

THE IMPACT OF TAXATION OF THE DOMESTIC ECONOMIC  
TRANSACTIONS ON THE VAT COLLECTION THROUGH ELECTRONIC  
FISCAL DEVICES

**Ionel Bostan<sup>1\*</sup>, Cristian Popescu<sup>2</sup>, Costel Istrate<sup>3</sup>, Ioan-Bogdan Robu<sup>4</sup>  
and Ioan Hurjui<sup>5</sup>**

<sup>1), 5)</sup> *University “Stefan cel Mare”, Suceava, Romania*

<sup>2), 3), 4)</sup> *University “Alexandru Ioan Cuza”, Iași, Romania*

<p><b>Please cite this article as:</b> Bostan, I., Popescu, C., Istrate, C. and Robu, I.B., 2017. The Impact of Taxation of the Domestic Economic Transactions on the Vat Collection Through Electronic Fiscal Devices. <i>Amfiteatru Economic</i>, 19(45), pp. 581-594.</p>	<p><b>Article History</b> Received: 20 December 2016 Revised: 14 March 2017 Accepted: 5 April 2017</p>
--	--

**Abstract**

The issue of collecting tax resources to the consolidated budget has determined and still determines difficulties which cannot be neglected in all the former socialist countries of the Central and Eastern Europe. From the Members States of the European Union, Romania is the country with the highest VAT Gap between EU Member States: 41%, compared to a European average of 15.2%. One solution tried to solve this problem was the regulation of mandatory use of electronic cash registers with fiscal memory. In this way, it was considered that a better highlight and also a tighter control of economic transactions will be achieved, from a fiscal point of view. In our study, we analyze, for the Romanian context in the post-EU accession, whether the mandatory introduction of these devices in recording commercial transactions has had a significant impact on VAT collection. The study includes two stages of the analysis: in the first stage we estimated the influence of VAT rate variation on the degree of the VAT collection. Then we used the residual component to test the influence of EFDs' mandatory introduction on VAT collection or on fiscal efficiency. The results indicate an improvement in the collection of VAT but also a decrease in the efficiency of fiscal collection.

**Keywords:** electronic fiscal devices, value added tax, fiscal efficiency, state/consolidated budget

**JEL Classification:** C58, E62, O33

---

\* Corresponding author, **Ionel Bostan** – ionel\_bostan@yahoo.com

## **Introduction**

Taking into account the period of the last ten years and analyzing the evolution of the budgetary execution at national level, one can easily found a decrease in the efficiency of tax collection. Among other things, such a fact can be explained based on the government inefficiency, on the application of rules complicated and hard predictable, and on the existence of a reduced tax base, etc.

In addition, all these were some quasi-permanent phenomena accompanied by a continuous act of evasion and budget fraud. Moreover, even the national body specialized in the analysis of fiscal policies of the government, namely the Fiscal Council (FC) from Romania, reported a negative aspect concerning the problem we address, namely that the net collections from the value added tax (VAT) are systematically lower than the projected ones.

That is why we are convinced that there are still important efforts to be done in order to increase revenue collection. In this respect, documented studies on the Romanian public finance and taxation could contribute to a better understanding of this topic. Obviously, given the weight of the VAT in all budget revenues, it requires a better fiscal evidence of this tax category among economic operators/traders, our paper arguing more issues in this direction.

What we have into account, for the purpose of significant increase in VAT collections, is the introduction, generalization and more strict regulation of the use of electronic fiscal devices (EFDs). Therefore, our effort is directed towards the analysis and assessment of the influence of the mandatory introduction of the EFDs on the VAT collection of VAT in Romania for the 2006-2014 period.

To this regard, our study proposes a series of econometric models for the estimation and testing of the EFDs influence on the VAT collection. Obtaining the research results involves estimating the influence of the VAT rate increase on the degree of revenues collection (aimed to determine the explained component of the VAT collected), and estimating and testing the influence of introducing EFDs on the VAT collected, for unexplained component taking into account the increasing the VAT rate.

Consequently, to the analysis of the collected data for the studied period, we found that the introduction of the EFDs determines an increase in the VAT collection. At the same time, based on the evolution of the budgeted prediction of the analyzed system, which takes into account changes in the odds and the simultaneously practicing several such odds, we justify the imperative measure of replacing the classic electronic cash registers (equipped with roller ledger paper) with the next generation (equipped with electronic ledger).

As for the robustness of the results, for the reasonable assurance, we used the sensitivity analysis of tax efficiency, related to the models that reflect the EFDs influence on the degree of VAT collection.

## **1. Literature review**

Complete tax collection is the desideratum of any fiscal administration to ensure the resources necessary to stimulate economic growth (Ebeke, 2015). Insufficient budgetary revenues can be expensive and leads to a series of reductions of certain public expenditure, with direct impact on the social stability (Ebeke and Ehrhart, 2011).

A good collection is based on the recording of all transactions that are subject to taxation, sometimes via the use of electronic devices (Lubua, 2014) that would prevent eluding the State's interests and committing fiscal fraud (Ainsworth and Hengartner, 2009). However, collecting budget revenues may be affected by a series of external shocks felt by national economies, with direct impact on the tax payers and hence on the fiscal efficiency (Morrissey et al., 2016).

Certainly, optimizing revenue collection to the national budget may occur as a result of tax reforms, aimed at introducing new specific tools to increase revenues by adopting practices by tax administrations to determine the taxpayers comply with the law; then, very important is increasing the autonomy of regional or local tax administrations in terms of implementing fiscal policies (Moore, 2014).

Such a reform implies the transition from direct taxation, through income tax, which creates a tension between tax authorities and taxpayers, to indirect taxation, for example, using VAT (Matthews, 2003). Apart from studies on tax collection in general and on differences between what was collected and what should have been collected (Raczkowski, 2015), at the level of the EU, there have been specific analyses conducted on the topic of VAT, more precisely its degree of collection and the extent to which tax payers comply with this tax' requirements.

VAT importance justifies the interest that enjoys this tax from the tax authorities and taxpayers' attempts to limit, as much as possible, the pressure of this tax. Adoption of the VAT provides a number of advantages in terms of collection, allowing easier tax authorities control at the level of sales reported (Aizenman and Jinjarak, 2008).

Changes in the VAT rates, as a result of fiscal policy may lead to the influence of the consumption through pricing adjustments of goods, with direct impact on the future tax base (Barrel and Weale, 2009). In some cases, increases in the VAT rates can encourage the manifestation of the fiscal fraud phenomenon by minimizing sales, which may lead to the reduction of VAT collection. (Matthews and Lloyd-Williams, 2001). Measuring the effect of VAT evasion can be achieved using indicator *VAT Gap*, the difference between VAT collected and theoretical amount that is estimated to collect as VAT (Gebauer et al., 2007).

The *VAT Gap* indicator is used to assess the effectiveness of VAT enforcement and compliance (Shuvaieva et al., 2015). In fact, the *VAT Gap* provides an estimation of the revenue loss by the fiscal authorities due to different forms of tax evasion and fraud, to miscalculations, to bankruptcies and other causes that negatively impact VAT budgetary cash-ins.

For example, in 2013 Romania is the country with the most important VAT Gap in EU countries: 41%, compared to a European average of 15.2% (Shuvaieva et al., 2015). However, the evolution is relatively good: from 50% in 2009, reaching the level of 45% in 2010, 42% in 2011 and 43% in 2012. This situation is valid for other taxes as well (Raczkowski, 2015).

Based on these statistical data at the Romanian setting, one can notice that the VAT is the tax that mostly contributes to the State's fiscal revenues, ranking higher than personal income tax and excises, as well as higher than companies' income tax: according to statistical data, the weight of VAT cash-ins in GDP is very close to the weight of the following three taxes taken together (personal income tax, companies income tax and excises).

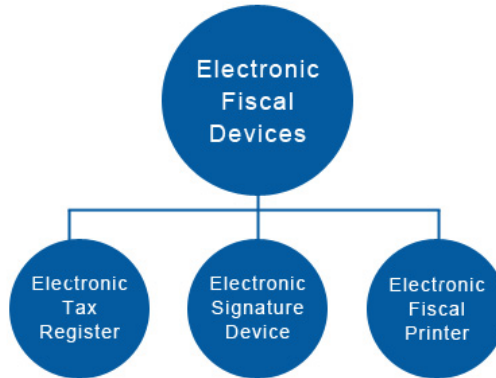
In this context, the use of EFDs can lead to a reduction of the tax evasion phenomenon, to an improvement of the control techniques of accounting records and to the increase of the business environment quality by reducing the burden of tax reporting and implementation in a timely manner to the tax administrations of information on VAT (Martin et al., 2010). Therefore, the use of EFDs ensures a better compliance of the economic operators in terms of tax legislation on VAT (Naibei and Siringi, 2011).

However, there are a number of problems associated to the use of EFDs, such as the impossibility of solving immediate technical issues, high costs associated to the maintenance services, and thereof, to any errors that may occur due to the improper use, with a direct impact on fiscal reporting and blocking the sales process (Hamdu and Zinash, 2014). Moreover, we must remember that a number of previous studies reveal that the emergence of changes in the tax law (in terms of improving the level of VAT collection) leads to a reduction in tax efficiency (Casey and Castro, 2015; Peter, 2007).

**2. Fiscal legislation in Romania related to the electronic fiscal devices**

*Electronic fiscal devices* (EFDs) are a term associated to the electronic equipment that registers economic transactions so that the fiscal administration could monitor and check how obligations to pay sales-associated taxes and VAT are registered (Casey and Castro, 2015). To this end, EFDs allow the storage of recorded data corresponding to transactions in a *fiscal memory* (usually Electronically Programmable Read Only Memory - EPROM), that can be accessed and modified only by the fiscal administrations or by persons authorized by them.

Depending on their role and the evolution of supporting information technologies, EFDs can be classified in three large groups (Figure no. 1): *Electronic Cash Registers* (ECRs), *Electronic Tax Register* (ETRs) and *Electronic Fiscal Printers* (EFPs).



**Figure no. 1: EFDs classification**

Source: Casey and Castro, 2015

ECRs have been created so as to reduce fraud associated with cash transactions (Ainsworth and Hengartner, 2009). ECRs are attached to various points of sales (POS) terminals and they make it possible to (Casey and Castro, 2015): establish the selling price for each individual product; calculate potential discounts and corresponding taxes; keep a record of stocks; date,

print and memorize transaction information; register payment methods; create daily or periodic reports.

Although they are similar to ECRs, ETRs differ from the former in that they have a fiscal memory that enables the storage of recorded tax data: the classification of sold goods, their selling price, taxation rate and the value of the calculated tax (Casey and Castro, 2015). We should point out that fiscal memory is not volatile. Stored data can be accessed only by fiscal administrations, for checking and analyzing purposes, a process that does not affect previously memorized data. The main advantage of ETRs is precisely the incorporation of memory, but their main limitation is determined by the impossibility of processing discounts or refunds or the transaction of returned goods (Casey and Castro, 2015).

The third type of EFDs comprises EFPs. This electronic equipment is used by major retailers, in combination with other electronic devices (POS). EFPs also contain a fiscal memory (for the storage of data on calculated tax) and in addition, they make it possible to print the bill. These devices are meant to register sales and establish the VAT relevant for each transaction.

In Romania, the mandatory use of EFDs was established by the Government's Emergency Ordinance no. 28/1999 (GEO no. 28, 1999) (The Government of Romania, 1999), modified by the Government's Emergency Ordinance no. 91/2014 (GEO no. 91, 2014; The Government of Romania, 2014), as well as by methodological norms established through the Government's Decision no. 479/2003 (GD no. 479, 2003). By national law, all economic operators who directly supply goods or services to the population, for which it is not compulsory to issue an invoice, must use EFDs. For these transactions, economic agents must issue receipts via EFDs and hand them over to customers.

By law, EFDs must cumulatively fulfill the following essential functions (The Government of Romania, 1999): to preserve data by progressive accumulation; to print and issue receipts, register paper rolls, fiscal reports at the end of each day, and periodic fiscal reports; to register, in the fiscal memory, synthetic fiscal data from fiscal reports drawn at the end of the day, changes in parameters that affect the interpretation of stored data, and events that affect the continuity of data recording; to automatically block the device when fiscal memory, the double printing device or the customer display are inactive; to ensure the continuity of operation and data recording, the coherence of the data structure and of issued documents, as well as to ensure recovery from error generated by wrong manipulations or from system errors.

In order to be approved by the Romanian National Agency for Fiscal Administration (NAFA) and therefore used, EFDs must cumulatively meet, the following characteristics (The Government of Romania, 1999): to have fiscal memory, usually of the E-PROM type; to contain a client display device with minimum 7 mm display characters, to be well legible in environmental light, and to ensure the display of the maximal value introduced; to include a printing device, with sensors for each paper roll, that would ensure the printing of minimum 18 characters in a line that is 2.5 mm high and to print both the fiscal receipt and the daily record paper roll; to include a display for the operator, the operating key board and a system to establish the work regime..

These devices must function autonomously, have an interface with the fiscal module, ensure the security of the data collection process, the continuity of the RAM memory and of the clock in time real, and control peripherals exclusively via the fiscal module. At the same time, they must ensure the long-term data and operation recording in the fiscal memory, data

recovery in case of operation anomalies, and prevent unauthorized access. In addition, they must have functions to test and monitor working parameters.

The main EFDs recognized by law which can be used in Romania are (The Government of Romania, 2014): (i) electronic cash registers of a closed and isolated structure (they are provided with dedicated hardware with an integrated fiscal module and an autonomous database, and they cannot be connected to a computer or a network); (ii) electronic cash registers of a closed structure, connectible to a network (they have an interface to be connected to a computer and/or a network, thus enabling the interaction with a specific external soft); (iii) computerized electronic cash registers (they are and they operate as a standard computer and they have an integrated fiscal hardware with a dedicated soft); (iv) electronic devices and terminal provided with a cash-register function (they are devices that include a tax component with a fiscal module); (v) fiscal printers (devices that include the fiscal module, have a fiscal memory but they lack their own integrated applications, being interfaced as peripherals with devices from the previous categories); (vi) electronic cash registers used as fiscal printers (they belong to the category of devices with a closed structure, with an inactive keyboard but, unlike cash registers from the first category, they can function as peripherals of an integrated calculus system, via an identifiable applicative program).

All electronic cash registers are recorded to a national registry in the NAFA and, in the near future, they will have to be remotely connected so as to transmit fiscal data (The Government of Romania, 2014). Such an integrated system, in direct and immediate connection to fiscal authorities is implemented in most of the EU states.

### **3. Research objectives and methodology**

The study proposed a series of econometric models to estimate and test the EFDs influence on VAT collection, and to increase the robustness of the results, these models were accompanied by a sensitivity analysis of fiscal efficiency.

The research hypotheses that we propose for testing and validating are as follows:

*H<sub>1</sub>: In Romania, the introduction of legal obligations on the mandatory use of EFDs had a significant impact on the degree of VAT collection.*

*H<sub>2</sub>: In Romania, the introduction of legal obligations on the mandatory use of EFDs had a significant impact on the degree of fiscal efficiency associated to VAT collection.*

In line with the objectives of the study, we propose the estimation and assessment of the influence of the use of EFDs on the degree of VAT collection. In order to reach this goal, the research will comprise two stages in the analysis: in the first stage we shall estimate the influence of the growth of the VAT rate on the degree of collection. In this sense, the residual (not-explained) part will be used to test the influence of the introduction of EFDs on the degree of VAT collection or on the growth of fiscal efficiency.

#### **3.1 Variables and data source**

In order to reach our research objectives, our study started from the variables considered by Casey and Castro (2015), in analyzing the influence of EFDs on VAT collection. The proposed variables are presented in Table no. 1.

Table no. 1: Variables used in the analysis

Symbol	Explanation and calculus
VAT/GDP (%)	VAT/GDP ratio (%) per month: the percentage of collected VAT per GDP for each month
VAT_rate (%)	VAT rate (%) established by Fiscal Law
ITR (%)	Implicit taxation rate of VAT = VAT collected/ Tax base of VAT
FEI	Fiscal Efficiency Index = ITR/VAT rate
EFD	A dummy variable: <ul style="list-style-type: none"> <li>• 0: for the non-mandatory use of EFDs before September 1st, 2007;</li> <li>• 1: for the mandatory use of EFDs from September 1st, 2007, until present moment, corresponding to the period of mandatory use of electronic Cash Register in Romania</li> </ul>

The study was conducted on Romanian economic operators based on aggregated data reported by the Romanian Ministry of Public Finance via informative bulletins (<http://www.mfinante.gov.ro/execbug.html?pagina=buletin>), and by the Fiscal Council (<http://www.consiliulfiscal.ro>), via annual reports (<http://www.consiliulfiscal.ro>), section: *Opinii și rapoarte/ Raport anual* (interval 2010 - 2015).

### 3.2 Models and methods for data analysis

In order to test the influence of EFDs on the degree of VAT collection, the study used a two stage linear regression analysis. In the first stage we estimate only the influence of *VAT\_rate* on *VAT/GDP*, without considering the influence of other factors. In the second stage, the non-explained part of *VAT/GDP*, i.e. the error component ( $\varepsilon$ ), is considered a dependent variable in order to test the influence of the use of *EFDs* on the degree of VAT collection or of fiscal efficiency (*FEI*).

For the considered variables, in the first stage, starting from the influence of fiscal rules on the tax base (Pecorino, 1995) highlighted via the Laffer theory, we estimated the influence of the *VAT rate* on VAT collection. According to Laffer, tax revenues are correlated with the tax rate in a form of reversed U curve. In other words, from a certain tax rate, the tax revenues are negatively correlated with the tax rate. According to Matthews (2003) this hypothesis is also validated in the VAT case. In a study conducted for 14 UE countries, Matthews found that an increase in VAT rates leads to a decrease of the consumption and to an increase in the black market. The model resulting from the principal analysis is the following:

$$\text{VAT/GDP} = \beta_0 + \beta_1 \cdot \text{VAT\_rate} + \varepsilon \quad (1)$$

In the second stage, starting from the model proposed by Chege et al. (2015) in the evaluation of *EFDs*' influence on VAT collection, the *VAT/GDP* part which cannot be explained by the influence of *VAT\_rate* (which we shall call *error term* –  $\varepsilon$  or *Residual*) will be used to estimate the influence of EFDs on VAT collection. Also, in the second stage we included the effect of time (Jaba et al., 2014) on the degree of VAT collection, and the proposed model will be the following:

$$\text{Residual (VAT/GDP)} = \delta_0 + \delta_1 \cdot \text{EFD} + \text{Year fixed effects} + \varepsilon \quad (2)$$

To increase the robustness of estimated results, the study also proposes a sensitivity analysis, which follows the same approach as the principal analysis. In the first stage we tested the influence of *VAT\_rate* on *FEI*, to estimate the residual part ( $\varepsilon$ ):

$$FEI = \beta_0 + \beta_1 \cdot VAT\_rate + \beta_2 \cdot ITR + \varepsilon \tag{3}$$

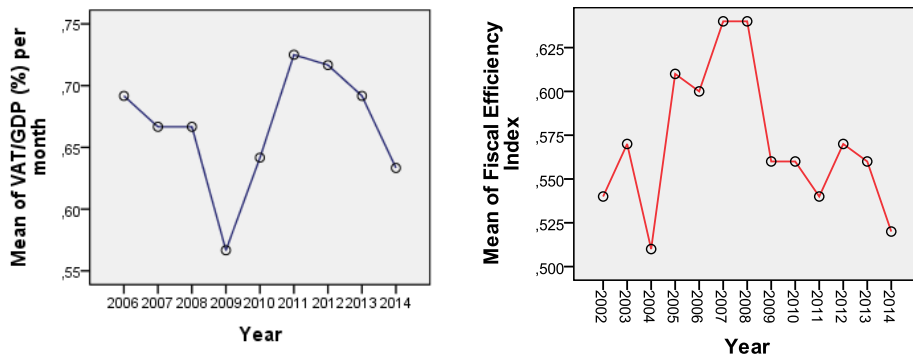
In the second stage, the residual part from the FEI was introduced in the analysis of EFDs' influence on the degree of fiscal efficiency of VAT collection, including also the time fixed effects:

$$Residual (FEI) = \delta_0 + \delta_1 \cdot EFD + Year \text{ fixed effects} + \varepsilon \tag{4}$$

In order to obtain our results, the study used SPSS 20.0 for data analysis.

**4. Results and discussions**

Following the data analysis for the period 2006-2014, the charts in Figure no. 2 present the evolution of the degree of VAT collection as a percentage from the GDP. Also, the charts in Figure no. 2 present the evolution of the fiscal efficiency index (FEI). Based on the obtained results we can notice an accelerated decrease of the degree of VAT collection and of the fiscal efficiency index in 2009 in comparison with 2008.



**Figure no. 2: Evolution of VAT/GDP (%) and FEI in Romania under the use of EFDs**

Given the mandatory use of EFDs beginning with 1999 (according to GEO no. 28/1999), the evolution in time can be explained in the following terms: Although the mandatory use of EFDs started in 1999, actual use occurred only in 2003, by issuing methodological norms to enforce the emergency ordinance. At the same time, in its early formulation, article 6 in GEO no. 28/1999 specified the categories of economic operators that must use cash registers (the chosen criterion was the size of total registered revenues). Yet, with the Government Ordinance GO no. 47/2007 (The Government of Romania, 2007) issued to modify GEO no. 28/1999 (The Government of Romania, 1999), economic agents have to use EFDs since the date when they start commercial activities performed in each location, a much more restrictive stipulation than in its initial form. It is precisely this stipulation, much more restrictive, as well as the increase of VAT rate in 2009, which led to a lower degree of VAT collection and the decrease of the fiscal efficiency index.



Therefore, it is precisely the moment of the much more restrictive mandatory introduction of the use of EFDs (the 1<sup>st</sup> of September 2007) by economic operators that our analysis will consider in order to test the influence of EFDs on the degree of VAT collection.

Table no. 2 presents the evolution of the average values of the analyzed variables for the period 2006-2014.

**Table no. 2: Means for the analyzed variables**

Variable	Year									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
VAT/GDP (%)	0.69	0.67	0.67	0.57	0.64	0.73	0.72	0.69	0.63	0.67
VAT rate (%)*	19.00	19.00	19.00	19.00	24.00	24.00	24.00	24.00	24.00	21.50
ITR (%)	11.50	12.30	12.10	10.70	12.00	13.10	13.70	13.50	12.38	12.36
FEI	0.60	0.64	0.64	0.56	0.56	0.54	0.57	0.56	0.52	0.58

\*Note: in the study we considered the standard VAT rate

The data presented in Table no. 2 show that an increase in the VAT rate causes the decrease of VAT collection degree (VAT/GDP) and of fiscal efficiency (FEI) in a long-term perspective. Yet the moment of VAT/GDP and FEI decrease coincides with the moment when mandatory use of EFDs became much more restrictive (the 1<sup>st</sup> of September 2007).

In order to test the influence of the introduction of EFDs on the degree of VAT collection (VAT/GDP), as well as of fiscal efficiency (FEI), Table no. 3 features the results obtained after using the ANOVA procedure.

**Table no. 3: Means for the VAT/GDP (%) and FEI under the influence of EFDs**

The use o EFDs	N	VAT/GDP (%)*	FEI**
a. Non-mandatory use of EFDs before September 1st, 2007	20	0.66	0.62
b. Mandatory use of EFDs from September 1st, 2007	88	0.67	0.57
c. Mandatory use of EFDs from September 1st, 2007 until December 31 <sup>st</sup> , 2009 (change of VAT rate)	28	0.64	0.61
Total (2006-2014)	108	0.67	0.58
Total (2006-2009)	48	0.65	0.61

Note: \*no significant difference between a. and b. under ANOVA ( $F$  value = 0.057; Sig. = 0.812)

\*no significant difference between a. and c. under ANOVA ( $F$  value = 0.026; Sig. = 0.872)

\*\*significant difference between a. and b. under ANOVA ( $F$  value = 30.958; Sig. = 0.000)

\*\*no significant difference between a. and c. under ANOVA ( $F$  value = 1.101; Sig. = 0.300)

Based on the results presented in Table no. 3 one can notice that during the analyzed period (2006-2014), the introduction of EFDs did not have a significant influence on the degree of VAT collection. Although there are differences between the collected VAT values (VAT/GDP) registered before the introduction of EFDs (0.66) and after (0.67), they are not significant. Yet significant differences can be identified only at the level of fiscal efficiency: the introduction of EFDs is accompanied by a decrease of FEI (0.62 before September 1st, 2007 and 0.57 after September 1st, 2007).

In order to eliminate the effect of VAT's variation on VAT/GDP and FEI, as well as to be able to better estimate the influence of EFDs on the degree of VAT collection, we resumed the ANOVA procedure for the period 2006-2009, for a VAT rate of 24%. The results obtained indicate a lack of improvement in the extent of VAT collection, as well as in fiscal efficiency under the circumstances of the introduction of EFDs.

The existence of significant connections between the variables included in model (1) and (3) in the study may be analyzed with the help of data from Table no. 4.

**Table no. 4: Pearson estimations for the correlations between the analyzed variables**

Pearson Correlation	VAT/GDP (%)	VAT rate (%)	ITR (%)	FEI
VAT/GDP (%)	1.000	0.147	-	-
VAT rate (%)	0.147	1.000	0.748*	-0.704*
ITR (%)	-	0.748*	1.000	-0.196*
FEI	-	-0.704*	-0.196*	1.000

Note: \*Correlation is significant at the 0.01 level (2-tailed).

The data presented above show that at the level of Romania, from 2006 to 2014, there is no significant connection between *VAT\_rate* and VAT collection rate (VAT/GDP). At the same time, one can notice the existence of a negative influence of *VAT\_rate* and of *ITR* on *FEI*: an increase in the tax rates leads to the decrease of fiscal efficiency. Any increase in the tax burden leads to secondary effects. An immediate effect is the decrease of the consumption, especially in the case of VAT, as a consumption tax. On the other hand, some of the economic activities go to the black market, due to the changes in the revenue/risk report.

Thus, in order to test the influence of EFDs on VAT collection and fiscal efficiency (*FEI*), Table no. 5 presents the estimations of the proposed regression models (main analysis and sensitivity analysis), for the two phases.

**Table no. 5: Parameter estimates for the proposed models**

Parameter	Principal analysis (2006-2014)		Sensitivity analysis (2006-2014)		Principal analysis (2006-2009)		Sensitivity analysis (2006-2009)	
	Model (1)	Model (2)	Model (3)	Model (4)	Model (1)	Model (2)	Model (3)	Model (4)
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Intercept	0.364	-0.269	0.601	-0.007	0.000	0.000	-0.006	0.000
VAT_rate	0.014	-	0.020*	-	0.000	0.000	0.000	0.000
ITR	-	-	0.033*	-	0.000	0.000	0.053*	0.000
EFD	-	0.200	-	0.057*	0.000	0.000	0.000	0.000
Year fixed effects	No	Yes	No	Yes	-	Yes	No	Yes
Observations (N)	108	108	108	108	48	48	48	48
R <sup>2</sup>	0.022	0.050	0.744	0.303	0.000	0.000	0.986	0.000

Note: Model 1:  $VAT/GDP = \beta_0 + \beta_1 \cdot VAT\_rate + \varepsilon$

*Model 2: Residual (VAT/GDP) =  $\delta_0 + \delta_1 \cdot EFD + \text{Year fixed effects} + \varepsilon$*

*Model 3: FEI =  $\beta_0 + \beta_1 \cdot \text{VAT\_rate} + \beta_2 \cdot \text{ITR} + \varepsilon$*

*Model 4: Residual (FEI) =  $\delta_0 + \delta_1 \cdot EFD + \text{Year fixed effects} + \varepsilon$*

*\*Parameters estimates are significant at the 0.01 level (2-tailed).*

The data presented in Table no. 5 show that on average, during the period 2006-2014, an increase in the VAT rate led to the increase of VAT/GDP (model 1). Yet, the results of the sensitivity analysis (model 3) show that an increase of the VAT rate determines, on average, a decrease of the index of fiscal efficiency, according to the negative influence of fiscal policies on the taxation base (Pecorino, 1995).

Once we calculated the residual values of VAT collection and those of *FEI* (which do not include the influence of VAT rate), in the second stage we performed the analysis of *EFDs'* influence on *VAT\_rate* and *FEI*. Based on the obtained results, in Table no. 5, we can notice that the mandatory use of *EFDs* by all economic operators, since the date when they start commercial activities in each point of sale, determined an increase of the degree of VAT collection (Model 2).

At the same time, given that at present the vast majority of *EFDs* are from the old generations, which lack electronic daily registers (according to the grounding note for GEO No 91/2014), the sensitivity analysis shows that the use of *EFDs* beginning with the 1<sup>st</sup> of September 2007 (especially those from the *ECRs* and *ETRs* category, without electronic records) leads to a significant decrease in *FEI*. This can possibly be explained by the economic operators' adaptation to the use of fraudulent *EFDs* manipulation techniques, to avoid registering transactions subject to taxation and VAT collection.

In order to eliminate the effects of VAT rate change on cash-ins and to better identify the effect of the introduction of *EFD*, we attempted to perform the analysis again for the period in which the VAT rate remained constant. By re-running the analyses to estimate the coefficients of the four projected models, for the period 2006-2009 (when the *VAT\_rate* registered constant values of 19%), one can notice that the introduction of *EFDs* in Romania did not have a significant influence at the level of VAT tax collection (VAT/GDP), nor at the level of fiscal efficiency (*FEI*), in the sense of improving it. The introduction of *EFD* did not lead to the expected effects; there was a gap due to enforcement (Shuvaieva et al., 2015).

## Conclusions

The results obtained by analyzing the collected data have enabled us to meet our research objectives and to validate the working hypothesis from which we started this study. Thus, we estimated *EFDs'* influences on the degree of VAT collection, as well as the index of fiscal efficiency.

The results of the analysis show that with the introduction of the mandatory use of *EFDs*, the degree of VAT collection did not increase significantly, but at the same time the fiscal efficiency index diminished as a result of the use of old generation *EFDs*, that do not allow the inclusion of electronic registers. At the same time, if we analyze the results from the perspective of the Chicago School theory, the response of state budget revenues following the increase of the tax rate, in our case the VAT, although it is very low, it follows the trend described by Laffer curve (Laffer, 2004), namely the elasticity of budgetary revenue is sub-unitary depending on the fiscal burden. This is obvious from the analysis of the efficiency of

fiscal revenues, which shows that although fiscal-budgetary revenues were higher as a result of raising VAT to 24%, they were not collected as efficiently as before.

A simple explanation is offered by Laffer as well: high taxation prompts economic agents to identify more or less legal solutions to avoid registering all taxable operations. In the case registered by us, this approach was also facilitated by the fact that the VAT rate increase was not paralleled by the enforcement of the mandatory registration by economic agents of all operations via cash registers, equipped with an electronic register, possibly connected to a single register of the NAFA. We remark that this drawback was removed by the measures imposed by GEO 91/2014.

Another limitation of the current study is determined by Romania's entry into the European Union - in 2007. Thus, future analyses must consider the fact that the decrease of VAT revenues can be partially accounted for by the volume of intra-community exports/deliveries. These transactions are exempt from VAT collection and their increase above the average of economic growth can lead to the decrease of VAT's weight in the GDP.

As a future line of research, we shall try to follow the impact of the enforcement of this ordinance on the efficiency of fiscal revenues.

### **Acknowledgements**

The authors would like to thank the anonymous reviewers for their valuable comments and suggestions to improve the quality of the paper.

### **References**

- Ainsworth, R.T. and Hengartner, U., 2009. Quebec's Sales Recording Module (SRM): Fighting the Zapper, Phantomware, and Tax Fraud with Technology. *Canadian Tax Journal/Revue Fiscale Canadienne*, 57(4), pp.715-761.
- Aizenman, J. and Yothin Jinjarak, Y., 2008. The collection efficiency of the Value Added Tax: Theory and international evidence. *The Journal of International Trade & Economic Development*, 17(3), pp.391-410.
- Barrell, R. and Weale, M., 2009. The Economics of a Reduction in VAT. *Fiscal Studies*, 30(1), pp.17-30.
- Casey, P. and Castro, P., 2015. *Electronic Fiscal Devices (EFDs). An Empirical Study of their Impact on Taxpayer Compliance and Administrative Efficiency*, *International Monetary Fund Working Paper (WP/15/73)* [online] Available at: <<http://www.imf.org/external/pubs/ft/wp/2015/wp1573.pdf>> [Accessed 20 October 2016].
- Chege, A., Kiragu, N., Lagat, C. and Muthoni G., 2015. Effect of electronic fiscal devices on VAT collection in Tanzania: A case of Tanzania revenue authority. *European Journal of Business and Management*, 7(33), pp.125-133.
- Consiliul Fiscal, 2015. *Raport anual 2014*. [online] Available at: <<http://www.consiliulfiscal.ro/RA2014.pdf>> [Accessed 5 January 2016].
- Ebeke, C., 2015. *Remittances, Value Added Tax and Tax Revenue in Developing Countries*. [online] Available at: <<http://publi.cerdi.org/ed/2010/2010.30.pdf>> [Accessed 25 November 2016].

- Ebeke, C., Ehrhart, H., 2011. Tax revenue instability in Sub-Saharan Africa: consequences and remedies. *Journal of African Economies*, 21(1), pp.1–27.
- Gebauer, A., Woon Nam, C. and Parsche, R., 2007. Can reform models of Value Added Taxation stop the VAT evasion and revenue shortfalls in the EU?. *Journal of Economic Policy Reform*, 10(1), pp.1-13.
- Hamdu, K.M. and Zinash, D.G., 2014. Challenges of electronics tax register machine (ETRS) to businesses and its impact in improving tax revenue. *International Journal of Scientific Knowledge*, 5(3), pp. 17-22.
- Jaba, E., Balan, C.B. and Robu, I.B., 2014. The relationship between life expectancy at birth and health expenditures estimated by a cross-country and time-series analysis. *Procedia Economics and Finance*, 15, pp. 108-114.
- Laffer, A.B., 2004. The Laffer curve: Past, present, and future. *Backgrounder Heritage Foundation*, no. 1765, June, pp.1-16.
- Lubua, E.W., 2014. Influencing tax compliance in SMEs through the use of ICTs. *International Journal of Learning, Teaching and Educational Research*, 2(1), pp.80-90.
- Martin, L.O., Obongo, B. M., Magutu, P. O. and Onsongo, C. O., 2010. The effectiveness of electronic tax registers in processing of value added tax returns. *African Journal of Business and Management*, Vol. 1, pp. 44-55.
- Matthews, K. and Lloyd-Williams, J., 2001. The VAT-evading firm and VAT evasion: an empirical analysis. *International Journal of the Economics of Business*, 8(1), pp.39-49.
- Matthews, K., 2003. VAT evasion and VAT avoidance: Is there a European Laffer curve for VAT?. *International Review of Applied Economics*, 17(1), pp. 105-114.
- Moore, M., 2014. Revenue reform and statebuilding in Anglophone Africa. *World Development*, Vol. 60, August, pp. 99-112.
- Morrissey, O., Von Haldenwang, C., Von Schiller, A., Ivanyna, M., Bordon, I., 2016. Tax Revenue Performance and Vulnerability in Developing Countries. *The Journal of Development Studies*, 52(12), pp. 1689-170.
- Naïbei, K.I. and Siringi, E.M., 2011. Impact of electronic tax register on VAT compliance: A study of private business firms. *African Research Review*, 5(1), pp. 73-88.
- Pecorino, P., 1995. Tax rates and tax revenues in a model of growth through human capital accumulation. *Journal of Monetary Economics*, 36(3), pp. 527-539.
- Peter, F., 1995. The fiscal consequences of competition for capital, In: Ann Markusen, ed. 1995. *Reining in the Competition for Capital*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, pp.57-86.
- Raczkowski, K., 2015. Measuring the tax gap in the European economy. *Journal of Economics and Management*, 21(3), pp. 58-72.
- Shuvaieva, I., Barbone, L., Bonch-Osmolovskiy, M. and Poniatowski, G., 2015. Study to quantify and analyse the VAT gap in the EU member states – 2015 Report. *CPB Netherlands Bureau for Economic Policy Analysis*. [online] Available at: <[http://ec.europa.eu/taxation\\_customs/resources/documents/common/publications/studies/vat\\_gap2013.pdf](http://ec.europa.eu/taxation_customs/resources/documents/common/publications/studies/vat_gap2013.pdf)> [Accessed 25 November 2016].
- The Government of Romania, 1999. *Ordonanța de Urgență no. 28 din 25 martie 1999, privind obligația agenților economici de a utiliza aparate de marcat electronice fiscale*, Monitorul Oficial, Partea I, no. 381.

The Government of Romania, 2003. *Hotărârea Guvernului no. 479 din 18 aprilie 2003 de aprobare a Normelor metodologice pentru aplicarea Ordonanței de Urgență a Guvernului no. 28/1999 privind obligația agenților economici de a utiliza aparate de marcat electronice fiscale*, Monitorul Oficial, Partea I, no. 348/2005.

The Government of Romani, 2007. *Ordonanța Guvernului no. 47 din 28 august 2007 privind reglementarea unor măsuri financiar-fiscale*, Monitorul Oficial, Partea I, no. 603.

The Government of Romani, 2014. *Ordonanța de Urgență no. 91 din 23 decembrie 2014, pentru modificarea si completarea OUG 28/1999 privind obligatia operatorilor economici de a utiliza aparate de marcat electronice fiscale*, Monitorul Oficial, Partea I, no. 966.