening of the rules concerning an unreliable payer, introduced at the beginning of 2013. The quarterly positive effect on VAT revenues exceeds CZK 4 billion, which means on average 4.5% of VAT revenues in 2016. An additional significantly positive effect has been identified for the adoption of the reverse charge mechanism on scrap and emission allowances, as well as for the implementation of the VAT control statement; in both cases, the quarterly effect exceeds CZK 2 billion. For the VAT control statement, the effect seems to be delayed by six month, possibly explained by the time needed for finalizing the data analysis by the tax authority before this measure could have been used for effective tax audits. The concept of the unreliable tax payer also showed a positive effect of CZK 3 million on average for

each additional record in the database (tax payer). Considering the average of new records in 2016 (1,013 new records per quarter), the quarterly positive effect is CZK 3 billion. Long-term multipliers based on the Model 1 suggest even higher effects of these measures.

The total annual effect of the above-mentioned measures was according to the model around CZK 51 billion by the end of 2015. This is 14.5% of the total annual VAT revenues. Compared to the estimated VAT gap which was 20% of the theoretical VAT liability in 2013 according to CASE (2017), the above mentioned measures lowered this gap by more than approx. 60%.

5. Discussion and Conclusions

Our analysis revealed that some of the anti-fraud measures are effective. These include making purchasers guarantors for the unpaid VAT, especially where the supplier is listed as an unreliable VAT payer. Variables for the number of listed unreliable payers and for the first phase of the stricter VAT guaranty application proved significant in our model. Also, the specific reverse charge had an impact on VAT revenues. In particular the reverse charge adopted on emission allowances and scrap, the first commodities (except for gold) that were subjected to this treatment. According to our research, the control statement appears to represent quite an effective measure, although it impacts VAT revenues with some delay. This is, however, understandable as the tax authorities had to process an enormous volume of data generated by these reports. On the other hand, the protective orders do not seem to have any significant impact on VAT revenues.

Our results are contradictory to the analysis conducted by the Supreme Audit Office of the CR (2015) that tested the efficiency of the above mentioned measures over the period 2013 – 2015. According to this report, measures adopted to suppress the VAT evasion did not bring the expected results. However, the document contains no details whatsoever with respect to the employed methodology.

When making the correct decision, policy makers should consider not only the potential revenues generated by specific anti-fraud measures, but they should also compare them with the associated costs. Administrative costs of the tax authorities and compliance costs of taxpayers may not be negligible. For example, in the case of the control statement the tax authority estimated CZK 250 million one-off costs for the public sector and CZK 1.37 billion for the VAT payers (Ministry of Finance of the Czech Republic, 2014).

However, some expenses are not so apparent and much more difficult to quantify. These relate to the legal certainty of businesses and the breach of neutrality of VAT if the input VAT deduction is generally distrusted and questioned.

Retaining the input VAT by the tax authorities prior to its refund back to the (in most cases) honest VAT payers causes on their part serious financial difficulties and cash-flow problems. Protective orders, where assets are taken from businesses as collateral for the potential future tax liability, could even bankrupt the particular company. Several cases have been brought before the Czech Administrative Supreme Court regarding the legitimacy of the protective orders (Hajdušek, 2017). In Romania, the tax authorities refuse the input tax deduction if the supplier is on the list of the so-called inactive VAT payers – similar to the Czech unreliable payers (EY, 2017). This measure was addressed by the European Court of Justice and it was approved by the Court on the condition that the VAT payer can get the refund if he proves to the tax authorities that his supplier (despite the fact he is included on the list) has paid the VAT due on the particular transaction. The burden to prove that the input VAT deduction is lawful is thus shifted to the VAT payer. It is questionable whether charging the VAT payer with the burden of proving that someone else has paid VAT complies with the principle of proportionality inherent to the EU law. It means that these measures should not be excessive and burdensome on the tax payers more than necessary, given the reason of their implementation. VAT should be collected by the VAT payers for the tax authorities as a transitory item and should not create additional costs for the VAT payers who, based on their economic activity, have a full entitlement to the VAT deduction.

Therefore, it seems reasonable to have a debate on modification of the existing VAT system suffering from excessive VAT evasion. Some of the system patterns that allow for VAT fraud are being considered at the EU-wide level. One option is to tax the cross-border transactions in goods, since the current exemption is abused by the carousel frauds (European Commission, 2017). Another discussed possibility is the general reverse charge applicable on all goods and services. However, the general reverse charge would represent a complete alteration of the VAT system and as such it is currently not supported by the European Commission (2016a).

References

AGHA, A. – HAUGHTON, J. (1996): Designing VAT Systems: Some Efficiency Considerations. The Review of Economics and Statistics, *78*, No. 2, pp. 303 – 308. Available at: <https://doi.org/10.2307/2109932>.

BARBONE, L. – BIRD, R. – VÁZQUEZ, C. (2012): The Costs of VAT: A Review of the Literature. [Case Network Reports, No. 106/2012.] Warsaw: Center for Economic and Social Research. Available at: <https://ssrn.com/abstract=2024880 or http://dx.doi.org/10.2139/ssrn.2024880>.

BODIN, J. P. – EBRILL, E. P. – KEEN, M. – SUMMERS, V. P. (2001): Modern VAT. Washington, DC: International Monetary Fund. ISBN 9781589060265.

BREUSCH, T. – GODFREY, L. G. (1986): Data Transformation Tests. Economic Journal, *96*, No. 1, pp. 47 – 58. Available at: <https://doi.org/10.2307/2232969>.

CASE (2013): Study to Quantify and Analyse VAT Gap in EU-27 Member States. [Final Report.] Warsaw: Center for Social and Economic Research. Available at: <https://ec.europa.eu/taxation_customs/sites/taxation/files/docs/body/vat-gap.pdf.>.

CASE (2017): Study to Quantify and Analyse VAT Gap in EU-28 Member States. [Final Report.] Warsaw: Center for Social and Economic Research. Available at: <https://ec.europa.eu/taxation_customs/sites/taxation/files/2016-09_vat-gap-report_final.pdf.>.

CHOW, G. C. (1960): Tests of Equality between Sets of Coefficients in Two Linear Regressions. Econometrica, *28*, No. 3, pp. 591 – 605.

CULLIS, J. – JONES, P. (2009): Public Finance and Public Choice. Analytical Perspectives. Oxford; New York: Oxford University Press. ISBN 10:9780199234783.

D'AGOSTO, E. – MARIGLIANI, M. – PISANI, S. (2014): Asymmetries in the Territorial VAT Gap. [Working Paper, No. 02/2014.] Roma: Agenzia della Entrate. Available at: <https://www.agenziaentrate.gov.it/portale/documents/20143/233958/Sintesi+articolo+2014-02_sintesi_2014-02_ITA.PDF/3da1a7b2-58c9-0270-6f99-025fd1ac5d95>.

DARNELL, A. C. (1994): A Dictionary of Econometrics. Camberley Surrey: Edward Elgar.

DICKEY, D. A. – FULLER, W. A. (1979): Distribution of Estimators for Autoregressive Time Series with a Unit Root. Journal of American Statistical Association, *74*, No. 366, pp. 427 – 431. Available at: <https://doi.org/10.2307/2286348>.

ENGLE, R. F. – GRANGER, C. W. J. (1987): Cointegration and Error Correction Representation: Estimation and Testing. Econometrica, *55*, No. 2, pp. 251 – 276. Available at: <https://doi.org/10.2307/1913236>.

EUROPEAN COMMISSION (2014): Assessment of the Application and Impact of the Optional 'Reverse Charge Mechanism' within the EU VAT System. Executive Summary. [Specific Contract No. 6 TAXUD/2013/DE/333 implementing Framework Contract No. TAXUD/2012/CC/117.] Available at: <https://doi.org/10.2778/578675>.

EUROPEAN COMMISSION (2016): The Concept of Tax Gaps. Report on VAT Gap Estimations, FISCALIS Tax Gap Project Group. [Report FPG/041.] Available at: <https://ec.europa.eu/taxation_customs/sites/taxation/files/docs/body/tgpg_report_en.pdf.>.

EUROPEAN COMMISSION (2016a): Towards a Single EU VAT Area – Time to Decide, Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee on an Action Plan on VAT. [Report COM(2016) 148 final.] Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM% 3A2016%3A148%3AFIN.>.

EUROPEAN COMMISSION (2017): Impact Assessment. Accompanying the document Proposal for a Council Directive amending Directive 2006/112/EC as regards harmonising and simplifying certain rules in the value added tax system and introducing the definitive system for the taxation of trade between Member States. [Commission Staff Working Document SWD (2017) 325 final.] Available at: <https://ec.europa.eu/taxation_customs/sites/taxation/files/ 18012018_ impactassessment_proposal_vat_rates_en.pdf.>.

EY (2017): Romania Publishes Ordinance on Implementation of VAT Split Payment Mechanism. [Indirect Tax Alert, 5 September 2017.] Bucharest: Ernst & Young SRL. Available at: <http://www.ey.com/gl/en/services/tax/international-tax/alert--romania-publishes-ordinance-on-implementation-of-vat-split-payment-mechanism>.

GENERAL FINANCIAL DIRECTORATE (2015): Press Conference on Control Statement [Presentation.] Prague: General Financial Directorate. Available at: <http://www.financnisprava.cz/cs/financni-sprava/pro-media/tiskove-zpravy/2015/kontrolni-hlaseni-startuje-prvniho-ledna-2016-6916>.

HAJDUŠEK, T. (2017): Zajišťovací příkazy – prostředek ultima ratio nebo standardní postup správce daně? Bulletin KDP, No. 2, pp. 18 – 24.

HALLAM, N. (2017): EU Tax Authorities: Anti-fraud Measures and a Grab for Cash. AccountancyAge. Available at: <https://www.accountancyage.com/2017/09/13/eu-tax-authorities-anti-fraud-measures-and-a-grab-for-cash/>.

HANSSON, A. – WALLBERG, K. (2008): Tax Gap Map for Sweden. How was It Created and How can It be Used? [Report 2008:1B.] Solna: Swedish National Tax Agency. Available at: <https://www.skatteverket.se/download/18.361dc8c15312eff6fd2b9a4/1473840293366/Report_2008_1B.pdf.>.

HMRC (2016): Measuring Tax Gaps 2016 Edition. Tax Gap Estimates for 2014-15. [HMRC Report.] Available at: <http://webarchive.nationalarchives.gov.uk/20170621230141/https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/561312/HMRC-measuring-tax-gaps-2016.pdf.>.

HENDRY, D. F. – PAGAN, A. – SARGAN, J. D. (1984): Dynamic Specification. In: GRILICHES, Z. and INTRILIGATOR, M. D. (eds): Handbook of Econometrics, No. 2, pp. 1023 – 1100.

CHANG, W. N. – GEBAUER, A. – PARSCHE, R. (2003): Is Completion of EU Single Market Hindered by VAT Evasion? [Working Paper, No. 974.] Munich: CESifo Group. Available at: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=427624>.

CHIARINI, B. – MARZANO, E. – SCHNEIDER, F. (2009): Tax Rates and Tax Evasion: An Empirical Analysis of Structural Aspects and Long-Run Characteristics in Italy. [Working Paper, No. 3447.] Bonn: IZA. Available at: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1136252>.

CHRISTIE, E. – HOLZNER, M. (2006): What Explains Tax Evasion? An Empirical Assessment Based on European Data. [WIIW Working Paper, No. 40.] Vienna: The Vienna Institute for International Economic Studies. Available at: <https://wiiw.ac.at/what-explains-tax-evasion-an-empirical-assessment-based-on-european-data-p-540.html>.

JARQUE, C. – BERA, A. (1980): Efficient Tests for Normality, Heteroscedasticity, and Serial Independence of Regression Residuals. Economics Letters, *6*, No. 3, pp. 255 – 259: Available at: <https://doi.org/10.1016/0165-1765(80)90024-5>.

KEEN, M. – SMITH, S. (2007): VAT Fraud and Evasion: What do We Know and what can be Done? [IMF Working Paper, No. 07/31.] Washington, DC: International Monetary Fund. Available at: <https://www.imf.org/en/Publications/WP/Issues/2016/12/31/VAT-Fraud-and-Evasion-What-Do-We-Know-and-What-Can-be-Done-20215>.

KRIKORIAN-SLADE, B. (2017): HMRC: Call for Input on Alternative Method of VAT Collection. London: Response from UK Finance: Available at: <https://www.ukfinance.org.uk/wp-content/uploads/2017/09/170714-UK-Finance-conres-HMRC-Alternative-method-of-VAT-collection-v1.0.pdf>.

MINISTRY OF FINANCE OF THE CZECH REPUBLIC (2014): Reasoning Report to Act No. 360/2014 Coll., Amendment to VAT Act. Prague.

MORAVEC, L. – HINKE, J. – KAŇKA, S. (2018): Stanovení mezery DPH – případ České republiky. Politická ekonomie, *66*, No. 4, pp. 450 – 472.

NOVYSEDLÁK, V. – PALKOVIČOVÁ, J. (2012): Estimate of Value Added Tax Revenue Loss. [Economic Analysis 25.] Bratislava: Ministry of Finance of the SR, Institute for Financial Policy. Available at: <https://www.mfsr.sk/en/finance/institute-financial-policy/working-papers/the-estimate-value-added-tax-revenue-loss/>.

PARSCHE, R. (2008): Trotz Erhöhung des Mehrwertsteuersatzes 2007 auf 19% ging die Ausfallquote auf 9% zurück und dürfte auch 2008 bei 9% liegen. Ifo Schnelldienst, *61*, No. 12, pp. 55 – 56. Available at: <http://www.ces-munich.de/DocDL/ifosd_2008_12_4.pdf.>.

PWC (2007): Study in Respect of Introducing an Optional Reverse Charge Mechanism in the EU VAT Directive. [Final Report to the European Commission TAXUD/2007/DE/305.] Available at: <https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/common/consultations/tax/4209_study_en.pdf>.

POMERANZ, D. (2015): No Taxation without Information: Deterrence and Self-Enforcement in the Value Added Tax. American Economic Review, *105*, No. 8, pp. 2539 – 2569. Available at: <http://www.aeaweb.org/aer/.>.

RECKON, L. L. P. (2009): Study to Quantify and Analyse the VAT Gap in the EU-25 Member States. [Report.] London: Reckon LLP. Available at: <https://ec.europa.eu/taxation_customs/sites/taxation/files/docs/body/reckon_report_sep2009.pdf.>

ROMER, CH. D. – ROMER, D. H. (2010): The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks. American Economic Review, *100*, No. 3, pp. 763 – 801. Available at: <https://doi.org/10.1257/aer.100.3.763>.

SUPREME AUDIT OFFICE OF THE CR (2015): Správa daně z přidané hodnoty a dopady legislativních změn na příjmy státního rozpočtu. [Report from Audit, No. 14/17.] Available at: <https://www.nku.cz/assets/media/informace-14-17.pdf>.

SLEMROD, J. (2008): Does It Matter Who Writes the Check to the Government? The Economics of Tax Remittance. National Tax Journal, *61*, No. 2, pp. 251 – 275. Available at: <http://ntanet.org/publications/national-tax-journal.html.>.

TAIT, A. A. (1988): Value Added Tax: International Practice and Problems. Washington, DC: International Monetary Fund. ISBN 9781557750129.

THACKRAY, M. – UEDA, J. (2014): Technical Assistance Report – Revenue Administration Gap Analysis Program. The Value-Added Tax Gap. Republic of Estonia. [IMF Report, No. 14/133.] Washington, DC: International Monetary Fund. Available at: <https://www.elibrary.imf.org/view/IMF002/21349-9781498370110/21349-9781498370110/21349-9781498370110.xml?redirect=true>.

THACKRAY, M. – HUTTON, E. – KAPOOR, K. (2015): Finland – Revenue Administration Gap Analysis Program. The Value-Added Tax Gap. [IMF Report, No. 16/60.]. Washington, DC: International Monetary Fund. Available at: <https://www.imf.org/en/Publications/CR/Issues/2016/12/31/Finland-Technical-Assistance-Report-Revenue-Administration-Gap-Analysis-Program-The-Value-43729>.

TRAN-NAM, B. – EVANS, CH. (2014): Towards the Development of a Tax System Complexity Index. Fiscal Studies, *35*, No. 3, pp. 341 – 370. Available at: <https://doi.org/10.1111/j.1475-5890.2014.12033.x>.

TPA (2017): Poland 2018: Voluntary VAT Split Payment. Available at: <http://www.tpa-group.com/en/publications-news/news/poland-2018-voluntary-vat-split-payment>.

U.S. CENSUS BUREAU (2017): X-13ARIMA-SEATS. Washington, DC: Center for Statistical Research and Methodology, Census Bureau, U.S.

ZÍDKOVÁ, H. – PAVEL, J. (2016): What Causes the VAT Gap? Ekonomický časopis/Journal of Economics, *64*, No. 9, pp. 811 – 826.