

ANALYSIS OF THE RELATIONSHIP BETWEEN TAX REVENUE AND GROSS VALUE ADDED IN THE ROMANIAN ECONOMY

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Abstract

Any government is interested in knowing, to a certain extent degree, the level of tax revenue at a given time in order to design public expenditures. On the other hand, this level of budget revenue is desirable to be sustainable, i.e. to be supported by the existing economic conditions at a given moment. One way to estimate the expected revenues is the relationship of the tax bases with the main macroeconomic indicators. It is assumed that the main source of tax is gross value added in the economy. This article examines the nature of gross value added links with the tax revenue, on the one hand, and with the tax bases of each category of tax, on the other hand, in order to identify the best predictors of tax revenue for Romania. The analysis was carried out using multiple time series regressions in the cases of Romania and the standard (benchmark) states (Germany, France, the United Kingdom and Italy), respectively regressions on cross-sectional data in the case of Member States of the European Union.

Keywords: tax revenue, macroeconomic analysis, public finance, econometric modeling, estimation

JEL Classification: H20, C51

1. Introduction

Securing budget revenues in a sustainable manner is the main concern of any responsible government. In the literature, the sustainability dimension is studied in complex macroeconomic models and is analyzed in relation with the most important factors defining an economy. From an operational perspective, economists are interested in the type of relationships that exist between tax revenues and macroeconomic or social indicators, in order to identify the best ways

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of evaluating and forecasting the level of public funds, within the timeframe for which they are based, and accordingly design fit for purpose public policies. Moreover, establishing the nature of a type of relationship between these macroeconomic aggregates may allow future development of top-down methodologies to assess the risk of not achieving a certain level of income. This study aims to evaluate the relationship between tax or budget revenue and gross value added in the economy (GVA). Why GVA? For a neutral observer, this relationship might appear to be a common one, and for a macroeconomist this kind of connection is easy to understand. Perhaps the lack of "evidence" is the reason why this relationship has not been studied at all in literature. The present study shows that things must be judged with caution, despite some existing empirical evidence.

In every economic doctrine on taxation, ranging from the two extremes, neoliberalism and statism, any state, however liberal or centralized it is, is interested in consolidating its revenue. And beyond fiscal policy changes, as a lever of intervention, it is interesting to what extent a state can secure a steady level of income. While the issue has been extensively dealt with in several papers, literature remains poor, primarily because of the very high interest in assessing the public spending mechanism and the presumption of (partial) neutrality of the level of taxation.

GVA is defined in national accounts as the production account's balance, measured as the difference between the value of goods and services (valued at basic prices) and intermediate consumption (measured at purchaser's prices) and is calculated before determining the consumption of fixed capital. Therefore, after deducting the depreciation, the net value is obtained. Therefore, GVA represents the newly created value in the production process of an economy. The very definition of this indicator reveals that there should be a causal link between GVA and tax or budget revenue and, moreover, an economically meaningful one. Firstly, the newly created value implies the accumulation of income at the level of the economic agents, which is the basis of taxation for the profit tax. Secondly, generating new value in an economy involves the payment of wage costs or other forms of remuneration for labor or capital, which in turn constitute the tax base for income tax and mandatory social contributions. Thirdly, as added value is created, money can be released in the economy in the form of wages or other income that go, even in part, into consumption, which in turn supports the creation of new value. Therefore, there should be

mutual influences between consumption and GVA, the first being a tax base for value added tax (VAT) and excise duties. If we also take into account the way microeconomic value added is calculated, we can deduce that there should be a close link between the two variables (tax revenues and GVA). It is worth mentioning that the macroeconomic analysis mainly studies the relationship between GVA and investments, the latter being considered as a generator of new value. From a strictly fiscal point of view, this type of relationship can be omitted. In a comprehensive analysis, however, the influence of interplay between investment (capital formation) and value added and the level of taxation on the achievement of a certain level of budgetary or fiscal revenues should provide an interested topic for study.

At microeconomic level, determining and studying added value is an important step as this indicator reflects the ability of an economic entity to generate new value and to resume its work at higher levels of performance. Two methods of calculating the added value are known and used in corporate finance: the subtractive method and the additive method. By subtracting, the added value (VA) is determined by the formula:

$$VA = \text{trade margin} + \text{production value of the exercise} - \text{value of consumption}$$

This relationship shows that there should be a significant relationship at least between GVA and tax revenue from corporate taxation.

The additive method consists in applying the following formula:

$$VA = \text{staff costs (including social contributions)} + \text{taxes (excluding VAT)} + \text{dividends} + \text{reinvested earnings} + \text{depreciation}$$

This formula results, also, in a relationship between VAB and income from taxes and contributions, less VAT.

Taking into account both the macroeconomic and the microeconomic perspectives presented above, it may be assumed that there are causal and/or direct relationships between the two variables, GVA and tax revenues (as increases or decreases in the level of one generates increases or decreases in the level of the other).

2. Literature review

Perhaps the most extensive research on the determinants of tax revenue is the study of A.S. Gupta, *Determinants of Tax Revenue Efforts in Developing Countries* (Gupta, 2007), and is based on

regression models applied to panel data. The analysis is focused on identifying the main factors that can influence the tax collection capacity of a country. One of the most important findings of Gupta's study is that there are no "universal" recipes to assess a state's tax performance. The analyzed factors are: GDP per capita in current prices, share of agriculture in GDP, weight of imports in GDP, weight of state aid in gross national income, share of public debt in gross national income, tax revenues from goods and services (as a share in total revenues), tax revenues from taxes on income, profit and capital gains (as a share of total income), tax revenue from commercial activities, as well as tax revenue from exports (as a weight in total revenues), the highest marginal tax rate for individuals, the highest marginal corporate tax rate, the average tariff applied to trade between countries and institutional factors such as political stability, economic stability, corruption, law enforcement and governmental stability.

Concerns for identifying tax revenue determinants and understanding tax patterns and fiscal potential, especially in emerging economies, are not new (see Chelliah, 1971). At the beginning of the 1970s, the research effort was focused on explaining the differences in tax regimes (especially the differences in quotas and the differences in the weights that fiscal revenues hold in GDP in different countries). One of the strongest explanatory factors is the share of agriculture in GDP, and it is expected that as the share of value added in the agricultural sector increases, tax revenue will decrease due to the narrower tax base existing in this sector (Tanzi, 1992).

Vito Tanzi and Parthasarathi Shome (1992) find that the structure of the tax system is not relevant in an unstable macroeconomic environment; therefore, a certain tax regime will not be able to explain the variation in tax revenue under conditions of macroeconomic instability. From the point of view of these authors, but also of others (Gupta, 2007), the key factor in achieving a comfortable level of tax revenue is the level of corruption. Other authors, also using econometric modeling, find a direct relationship between gross value added in mining and tax revenue and an indirect relationship between gross added value in agriculture and these incomes, as well (Bahl, 1971). The direct relationship between the mining industry and tax revenue must be attributed to the very high share that this sector held in the seventh decade of the last century.

More recently, attention was directed to assessing performance in terms of tax collection by inspecting the elasticity of tax bases (Sobel

and Holcombe, 1996; Bruce et al., 2006; Fricke and Suessmuth, 2014; Koester and Priesmeier, 2017). Davoodi and Grigorian (2007) highlight the impact of institutional factors on tax revenues, the only macroeconomic factor being GDP per capita. Institutional factors are also analyzed in most of the papers on the relationship between tax revenue and GDP (Gupta, 2007; Tanzi, 1992; Le et al., 2008; Javid and Arif, 2012). Other authors study the reverse relationship between tax revenue and economic growth (Ofoegbu et al., 2016), respectively, between fiscal policy and economic output (Baum and Koester, 2011).

The study of Gobachew et al. (2018), one of the most recent in the field, considers macroeconomic factors only, in the case of Ethiopia. Based on the econometric modeling they found that structural factors, macroeconomic conditions (such as inflation rates) and external trade are levers that can improve tax revenue. It is also found that the inflation rate and the share of agriculture in GDP negatively affects tax revenue, while openness to foreign trade, the share of manufacturing and per capita income positively influence the level of tax revenue. Another recent study exclusively addresses the influence of structural and conjunctural factors (Yi and Suyono, 2014), assessing the effect of the fiscal multiplier on both tax revenue and GDP, under the general hypothesis on the incompatibility between maximizing of tax revenue and consecutively maximizing the GDP.

Finally, Aizenman and Jinjark (2009) analyze government expenditures as a potential determinant of tax bases.

These studies primarily focus on the relationship between GDP and tax revenue, even when contextual factors such as institutional ones are present. Thus, the link between gross value added in the economy and tax revenue is analyzed either indirectly (through economic output) or directly (by economic sectors), but we do not have an explicit picture of this type of relationship. This study aims to inspect the evolution of fiscal and GVA variables at different time points and across the EU as a whole, but in some selected countries.

3. Data and methodology

3.1. Description of the data

The following macro-variables have been taken into account, the values of which have been extracted from national accounts: gross value added (GVA), tax revenue, indirect tax revenues, direct income, gross operating surplus, compensation of employees, mixed income

and final consumption. In the case of Romania, these variables are tracked in time series, consisting in annual values of the indicators, for the period 1995-2017. As a "blank sample", values of those variables were used for each Member State of the European Union in 2017 (cross-sectional data). In addition, for the comparative analysis, four EU-level benchmarks have been considered, at which the highest level of GVA is recorded.

The data source was the European Commission's AMECO database. The extracted values were reconciled with the values in the national accounts published by Eurostat and the information regarding the tax revenue collected in Romania was confronted with the existing data at the level of the Romanian National Agency for Fiscal Administration and adjusted, where necessary.

Together with the primary variables, GVA and aggregate tax revenue, variables reflecting or approximating the tax bases of the main taxes were also considered, in order to assess their relationships with the GVA. At the same time, the link between GVA and the main categories of taxes (direct and indirect) was also assessed.

The macroeconomic aggregates considered as proxy tax bases are:

- Gross operating surplus (GOS) approximates the tax base for corporate tax;
- Compensation of employees approximates the tax base for wage tax and compulsory social contributions;
- Mixed Income approximates the tax base for income tax obtained by individuals in self-employment arrangements;
- Final consumption approximates the tax base for VAT and excises (generally for indirect/consumption taxes).

Total revenue from taxes is by far the main category of public revenue.

3.2. Method

Definitions and conceptualizations of Gross Value Added allow us to formulate hypotheses about the influence it may have on tax revenue. If we also take into account the neo-Keynesian theory regarding the relationship between output and tax, we can admit that the level of taxation does not significantly influence the achievement of a certain level of tax revenue. If the tax burden is increased, we expect an "eviction" effect and the compression of economic activity, due to higher potential tax bills. In the case of a reduction in the tax burden,

economic activity is expanding, leading to higher tax base, as economic expansion is achieved. Consequently, we can neglect the possible effect of fiscal policy changes in the analysis, considering only the link between GVA and these revenues.

In the light of the above, the following working hypotheses are formulated:

- There is a direct (positive) link between GVA and tax revenue;
- The level of taxation is neutral with respect to this relationship;
- GVA significantly determines the achievement of a certain level of tax revenue, *ceteris paribus*;
- Considering the above assumptions, we expect revenue to be higher as GVA increases.

If the hypotheses are confirmed, it is possible to identify, using the GVA criterion, what economic sectors or categories of taxpayers can provide or generate higher tax revenue or, in correlation with the level of tax compliance, may pose a lower or higher risk in terms of budget revenue.

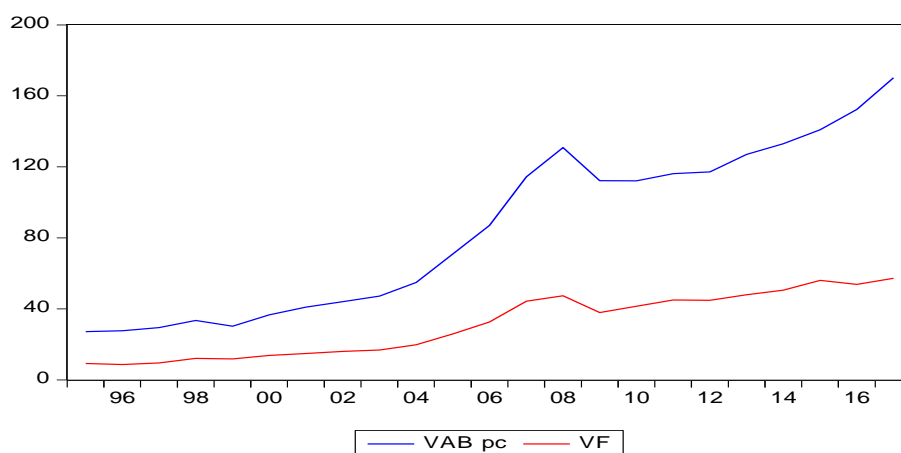
For studying the nature and significance of some relationships, the most appropriate method is classical regression modeling and Granger causality analysis.

4. Results and discussions

4.1. The link between GVA and tax revenue

The central hypothesis of this study is that there is a relationship of determination between GVA and tax revenue, a hypothesis based on economic theory. At the level of Romania, the two variables co-vary, but the difference between the values of the two tends to increase over time (Figure 1). For the past years (2015-2017), a quasi-exponential increase in GVA may be observed, contrasting with the steep slowdown in tax revenue growth.

Figure 1
Evolution of GVA and tax revenue over 1995-2017 (annual data)

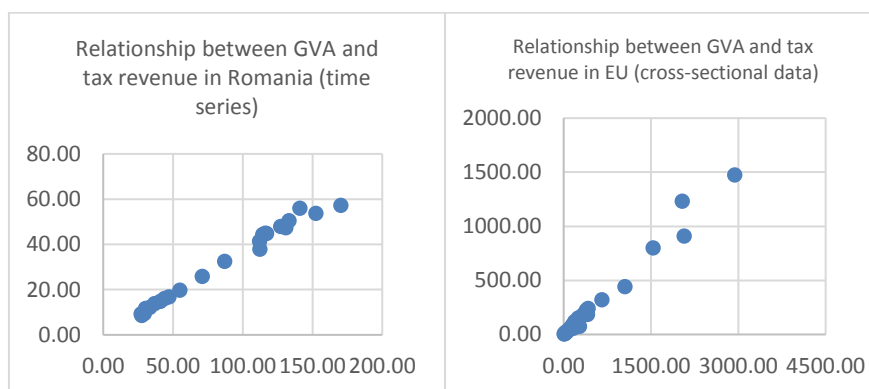


Note: VAB pc = GVA in current prices; VF = tax revenue

Source: AMECO database and own computations

These most recent developments indicate a possible rupture of economic logic or, more precisely, a possible refutation of the hypothesis.

Figure 2
Correlation between GVA and tax revenue (Romania, 1995-2017 and EU, year 2017)



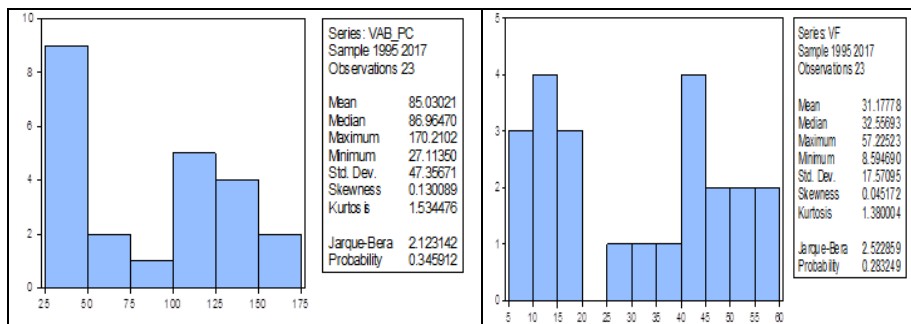
Source: AMECO database and own computations

Variables GVA and tax revenue are strongly correlated, and a positive and linear relationship exists between the two (Figure 2).

Correlation coefficients are 99.35% for Romania (time series) and 99.03% for the European Union (cross-sectional data).

Residues of the two variables appear to be normally distributed, the probability associated with the Jarque-Bera test being 28% and 34% respectively (Figure 3).

Figure 3
Descriptive statistics for the GVA and tax revenue for Romania



Both distributions present positive asymmetries and are platikurtic. The distribution of the tax revenue variable tends to be perfectly symmetrical. At the same time, both series are non-stationary. The two series are serially auto correlated (Figure 4), with very high correlation coefficients up to lag 4.

Figure 4
Auto correlation function for the variables GVA and tax revenue

VAB_pc – GVA in current prices							VF – tax revenue						
Date: 08/05/18 Time: 12:35 Sample: 1995 2017 Included observations: 23							Date: 08/05/18 Time: 12:36 Sample: 1995 2017 Included observations: 23						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob		
1	0.865	0.865	0.865	19.552	0.00	1	0.883	0.883	0.883	20.371	0.00		
2	0.732	-0.06...	0.732	34.237	0.00	2	0.758	-0.09...	0.758	36.090	0.00		
3	0.608	-0.04...	0.608	44.850	0.00	3	0.622	-0.12...	0.622	47.197	0.00		
4	0.488	-0.05...	0.488	52.059	0.00	4	0.502	-0.00...	0.502	54.831	0.00		
5	0.370	-0.07...	0.370	56.432	0.00	5	0.383	-0.08...	0.383	59.524	0.00		
6	0.269	-0.01...	0.269	58.884	0.00	6	0.276	-0.04...	0.276	62.094	0.00		
7	0.163	-0.10...	0.163	59.844	0.00	7	0.163	-0.10...	0.163	63.047	0.00		
8	0.058	-0.08...	0.058	59.974	0.00	8	0.046	-0.12...	0.046	63.128	0.00		
9	-0.05...	-0.11...	-0.05...	60.082	0.00	9	-0.06...	-0.08...	-0.06...	63.313	0.00		
1...	-0.20...	-0.28...	-0.20...	61.892	0.00	1...	-0.21...	-0.29...	-0.21...	65.384	0.00		
1...	-0.32...	-0.07...	-0.32...	67.037	0.00	1...	-0.34...	-0.09...	-0.34...	71.207	0.00		
1...	-0.39...	0.050	-0.39...	75.345	0.00	1...	-0.41...	0.160	-0.41...	80.221	0.00		

Both the VAB (GVA in current prices) series and the VF series (tax revenue) have a steady trend. Therefore, the Augmented Dickey-

Fuller ADF test is applied using constant parameter and linear trend equation (see Table 1, in the Appendix).

The GVA values series has a probability of 24.4% to be non-stationary and to have a unitary root. Also, the tax revenue series has a probability of 39.1% to be non-stationary. The series were staged by level one differentials. The first evaluations were carried out in level and linear series (log) as well. The results generated by these regression models are shown in Table 2 and 3 (in the Appendix).

It can be noticed that regardless of the form of the variable (linearized or logarithmic), valid models (statistical probability F is 0) confirm the causal link, where the coefficient of regression is statistically significant, and the coefficient of determination is extremely high. Obviously, since the series is not stationary, the DW test value indicates an autocorrelation error. However, assessing the relationship between the two variables in the linear form is important. All model validation elements, except for DW, are statistically significant. For estimation and forecasting, staging of variables is required. In Table 4 (in the Appendix) there are the results generated by the regression model between the first order differentials of the two variables.

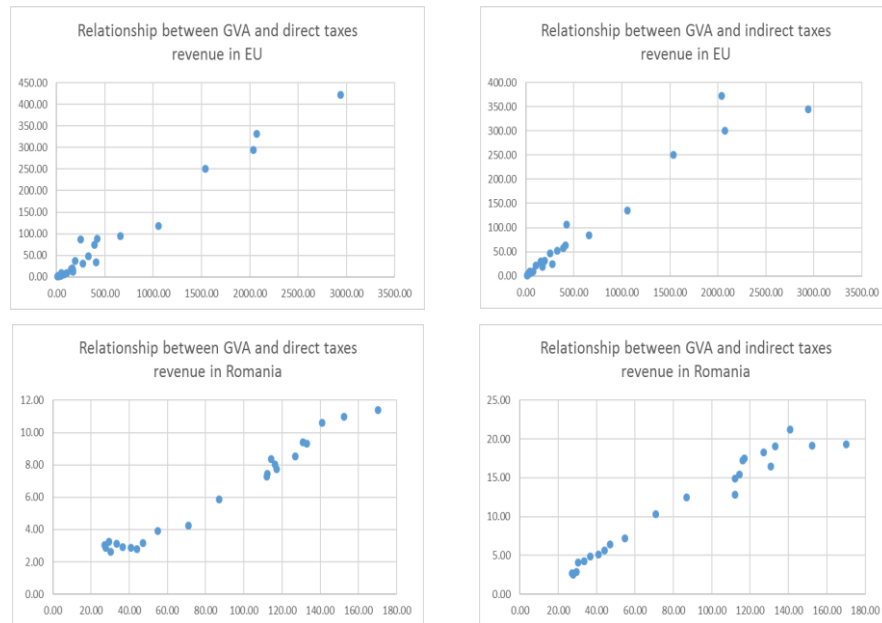
The regression model developed across EU data (see Table 5, in the Appendix) also confirms the close causal link between GVA and tax revenue.

This result requires a careful analysis of the gross value added relationship with the different tax categories, as well as with the tax bases for the respective categories.

4.2. Patterns of variation by tax category

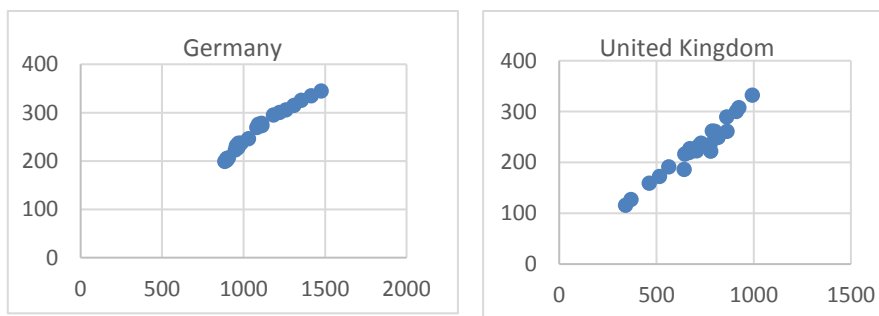
A first step is to inspect the nature of the relationship between GVA and tax revenue by tax category. Although the co-ordinates show generally linear forms of simultaneous evolution of the two types of variables, thus confirming the central hypothesis, it can be noticed that in the case of Romania both the relationship between GVA and direct taxes, as well as between GVA and indirect taxes tend to get out of the existing EU pattern. At least in the case of direct taxes, the link gets a polynomial form. At the level of the benchmark countries (Germany, the United Kingdom, France and Italy), the links of GVA with both categories of tax revenue are perfectly linear. Therefore, in the case of Romania, we have an atypical situation. GVA will not be a good predictor for tax revenue.

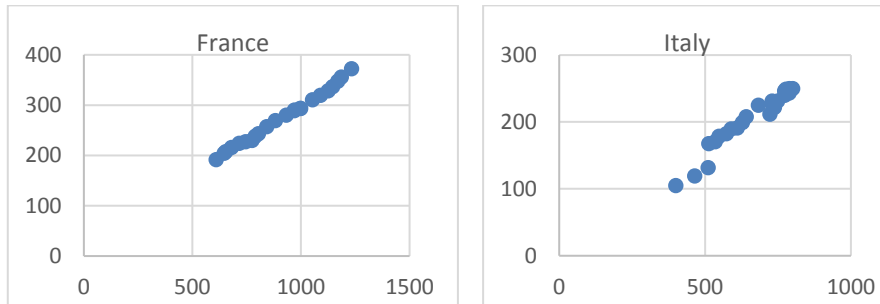
Figure 5
Correlation between GVA and revenue from direct and indirect taxes in the EU (year 2017, cross-sectional data) and in Romania (time series, 1995-2017)



Source: AMECO database and own computations

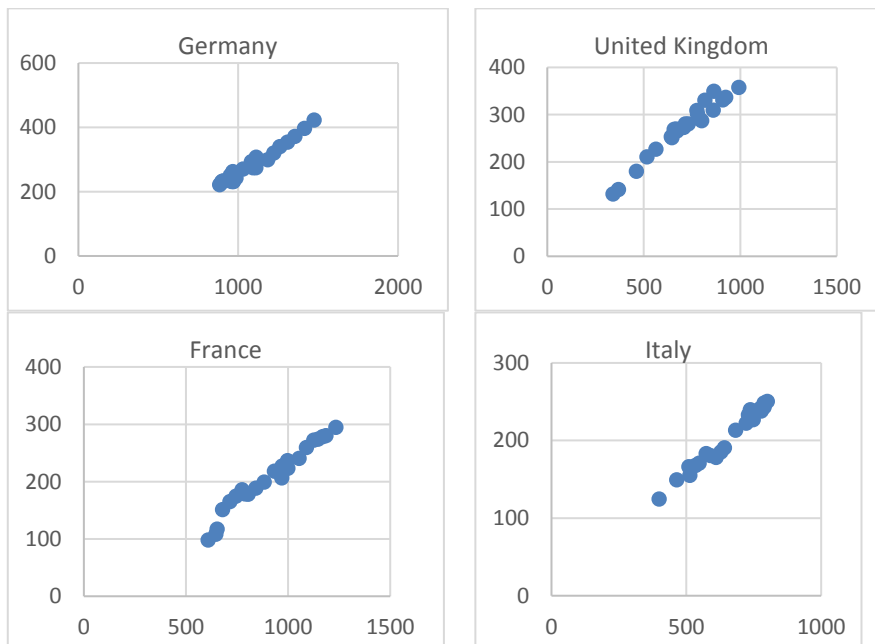
Figure 6
Correlation between GVA and revenue from indirect taxes in the benchmark countries (time series 1995-2017)





Source: AMECO database and own computations

Figure 7
Correlation between GVA and revenue from direct taxes in the benchmark countries (time series 1995-2017)



Source: AMECO database and own computations

4.3. The relationship between GVA and tax bases

At the European Union level, the linkage between GVA and tax bases is confirmed, with the exception of mixed income (Figure 8).

Figure 8

Correlation between GVA and tax bases at EU level



Source: AMECO database and own computations

In the case of Romania, the linearity of the link between the GVA and the tax bases, including mixed income (possible inflections of the simultaneous evolution of GVA and mixed income), is also confirmed, being also somewhat in line with the disruptive evolution between these variables at EU level (Figure 9).

Figure 9
Correlation between GVA and tax bases in Romania (time series)



Source: AMECO database and own computations

It is also important to determine whether there is a causality within these links. In order to assess the influence of the tax bases on the total tax revenues and on the GVA, two econometric models (multiple regression) were generated, the results being presented in Table 7 and Table 8 (see the Appendix), and the Granger causality between the tax bases and GVA was tested (see Table 9, in the Appendix).

The variables were designated as follows:

- COMP – compensation of employees
- Cons – final consumption
- EBE – Gross Operating Surplus
- VENIT_MIXT – mixed income achieved at the household level
- VAB_PC – gross added value in current prices
- VF – total tax revenue

The two models show that the only predictor for both GVA and tax revenue is consumption (statistically significant coefficient), and in the case of tax revenue, mixed income may be accepted as a predictor for a significance threshold of 5%.

Although the regression models indicate the final consumption variable as the only predictor for GVA (regression coefficient is statistically significant for a significance threshold below 1%), the Granger causality is not verified. The test was performed for lags 2, 3 and 4, with only the relevant results being selected. There is causality between the GOS (EBE) and GVA variables, as well as between the employee compensation variable and GVA, the latter at lag 2. The relationship GVA - compensation of employees is also bidirectional for a 10% significance threshold (Table 9, Appendix). Broadly, it can be admitted that GOS (EBE) and compensation of employees significantly influence GVA. The link between GOS (EBE) and GVA seems to be rather negative (Table 9, Appendix). Consumption remains a good predictor for GVA. In short, the tax bases, with the exception of mixed income, influence the achievement of gross value added in the economy. Therefore, tax revenue can be assessed through GVA, but in the case of Romania some adjustments are needed to mitigate or, on the contrary, to highlight the impact of circumstantial or institutional factors.

5. Conclusions

This article looks at the evolution of tax revenue for the first time in terms of Gross Value Added (GVA), which is considered a proxy variable for tax bases rather than GDP, unlike most approaches that analyze the link between tax revenue and GDP. GVA simultaneously captures both the influence of existing economic conditions at one time and the variation of the basis on which different tax regimes are applied. Furthermore, the relationship between tax revenues and GVA has been assessed with the tax bases of each tax category, so that variation patterns and reliable predictors of tax revenue can be identified.

Although the GVA and tax revenues (as a whole) variables are almost perfectly correlated, and the regression analysis indicates a causal link between the two, where tax revenue is the dependent variable (adjusted coefficient of determination is 68%), the Granger causality is not verified in any sense of the implication between the two

variables in the case of Romania. However, it should be noted that for Romania the coefficient of regression is 0.3579, very close to the value of regression coefficient (cross-section data) at European level - 0.3686. Both models of regression confirm the existence of a positive causal relationship between GVA and tax revenue. Under these circumstances, we can expect that the EUR 1000 increase in gross added value will increase tax revenue by 360 euros. However, level estimates and Granger's causality check after staging variables, signal a possible skew of the model. In the first step, attention was focused on identifying patterns of variation according to tax categories, taking as a benchmark the links established between GVA and tax revenue of different tax categories in the countries with the highest gross added value from the EU, namely Germany, France, the United Kingdom and Italy. In all these countries except Italy, the link between the variables considered is perfectly linear, which corresponds to the economic model. In the case of Romania, the links between the GVA and the categories of taxes (direct and indirect) are not linear. This situation reveals that, in reality, atypical evolution in Romania does not correspond to an economic reality, but rather to other causes. One of the causes can be tax evasion. In the second step, the relationship between the GVA and the tax bases was assessed.

The GVA link with the tax bases is perfectly linear, with the exception of mixed income, but this variation pattern is similar to the one existing at the level of the European Union. Therefore, from an economic point of view, Romania does not register atypical developments from the perspective of this type of relationship. Verifying the Granger causality for each GVA relationship with the tax bases shows that there is only a determination between GVA and GOS (EBE), and between GVA and compensation for employees. The causal relationship GVA - compensation for employees is even bidirectional for a materiality threshold of 10%. In the case of mixed income, an absence of direct causality was expected, but no causal relationship between GVA and consumption was verified, although the linkage is perfectly linear. Based on two multiple regression models, the link between GVA and tax bases was assessed, on the one hand, and the link between tax revenues and tax bases, on the other. From these models it was found that GVA variation is only explained by final consumption, in circumstances where the Granger causality was not verified in this case. Also, the variation in tax revenue is explained only by the change in final consumption, which can be attributed to the fact

that more than 50% of the state budget revenue comes from indirect taxes.

In short, atypical variations in Romania are not economic in nature, but are due to other factors, one of which may be tax evasion. The causal link between GOS (EBE) and compensation of employees on the one hand and GVA on the other hand is due to the fact that the tax bases mentioned are, by definition, included in the GVA but at the same time these tax bases do not explain variation in GVA and tax revenue as a whole. Final consumption is a very good predictor for both GVA and tax revenues as a whole, but no strict causality between these two variables is identified, which can be attributed to the very large share of imports in final consumption.

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Table 1

ADF test for the variables GVA and tax revenue

Null Hypothesis: VAB_PC has a unit root Exogenous: Constant, Linear Trend Lag Length: 1 (Automatic - based on SIC, maxlag=6)				Null Hypothesis: VF has a unit root Exogenous: Constant, Linear Trend Lag Length: 0 (Automatic - based on SIC, maxlag=6)			
		t-Statistic	Prob.*			t-Statistic	Prob.*
Augmented statistic	Dickey-Fuller test	-2.704987	0.2443	Augmented statistic	Dickey-Fuller test	-2.353094	0.3912
Test values:	critical			Test values:	critical		
	1% level	-4.467895			1% level	-4.440739	
	5% level	-3.644963			5% level	-3.632896	
	10% level	-3.261452			10% level	-3.254671	
*MacKinnon (1996) one-sided p-values.				*MacKinnon (1996) one-sided p-values.			

Table 2

Assesment of the relationship, in level, between GVA and tax revenue

Dependent Variable: VF
Method: Least Squares
Sample: 1995 2017
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.168491	0.887527	-0.189843	0.8513
VAB_PC	0.368649	0.009166	40.21828	0.0000
R-squared	0.987183	Mean dependent var		31.17778
Adjusted R-squared	0.986573	S.D. dependent var		17.57095
S.E. of regression	2.036020	Akaike info criterion		4.342812
Sum squared resid	87.05292	Schwarz criterion		4.441551
Log likelihood	-47.94234	Hannan-Quinn criter.		4.367645
F-statistic	1617.510	Durbin-Watson stat		1.136489
Prob(F-statistic)	0.000000			

Table 3

Assesment of the relationship, in log, between GVA and tax revenue

Dependent Variable: LOG(VF)
Method: Least Squares
Sample: 1995 2017
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.169449	0.083089	-14.07465	0.0000
LOG(VAB_PC)	1.036336	0.019285	53.73675	0.0000
R-squared	0.992780	Mean dependent var		3.247132
Adjusted R-squared	0.992436	S.D. dependent var		0.672497
S.E. of regression	0.058487	Akaike info criterion		-2.757094
Sum squared resid	0.071835	Schwarz criterion		-2.658355
Log likelihood	33.70658	Hannan-Quinn criter.		-2.732261
F-statistic	2887.639	Durbin-Watson stat		0.993960
Prob(F-statistic)	0.000000			

Table 4

Assesment of the relationship, in differential, between GVA and tax revenue

Dependent Variable: D(VF)

Method: Least Squares

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.147010	0.581001	-0.253029	0.8028
D(VAB_PC)	0.357970	0.052254	6.850628	0.0000
R-squared	0.701185	Mean dependent var		2.181371
Adjusted R-squared	0.686245	S.D. dependent var		3.945811
S.E. of regression	2.210202	Akaike info criterion		4.510553
Sum squared resid	97.69986	Schwarz criterion		4.609739
Log likelihood	-47.61608	Hannan-Quinn criter.		4.533918
F-statistic	46.93110	Durbin-Watson stat		1.825343
Prob(F-statistic)	0.000001			

Table 5

Assessment of the relationship between GVA and tax revenue at EU level, in 2017 (cross-sectional data)

<i>Regression Statistics</i>						
Multiple R	0.993571074					
R Square	0.987183479					
Adjusted R Square	0.986573168					
Standard Error	2.036019887					
Observations	23					
<i>ANOVA</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	6705.189311	6705.189311	1617.510142	2.34318E-21	
Residual	21	87.05291662	4.145376982			
Total	22	6792.242228				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.168490599	0.887526782	-0.189842834	0.851255333	-2.014203584	1.677222385
X Variable VAB	0.368648679	0.009166197	40.21828119	2.34318E-21	0.349586529	0.387710828

Table 6

Granger causality between GVA and tax revenue (in differential)

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	21	0.17576	0.6800
DVF does not Granger Cause DVAB_PC		0.19065	0.6676

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	20	0.48719	0.6237
DVF does not Granger Cause DVAB_PC		0.11747	0.8900

Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	19	0.86066	0.4879
DVF does not Granger Cause DVAB_PC		0.24189	0.8655

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	18	1.58694	0.2591
DVF does not Granger Cause DVAB_PC		1.32039	0.3336

Lags: 5

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	17	1.02557	0.4782
DVF does not Granger Cause DVAB_PC		1.06421	0.4618

Lags: 6

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	16	1.11345	0.5051
DVF does not Granger Cause DVAB_PC		0.56442	0.7478

Table 7

**Multiple regression model between GVA and tax bases in Romania
(stationary series)**

Dependent Variable: D(VAB_PC)

Method: Least Squares

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.259021	0.545378	0.474938	0.6409
D(COMP)	0.237391	0.221131	1.073529	0.2980
D(CONS)	0.961199	0.158557	6.062166	0.0000
D(EBE)	-0.025263	0.071172	-0.354960	0.7270
D(VENIT_MIXT)	0.281491	0.223228	1.261003	0.2243
R-squared	0.959100	Mean dependent var		6.504395
Adjusted R-squared	0.949476	S.D. dependent var		9.230083
S.E. of regression	2.074693	Akaike info criterion		4.494220
Sum squared resid	73.17399	Schwarz criterion		4.742184
Log likelihood	-44.43642	Hannan-Quinn criter.		4.552633
F-statistic	99.66128	Durbin-Watson stat		1.500032
Prob(F-statistic)	0.000000			

Table 8

**Multiple regression model between tax revenue and tax bases in Romania
(stationary series)**

Dependent Variable: D(VF)

Method: Least Squares

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.311272	0.473541	-0.657328	0.5198
D(COMP)	-0.328644	0.192004	-1.711655	0.1051
D(CONS)	0.485610	0.137672	3.527299	0.0026
D(EBE)	-0.008950	0.061797	-0.144827	0.8866
D(VENIT_MIXT)	0.486571	0.193824	2.510369	0.0225
R-squared	0.831273	Mean dependent var		2.181371
Adjusted R-squared	0.791573	S.D. dependent var		3.945811
S.E. of regression	1.801415	Akaike info criterion		4.211738
Sum squared resid	55.16662	Schwarz criterion		4.459702
Log likelihood	-41.32912	Hannan-Quinn criter.		4.270151
F-statistic	20.93862	Durbin-Watson stat		1.984141
Prob(F-statistic)	0.000002			

Table 9

Granger causality between GVA and tax bases in Romania

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
DVENITMIXT does not Granger Cause DVAB_PC	18	0.23088	0.9141
DVAB_PC does not Granger Cause DVENITMIXT		0.59324	0.6764
Null Hypothesis:	Obs	F-Statistic	Prob.
DEBE does not Granger Cause DVAB_PC	18	8.08257	0.0047
DVAB_PC does not Granger Cause DEBE		0.72890	0.5943
Null Hypothesis:	Obs	F-Statistic	Prob.
DCONS does not Granger Cause DVAB_PC	18	2.33980	0.1332
DVAB_PC does not Granger Cause DCONS		1.55981	0.2657

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DCOMP does not Granger Cause DVAB_PC	20	3.39906	0.0606
DVAB_PC does not Granger Cause DCOMP		5.16655	0.0196