



Approaches to the Determination of the Underground Economy Component by Methods of Budget Execution Management Through Statistical Analysis in Romania

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ABSTRACT

In this article we propose to carry out an impact study on the construction and execution of the general consolidated budget of Romania for the period 2017-2021 through a critical approach to measure the level of financial security starting from the redistribution of tax burden within the budget construction and execution stages in order to highlight the underground economy component based on segregation and statistical analysis of budget revenues constituent elements. The used methodology includes data consolidation techniques, dynamic analysis and econometric modelling using specialised statistical software. The study results will capture the vulnerability aspects of the underground economy and the tax security aspects and will be useful to tax authorities in order to improve tax procedures.

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1. Introduction

Public system financing is a management policy tool of public authorities that enables the social function to be ensured through the effects of a good distribution of resources. In the current European context, system financing takes into account national and supranational considerations and is integrated into the European financial system. For this reason, it can be seen that Romania has benefited from the European experience and has improved its performance targets since accession. However, the new challenges of the economic crisis in a pandemic context and in an unstable geopolitical security context motivate the improvement of management practices at the level of the financial system, as the current conditions of uncertainty have a strong impact on the entire economy and on social security, both through the continuous devaluation of the national currency (decrease in purchasing power) and through ever-increasing inflation. We propose to analyse, through a correlation model, the evolution of the financial achievements of the general consolidated budget over the last 5 years and to identify the main vulnerabilities transmitted on the exploitation stages of public and private revenues. In order to achieve the proposed aim, we define the following research objectives:

- Objective 1 Identification of impact indicators whose correlation can strengthen the overall image of the financial management policy used in the construction of the general consolidated budget.
- Objective 2 Consolidation of parallel databases corresponding to the strategic moments of budget construction and execution using statistical methods and procedures
- Objective 3 Defining, testing and validating the econometric financial management model
- Objective 4 Dissemination of model results
- Objective 5 Identification of the tax security and vulnerability elements associated with the underground economy

The obtained results will allow the construction of the vulnerability picture showing the system's main vulnerable elements and comfort zones within the general consolidated budget revenue section.

2. Literature review

Budget taxonomy is analysed by some authors (Di Francesco & Alford, 2016) who show that there is a budget staging and flexibility according to 5 stages related to budget planning and execution, defined as

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follows: Budget preparation, Budget approval, Budget management, Budget control, Performance assessment. The control components defined as discrete rules are: accountability, amount, purpose, time, transfer and information.

Other authors assess the performance of budget execution in Romania (Anghelache et al., 2017), concluding further to the assessment on concrete measures to improve collection efficiency, namely improving the structure of payments balance, increasing the impact of government bond issuance programs, decreasing public debt by using exchange rate volatility.

In the same sense (Cicatiello et al., 2021) other authors analyse the role of fiscal transparency for increasing FDI (Foreign Direct Investment); thus through panel research, it is shown that some measures associated with fiscal transparency, such as Openness of Budget Formulation, Openness of Budget Execution, GDP Growth, Civil Liberties, Transfer Risk, increase the chances of benefiting from FDI inflows.

The budget is (Rafi et al., 2020) a tool for predicting and controlling resources, which, if used properly, can lead to improved performance and more efficient allocations. The authors point out that a slowdown in financial and planning data collection practices renders the results vulnerable because the temporary size of budgets based on the assumed reality is limited, as they come into contact with economic realities in the budget execution section.

In the literature we find (Ho, 2018) an interesting scheme for the constitution of the general performance framework, a scheme that has a pyramidal distribution with a reverse base, starting from normative and social institutions, passing through the organizational context, to operationalization, which structures budget inputs and monitors the outputs as a basis for performance practices.

Another approach to budget risks, based on risk theory (Terentieva & Svistunov, 2021) shows that budget deficit channels budget underfunding risks, revenue non-collection risks and overspending risks.

A study of interest on the external public audit carried out by the Romanian Court of Accounts (Dragusin & Cârstina, 2020) on the budget execution and its evolution shows that in general, through the control measures in the period under analysis, the expenditure recorded in the general consolidated budget was adjusted by 0.09%, respectively by 9.18% the expenditure in the state budget.

Other authors (Andrei & Brezeanu, 2019) appreciate that in the era of globalisation the dynamics of the tax system can demonstrate the existence of the connection with international market shocks generated by crisis episodes, thus the innovation cost, although high, is appropriate because innovation is the component that can facilitate budget efficiency.

In times of crisis such as the epidemiological crisis, the public finance system faces challenges in meeting the funding need, with crises perceived as stress tests for the public sector (Seiwald & Polzer, 2020). The authors' analysis shows that in the presence of a reactive and integrated pattern, crisis mitigation measures find their compliance in the defensive mechanisms applied to support budgets.

A model of integrated financial management presented in the literature (Jeong & Oh, 2019) is the South Korean model, which started reforms in 2004 with the construction of a centralised expenditure framework, setting maximum and minimum budget limits and building a budget performance system based on information systems management.

3. Methodology

In order to achieve the research objectives, we have queried the public databases provided by the Ministry of Public Finance (Romanian Ministry of Public Finance, 2022) regarding the funding sources to the general consolidated budget and the statistics on the reality of dynamic revenue collection for the period 2017-2021. The data have been consolidated using mathematical procedures using the pairwise comparison method and the moving average method to assess the dynamics of the indicators:

- Profit tax - representing the determinant of the economic yield of private economic agents in Romania, yield collected through fixed tax rates, with the exception of those who earn income from gambling
- Income tax - is a measure of the general economic yield, yield collected through fixed rates from any individual in Romania
- VAT - is the value added tax collected in Romania according to the provisions of the tax code
- Excise duties - are taxes paid by private entities for economic activity with products subject to excise duty
- Contributions to the state social insurance budget - are those contributions levied for social insurance services and on the basis of which some social protection programmes are carried out, such as: pension insurance, job seekers insurance, social insertion insurance, etc.
- Contributions to the unemployment budget - contributions to help people on the records of the AJOFM (County Employment Agency)
- Health budget - another category of contributions that are collected separately and used for the provision of health programmes for the population.

4. Results of the study

In order to achieve the research goals, we propose to model the correlation between the taxation efficiency of economic activity and the taxation efficiency of the other components on which the consolidated general government budget is based in three distinct stages: the initial stage of strategic budget planning, the second stage of voluntary compliance and the final third stage of budget implementation. The first planning stage is captured by the model equation:

$$VAT_p = -0,572 * Income\ tax_p - 3,477 * Excise\ duties_p + 74,341 * Unemployment\ Budget_p - 3,608 * Health\ Budget_p - 261516819,121$$

Where VAT_p is the model's dependent variable, i.e. the VAT collection to the state budget in the version planned at the beginning of the fiscal year.

$Income\ tax_p$ – is the independent, planned variable amount of tax revenue at the beginning of the fiscal year.

$Excise\ duties_p$ – is the independent variable, the amount of excise duties planned to be collected to the state budget at the beginning of the fiscal year.

$Unemployment\ Budget_p$ – is the independent variable, the amount of payroll contributions expected to be collected to the state budget at the beginning of the fiscal year.

$Health\ Budget_p$ – is the independent variable, the amount of social health insurance contributions planned to be collected to the state budget at the beginning of the fiscal year.

According to the model equation, it is observed that the correlation level of the planned VAT revenue varies inversely with most of the budgetary sources, thus at the planned level the increase in VAT revenue reduces by correlation the tax burden:

- on tax revenues (by 50%),
- on excise duties (by 347%),
- on the health budget (by 360%)

The only deviation from the tax compensation rule is in the case of the unemployment contribution, where we observe that the increase by one monetary unit in the planned VAT revenue induces an increase of 74 monetary units in the tax burden on the unemployment budget, which constitutes a vulnerability of budgetary construction in terms of uncorrelated tax burden related to social protection in relation to the other financing sources from the state budget.

Representativeness statistics are presented in Table 1 - Summary of Planned Revenue Correlation Model. This table shows that the statistical representativeness is 100%, the budget planning model being representative for all the analysed cases, under the conditions of an estimator standard error tending to 0, and a correlation coefficient on the change function tending to 0, which validates the alternative hypothesis, rejects the null hypothesis and determines the validity and homogeneity of the model, which is also confirmed by the Durbin-Watson coefficient (Table 1).

Table 1. Summary of Planned Revenue Correlation Model

Model	R	R Square	Adjusted R Square	Estimate Std. Error	Change Statistics	
					R Square Change	F Change
Plan	1,000a	1,000	1,000	0	1,000	0
Model	Change Statistics					
	df1		df2	Sig. F Change		Durbin-Watson
Plan	4		0	0		2,472
a. Predictors: (Constant), Health Budget, Excise duties, Income tax, unemployment budget						
b. Dependent Variable: VAT						

Source: The authors

From the Anova table we observe that the residual variable is minimally represented both in terms of the sums of regression squares and in terms of the number of degrees of freedom attributable to the residual component (0). The Anova table confirms that the model is valid and at the planned level, the criteria of tax burden distributivity are mainly expressed on the basis of the security of sources and the predictability level of achieving revenues from these sources (Table 2).

Table 2. ANOVA statistical test for Planned Revenue Correlation Model

Model		Sum of Squares	df	Mean Square
Plan	Regression	59523575320000008,000	4	14880893830000002,000
	Residual	0,000	0	.
	Total	59523575320000008,000	4	
a. Dependent Variable: VAT				
b. Predictors: (Constant), Health Budget, Excise duties, Income tax, unemployment budget				

Source: The authors

The second step of voluntary compliance is represented by the model equation:

$$VAT_D = -1,968 * Profit\ tax_D + 1,492 * Income\ tax_D + 2,553 * Excise\ duties_D + 1,455 * Health\ Budget_D - 438855493,546$$

Where VAT_D is the dependent variable of the model, namely the declaration of VAT to the state budget in the light of voluntary compliance throughout the fiscal year.

Profit Tax_D – is the independent variable, the declared amount of profit tax generated by the economic activity carried out by economic agents in Romania throughout the fiscal year.

Income tax_D – is the independent variable, the amount of tax declared throughout the fiscal year.

Excise duties_D – is the independent variable, the declared amount of excise duties to be collected to the state budget during the fiscal year.

Health Budget_D – is the independent variable, the declared amount of declared social health insurance contributions to be paid to the state budget during the fiscal year.

From the point of view of the model equation, a reversal of the situation (trend) is observed for most of the indicators, so, if at the planned level the tax burden function was correctly distributed, the practical reality after voluntary compliance shows that the increase in the tax burden on VAT determines:

- increased tax burden on tax and duty collection (by 150%)
- increased tax burden on excise tax collection (255%)
- increase in the tax burden on the health insurance budget (145%)

These aspects show that the economic reality is not reaching the expected level, the robustness of the planning of general consolidated budgets being questionable both in terms of consistency of the forecasts and in terms of the covered financing needs.

Representativeness statistics are presented in the table Summary of the Correlation Model of Reported Revenues. This table shows that the statistical representativeness is 100%, the voluntary compliance model being representative for all the cases analysed, with an estimator standard error tending to 0, and a correlation coefficient on the change function tending to 0, which validates the alternative hypothesis, rejects the null hypothesis and determines the validity and homogeneity of the model, as confirmed by the Durbin-Watson coefficient (Table 3).

Table 3. Summary of Voluntary Compliance Revenue Correlation Model

Model	R	R Square	Adjusted R Square	Estimate Std. Error	Change Statistics			
					R Square Change	F Change		
Declared	1,000a	1,000	1,000	0	1,000	0		
Model	Change Statistics							
	df1		df2		Sig. F Change		Durbin - Watson	
Declared	4		0		0		2,608	
a. Predictors: (Constant), Health Budget, Income tax, Excise duties, Profit Tax								
b. Dependent Variable: VAT								

Source: The authors

From the Anova table we observe that the residual variable is minimally represented both in terms of the sums of squares of the regression and in terms of the number of degrees of freedom attributable to the residual component (0). The Anova table confirms that the model is valid and at the planned level the criteria of distributivity of the tax burden are mainly expressed on the basis of the security of sources and the level of predictability of revenue collection from these sources (Table 4).

Table 4. ANOVA statistical test for Voluntary Compliance Revenue Correlation Model

Model		Sum of Squares	df	Mean Square	F	Sig.
Declared	Regression	198714898524526592,000	4	49678724631131648,000	.	.b
	Residual	0,000	0			
	Total	198714898524526592,000	4			
a. Dependent Variable: VAT						
b. Predictors: (Constant), Health Budget, Income tax, Excise duties, Profit Tax						

Source: The authors

The last stage concerning the materialization of receipts assimilated to the realization of the general consolidated budget is represented by the model equation:

$$VAT_R = 2,857 * Profit\ tax_D - 1,133 * Income\ tax_D + 2,358 * Excise\ duties_D + 0,228 * Health\ Budget_D + 319916747,794$$

Where VAT_R is the dependent variable of the model, namely the actual collection of VAT to the state budget in the light of voluntary compliance throughout the fiscal year.

Profit Tax_R – is the independent variable, the actual amount of profit tax collected on the economic activity carried out by economic agents in Romania throughout the fiscal year.

Income tax_R – is the independent variable, the actual amount of taxes due to the consolidated state budget during the fiscal year.

Excise duties_R – is the independent variable, the actual amount of excise duties collected to the state budget during the fiscal year.

Health Budget_R – is the independent variable, the declared amount of declared social health insurance contributions to be paid to the state budget during the fiscal year.

From the point of view of the model equation, a normalization of the trend is observed for most indicators at the realized level of the general consolidated budget, noting that the increase in the tax burden on VAT causes:

- increased tax burden on profit tax collection (by 285%)
- increased tax burden on tax collection (by 113%)
- increase in the tax burden on the collection of excise duties (235%)
- increase in the tax burden on the health insurance budget (23%)

The model summary shows that the budget execution component has the same elements of validity as the other two models, i.e. maximum statistical significance and homogeneity generated by the 4 degrees of freedom attributed entirely to the regression component, the Durbin-Watson test value being 2 (Table 5).

Table 5. Summary of Realised Revenue Correlation Model

Model	R	R Square	Adjusted R Square	Estimate Std. Error	Change Statistics	
					R Square Change	F Change
Achieved	1,000a	1,000	1,000	0	1,000	0
Model	Change Statistics					Durbin-Watson
	df1		df2	Sig. F Change		
Achieved	4		0	0		2,000
a. Predictors: (Constant), Health Budget, Income tax, Excise duties, Profit Tax						
b. Dependent Variable: VAT						

Source: The authors

The ANOVA table allows validation of the alternative hypothesis and rejection of the null hypothesis by the one-sided critical probability test, the Sig coefficient tending to 0 (Table 6).

Table 6. ANOVA statistical test for Realised Revenue Correlation Model

Model		Sum of Squares	df	Mean Square	F	Sig.
Achieved	Regression	60320990173103700,000	4	15080247543275900	0	0.b
	Residual	0,000	0			
	Total	60320990173103700,000	4			
a. Dependent Variable: VAT						
b. Predictors: (Constant), Health Budget, Income tax, Excise duties, Profit Tax						

Source: The authors

In terms of descriptive statistics, it is noted that the largest value component of the budget is the State Social Insurance Budget, which exceeds the planned level in terms of implementation by 3%, at the opposite end of the spectrum is Excise duties with an implementation of only 99.06% of the planned level.

From the point of view of the implementation percentage, the Income Tax is on the first place of the budget execution, exceeding the planned level by 4.7%, and at the opposite pole is the Income Tax with an implementation of 97.7% compared to the planned level and VAT with an implementation of 97.8% compared to the planned level (Table 7).

Table 7. Tax burden distribution table

Indicators	Planned	Declared	Achieved
VAT/VAT	100%	100%	100%
Profit Tax/VAT	26%	16%	26%
Income tax/VAT	102%	61%	109%
Excise duties/VAT	6%	4%	6%
State Social Insurance Budget/VAT	299%	188%	316%
Unemployment budget/VAT	10%	6%	10%
Health Budget/VAT	129%	80%	134%

Source: The authors

From a modelling point of view, the tax burden distribution table versus the dependent variable shows in the budget planning section that the State Social Insurance Budget component is maximized (299%) versus VAT, together with the Health Budget component (129%) versus VAT. The voluntary compliance section highlights vulnerability areas, showing that at the declarative level there are significant gaps compared to the planned section in relation to VAT, as follows:

- As for the Profit Tax indicator, only 61% of the tax is declared compared to the planned VAT level;
- As for the Income tax, only 60% of the tax is declared compared to the planned level in relation to VAT;
- As for the Excise duties, only 64% of the tax is declared compared to the planned level of VAT;
- As for the State Social Insurance Budget, only 63% of the tax is declared in relation to the planned VAT level;
- As for the Unemployment budget, only 64% of the tax is declared compared to the planned level in relation to VAT;
- As for the Health Budget, only 62% of the tax is declared compared to the planned level in relation to VAT.

These significant deviations are due to a GAP of 60% of VAT assimilated to the underground economy because it is included in the voluntary compliance section, but the achieved value is 97.84% of the planned level, i.e. 61% of the declared level.

5. Conclusions

The study objectives have been achieved, the authors having identified the impact indicators used for the development of the econometric model, and by consolidating the databases it was possible to define, test and validate the three econometric models related to the three stages of budget construction and execution: planning, voluntary declaration and revenue realization.

The study shows that from the point of view of the budget planning and construction stages for the analysed period 2017-2021, there are large differences in the budget construction and distribution of the tax burden, identifying also the component of maximum volatility, the exponent of the business environment economic return, i.e. VAT that exposes the underground economy as a percentage of the voluntary compliance value of about 40%.

The conducted research is of interest for the tax authorities and business environment in order to improve tax policy and economic practices. The limitations of the study are the relatively short analysis period and the relatively small number of indicators used in the econometric modelling.

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