
Dynamics of Personnel Expenses in the General Consolidated Budget Depending on the Dynamics of the Gross Domestic Product, by Econometric Modeling

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SUMMARY

The analysis presented in this article identifies an econometric model of the interdependence of the personnel expense's dynamics from the general consolidated budget with the dynamics of the gross domestic product of Romania for the period 2010-2017 and the levels estimated by the Ministry of Public Finance for the years 2018-2022.

The developed econometric model has the linear unifactorial form and is supported by an adequate statistical support that confirms its usefulness for substantiating the decisions of macroeconomic policy, budgetary and fiscal.

Keywords: *personnel expenses from the general consolidated budget, gross domestic product, econometric model*

JEL Classification: *C52, H51, H61*

INTRODUCTION

Personnel expenses measure the economic power of the employees and is a result of the general level of economic development of a country and the gross domestic product is the value expression of this development. A study of the interdependence between the dynamics of personnel expenses and the dynamics of the gross domestic product has a sustainable motivation and can provide useful information regarding this legality, the speed of changing the value of the personnel expenses depending on the modification of the gross domestic product.

In order to substantiate the personnel expenses in the case of public institutions, the start point is the organization chart. This includes the number of positions, their degree of employment with staff, as well as the differentiation of staff by salary levels.

The legal regulations establish the minimum and maximum limits between which the basic salaries for the employed personnel of public institutions can be assigned, depending on the specificity of the institution. These limits are set either according to certain coefficients that apply to the sectoral value of the salary, or in the form of minimum and maximum value limits.

If public institutions also obtain revenues from extra-budgetary activities, the level of wages can be increased on account of these revenues.

The economic classification of the expenditures made by public institutions highlights the following categories:

a) current (operating) expenses:

- Staff expenditure,
- material expenses and services,
- subsidies,
- premiums,
- transfers,
- interest.

b) capital expenditures (investment character),

c) financial operations,

- given loans
- loan repayments, interest payments, loan commissions

It is mentioned that in the structure of the expenditures made by public institutions some are common to all public institutions, others being specific only to certain public institutions.

An alternative way of determining the expected level of personnel expenses can be based on the following reasoning: the structure of the staff

and the average level of salary for each employee (or category of employees), the amount of basic salaries, merit salaries, management allowances, are identified, as well as bonuses, overtime, prizes and other salary rights planned for the plan year. These salary components are summed and form the personnel expenses or the salary fund of the public institution.

Personnel expenses represent an important category of expenditure incurred by public institutions, comprising:

- a) expenses with salaries:
 - basic salaries;
 - merit salaries;
 - management allowances and other allowances;
 - long service allowance;
 - bonuses for working conditions;
 - other bonuses;
 - funds for posts occupied by cumulation;
 - overtime payments;
 - prize fund;
 - holiday bonus;
 - other salary rights granted to the personnel employed with a work card;
 - salary rights paid to persons outside the unit;
 - other wage rights;
- b) contributions for state social insurance;
- c) expenses for setting up the fund for the payment of unemployment aid;
- d) contributions for setting up the social health insurance fund;
- e) contribution to the risk and accident fund;
- f) the commission for the Chamber of Labor;
- g) the fund for guaranteeing the payables
- h) trips, secondments, transfers (daily):
 - trips, secondments, transfers in the country;
 - trips abroad;
- i) meal vouchers.

LITERATURE REVIEW

Research on the role of gross domestic product in a system of interdependent variables, both as an exogenous variable and as an endogenous variable, has been presented in numerous articles and specialized papers in the country and abroad.

All reference works highlight the methodology for developing models with a rigorously based support on economic theory, mathematical statistics, probability theory and statistical inference, respectively. Particular cases of the formation of interdependence relationships between variables formed in a systemic format are treated separately and offer appropriate solutions for the completion and validation of models.

In this sense, the most recent works are relevant, published by Anghelache, C., Anghel, M.G., Manole, A. (2015) - "Economic modeling, financial-banking and informatics", Artifex Publishing House, Bucharest; Anghel, M.G. (2014) - „Econometric Model Applied in the Analysis of the Correlation between Some of the Macroeconomic Variables”, Romanian Statistical Review - Supplement / Nr. 1/2014; Andrei, T., Bourbonnais, R. (2008) - „Econometrics”, Economic Publishing House, Bucharest.

In the paper prepared by Mihailescu, N. (2014) - "Statistics and Statistical Basics of Econometrics", Transversal Publishing House, Bucharest, are identified multifactorial models of gross domestic product dynamics depending on the dynamics of the employed population and the dynamics of the value of tangible fixed assets in Romania's economy.

A similar topic that refers to the complex analysis of the evolution of the money supply with the help of interdependent models is treated by Mihailescu, N. (2019) - „Analysis of economic-financial activity - Research methodologies, case studies solved to substantiate economic-financial decisions and knowledge tests”, Transversal Publishing House, Bucharest.

Other reference works are: Mihailescu, N., Căpățână, C. (2018) - „The reversible impact of the dynamics of the gross domestic product with the imports and exports of goods and services of Romania, Romanian Statistical Review - Supplement / Nr. 11 and No. 12/2018; Pagliacci, M., Anghelache, G.V., Pocan, I.M., Marinescu, R.T., Manole, A. (2011) - "Multiple Regression - Method of Financial Performance Evaluation", ART ECO - Review of Economic Studies and Research, Editura Artifex, Vol. 2 / No.4 / 2011.

The mentioned works present in the context of the scientifically substantiated methodology of econometrics the statistical legitimacy that is formed between economic variables both at macroeconomic level and at microeconomic level. Also, models of some economic variables with demographic or social variables are presented.

DATABASE

The statistical data based on which will be carried out the methodology for analyzing the interdependence of personnel expenditure dynamics from the general consolidated budget with the dynamics of gross domestic product are presented in Table 1.

Dynamics of personnel expenditures from the general consolidated budget and gross domestic product achieved between 2010 and 2017 as well as the levels estimated by the Ministry of Public Finance for the years 2018 – 2022

Table 1.

Years	G.D.P.	Personnel expenditures (general consolidated budget)	
	Amounts -million lei- (x) Ser 02	Amounts -million lei- (y) Ser 01	% of gross domestic product
I. Achievements 2010	533,881.1	42,836.8	8.0
II. Achievements 2011	565,097.2	38,422.7	6.8
III. Achievements 2012	595,367.3	40,798.8	6.9
IV. Achievements 2013	637,456.0	46,241.0	7.3
V. Achievements 2014	668,143.6	50,400.1	7.5
VI. Achievements 2015	712,658.5	52,070.0	7.3
VII. Achievements 2016	762,341.8	57,068.4	7.5
VIII. Achievements 2017	856,700.0	69,611.4	8.1
IX. Estimated 2018 - execution	949,600.0	86,141.9	9.1
X. Proposals 2019 - February 15	1,022,500.0	102,117.8	10.0
XI. Estimates 2020	1,101,000.0	106,587.8	9.7
XII. Estimates 2021	1,178,600.0	110,387.9	9.4
XIII. Estimates 2022	1,261,500.0	114,646.2	9.1

Data source: Ministry of Public Finance

RESEARCH METHODOLOGY

The methodology of researching the interdependence of the dynamics of personnel expenses from the general consolidated budget with the dynamics of the gross domestic product is carried out during the following stages:

- The dynamics of the absolute indicators considered as forming an interdependent system are represented graphically - the personnel expenses from the general consolidated budget in correlation with the gross domestic product of Romania, from 2010-2022.

- The mathematical form of the model is chosen based on the graphical representation,

- The estimators of the model are defined using the method of the smallest squares and the statistical significance of them is verified using the „*Criterion t*”,

- The econometric representation indicators are calculated and the statistical viability of the model is assessed based on a set of statistical tests aimed at: the significance of the correlation ratio with the help of „*Criterion F*”, the normality of the distribution of the residual variable with the help of the „*Jarque-Bera criterion*”, the existence of the phenomenon of residual autocorrelation using the „*Durbin-Watson Criterion*” and the residual homoscedasticity phenomenon with the help of the „*White Test*”, also quantifies the „power” of the model for calculating predictable levels of personnel expenses from the general consolidated budget depending on the increase of the gross domestic product, with the help of „*Theil's inequality coefficient*” as well as by the relative expression of „*Estimation of the average error of the regression equation*”,

- The amount of personnel expenses from the general consolidated budget for the year 2023 is estimated, as a point value and as a guaranteed confidence interval with a probability of 95% depending on the estimated value of the gross domestic product.

The methodology used to elaborate and attest the viability of the model of personnel expenditure dynamics from the general consolidated budget depending to the dynamics of the gross domestic product is applied by using the EViews software.

DEFINING THE MODEL AND CALCULATING THE ECONOMETRIC REPRESENTATION INDICATORS

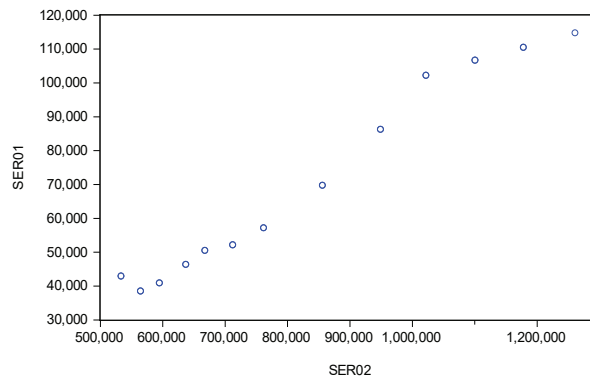
The analysis of the interdependence of the dynamics of personnel expenses from the general consolidated budget with the dynamics of the gross domestic product has as statistical information support the data presented in Table 1.

To identify the mathematical form of the econometric model, one proceeds to analyze the graphical representation of the correlation between the variables of the system under study (Figure 1). The way in which the “point cloud” is shown in the graph, marked at the intersection of the coordinates of the two variables, provides sufficiently convincing information about the form of their interdependence. Under these conditions, a simple linear regression equation is chosen which has the general form of representing the

real levels: $y = a + b \cdot x + u$, where y is the endogenous (dependent) variable - personnel expenses from the general consolidated budget, x is the exogenous (independent) variable - the gross domestic product, and u is the residual variable.

Graphical representation of the correlation between the dynamics of personnel expenditures from the general consolidated budget with the dynamics of gross domestic product

Figure 1.



Note: The graph legend (Figure 1) is explained as follows:
Ser 01 = dynamics of personnel expenditures from the general consolidated budget (millions of lei); Ser 02 = dynamics of gross domestic product (millions of lei)

The econometric model developed to meet the proposed knowledge interest is in the form of a simple linear regression equation and the econometric representation indicators are presented in Table 2.

The synoptic table of the econometric representation indicators system for the unifactorial linear model of the dynamics of personnel expenditures in the general consolidated budget (y) depending to the dynamics of the gross domestic product (x)

Table 2

Dependent Variable: SER01 = y				
Method: Least Squares				
Sample: 2010 – 2022; Included observations: 13				
The regression equation: $\hat{y} = a + b \cdot x \rightarrow \hat{y} = -27,265.07 + 0.117270 \cdot x$				
Variable	Coefficient	Std. Error	t-Statistic	Probability of accepting the null hypothesis (q = significance threshold)
SER02 = x „b”	0.117270	0.005821	20.14717	0.0000
C „a”	-27,265.07	5047.183	-5.402037	0.0002
R-squared: $R^2_{y, \hat{y}}$	0.973615	Mean dependent var: \bar{y}		70,563.91
Adjusted R-squared	0.971217	S.D. dependent var		29,263.60
S.E. of regression: $\hat{\sigma}_{y, \hat{y}}$	4,964.756	Akaike info criterion		19.99875
$\hat{V}_{y, \hat{y}} = \frac{\hat{\sigma}_{y, \hat{y}}}{\bar{y}} \cdot 100$	7.0358%	Theil inequality Coefficient		3.0089%
Sum squared resid	(2.71E+08)	Schwarz criterion		20.08567
Log likelihood	-127.9919	Hannan-Quinn criter.		19.98089
F-statistic	405.9085	Durbin-Watson stat		0.921732
Prob (F-statistic)	0.000000	Heteroskedasticity Test: White (Auxiliary regression equation: squaring the residual variable according to the exogenous variable)		
Jarque – Bera (J-B)	1.291019	$F\text{-statistic} < F\text{-theoretical}$ (P = 95%, $f_1=2, f_2=10$) 0,252562 < 4,10 – The model is homoskedastic		q = 0.7816
Prob. (Jarque - Bera)	0.524395	$\chi^2\text{-statistic} < \chi^2\text{-theoretical}$ (P = 95%, $f=2$) 0,625087 < 5,99 – The model is homoskedastic		q = 0.7316

In Table 3 are presented the real levels, the estimated levels and the levels of the error term or the residuals related to the model which are dimensioned, for each year, by making the difference between the real levels and the estimated levels of the dependent variable, *the value of the personnel expenses from the general consolidated budget*. It is mentioned that the range of the residuals (errors) is presented in comparison with the size of the estimation of the average error of the regression equation, $\hat{\sigma}_{y, \hat{y}} = \pm 4,964.756$ million lei to illustrate their arrangement.

It is also observed that the residuals do not exceed the limits framed by ± 2.201 estimates of the average error of the regression equation, based on the Student distribution law, for a significance threshold of 5% arranged

bilaterally and 11 degrees of freedom, as confirmed by the graph from Figure 2.

This statistical finding is able to justify the appreciation that the econometric model of the dynamics of personnel expenses from the general consolidated budget depending on the dynamics of the gross domestic product is a viable analytical representation of the reality.

However, at the same time, there is also an unalternative positioning of the residues in relation to the origin, which warns that the errors are affected by the phenomenon of autocorrelation. This graphical finding also has a numerical statistical expression given by the size of the Durbin – Watson coefficient, $DW = 0.921732$.

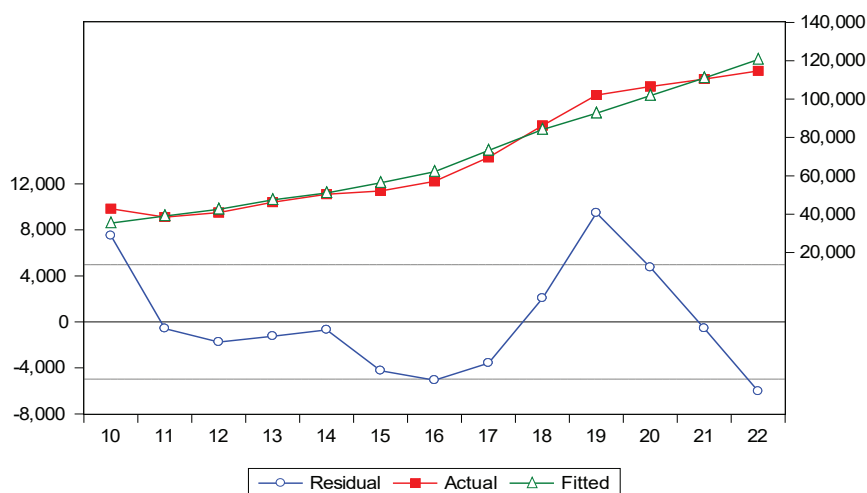
The series of the basic levels of calculation, of the levels estimated based on the regression equation, regarding the dependent variable (personnel expenses from the general consolidated budget) depending on the gross domestic product and the residual term range respectively - (Linear unifactorial econometric model)

Table 3.

Years	Personnel expenses from the general consolidated budget (basic calculation levels) -millions of lei- y	Personnel expenses from the general consolidated budget (estimated levels) -millions of lei- \hat{y}	Residues -millions of lei- $u = y - \hat{y}$	Residual plot $\hat{\sigma}_{y,\hat{y}} = \pm 4,964.756$ $-\hat{\sigma}_{y,\hat{y}} \quad 0 \quad +\hat{\sigma}_{y,\hat{y}}$
2010	42,836.8	35,343.2	7493.55	. . *
2011	38,422.7	39,004.0	-581.266	. * .
2012	40,798.8	42,553.7	-1,754.95	. * .
2013	46,241.0	47,489.5	-1,248.49	. * .
2014	50,400.1	51,088.2	-688.134	. * .
2015	52,070.0	56,308.5	-4,238.50	. * .
2016	57,068.4	62,134.9	-5,066.47	* .
2017	69,611.4	73,200.3	-3,588.87	. * .
2018	86,141.9	84,094.7	2,047.23	. * .
2019	102,118.0	92,643.7	9,474.14	. . *
2020	106,588.0	101,849.0	4,738.43	. * .
2021	110,388.0	110,950.0	-561.634	. * .
2022	114,646.0	120,671.0	-6,025.03	* . .
Sum	917,330.8	917,330.8	0.00	

**Graphic representation of the residuals, the basic levels of calculation and the levels estimated for the dynamics of personnel expenses from the general consolidated budget depending on the dynamics of the gross domestic product
(Linear unifactorial econometric model)**

Figure 2



Note: The graph legend (Figure 2) is explained as follows:

Residual = the series of values of the residual variable;

Actual = the series of values of personnel expenses from the general consolidated budget from 2010 to 2020, calculation basis;

Fitted = series of estimated values of personnel expenditure from the general consolidated budget for the period 2010-2022 based on the linear simple regression equation.

INTERPRETING THE RESULTS AND ASSESSING THE VIABILITY OF THE MODEL

The interpretation of the obtained results refers to the significance of the econometric representation indicators on the basis of which the quality and the viability certification of the model are evaluated.

The linear unifactorial econometric model of the dynamics of personnel expenses from the general consolidated budget depending on the dynamics of the gross domestic product has the following analytical form,

$$\hat{y} = -27,265.07 + 0.117270 \cdot x$$

and it is confirmed as a model with reserved viability because not all the conditions required by the certification are met:

1- „**The Correlation report**” has a size close to the maximum limit one, ($R = 0.98672$) to obtain the confirmation that there is a very strong correlation of the dynamics of personnel expenses from the general consolidated budget with the gross domestic product. Also, by the size of “**The coefficient of determination**” ($R^2 = 0.973615$) it can be specified that 97.3615% of the change in the value of personnel expenses from the general consolidated budget is explained by the modification of the gross domestic product, the difference up to 100% represents the proportion of the residual component or is motivated by the influence of other factors, not included in the model;

2- the linear unifactorial model of the dynamics of personnel expenses from the general consolidated budget depending to the dynamics of the gross domestic product, through the correlation ratio, is viable according to “**Criterion F**”, because the obtained result is significantly different from zero, with a probability of over 95% and thus validates the existence of a real statistical correlation between the variables of the studied system, considering that $F_{statistic} = 405.9085$ has a size that exceeds to a large extent the tabular value of 4.84 ($F_{tabular} = 4.84$);

3- the regression coefficient of the model, “**b**”, ($b = 0.117270$) is significantly different from zero (the null hypothesis is rejected), based on “**Criterion t**” with a significance threshold below the maximum limit of 5% for rejection null hypothesis. Under these conditions, the independent (exogenous) variable, the gross domestic product, has a significant influence on the level of personnel expenses in the general consolidated budget.

The situation presented allows us to appreciate that at an increase by one unit (one million lei) of the independent variable (gross domestic product), the personnel expenses of the general consolidated budget increase during the period 2010 - 2022 on average every year with 0.117270 units (million lei).

Also, the parameter “**a**”, the model constant, subject to the same test criterion has the statistical recognition of being significantly different from zero, thus supporting the viability of the regression equation;

4- “**The Durbin-Watson statistical coefficient**” ($DW = 0.921732$) has a size that is not positioned in the interval of acceptance of the absence of the phenomenon of autocorrelation of the variants of the residual term.

The conclusion is formulated based on the Durbin - Watson distribution for a significance threshold of 5%, the number of exogenous variables, $k = 1$ and the number of observations, $n = 13$;

It is mentioned, that the state of self-correlation of the residual terms has the effect of interpreting the following statistical indicators in a reserved way:

- o - the estimation of the standard deviation of the regression equation has an undervalued and implicit value, the coefficient of determination and the correlation ratio are overvalued. In these conditions the intensity of the interdependence between the variables of the studied system has a size marked by a certain distortion;
- o - “**The criterion t** ” used to test the significance of the estimated values of the regression equation parameters is not completely conclusive. In this case, the t-statistic values are to a certain extent overvalued, which confirms a better significance of the parameters of the dynamics of the contribution for social insurance depending on the dynamics of the gross domestic product;

5- the relative expression of the “**Estimation of the standard error of the regression equation**”, which has the value of 7.0358%, provides the information that the model (the regression equation) has viability, statistically confirmed, for an estimation of forecast estimation, because the size of this indicator does not exceed the acceptance threshold considered 10% restrictive;

6- a statistical significance similar to the one presented by the estimation of the relative standard error of the regression equation is obtained by calculating and interpreting „**Theil inequality coefficient**” ($Th = 3.0089\%$). The econometric model of the dynamics of personnel expenditures from the general consolidated budget depending on the dynamics of the gross domestic product is attested with a corresponding viability in the light of this indicator because „Theil inequality coefficient” has a value that does not exceed the allowed limit of 5 %;

7- the statistical description of the series of the error term (residual) by the coefficient of asymmetry (Skewness) and the coefficient of flattening-flattening (Kurtosis), results „**Jarque-Bera statistical coefficient**” ($JB = 1.291019$) and the probability corresponding to the JB coefficient ($P = 52.4395\%$). This information is based on an indecision assessment regarding the arrangement of the values of the error term in accordance with the normal

distribution law (the normality test of the distribution of the residual variable), since the probability associated with the *JB* coefficient is between 50% and 60%;

8- The test of the existence of the heteroscedasticity state of the errors (residual variable), „**White Heteroskedasticity Test**”, confirms the homoscedasticity property of the linear model of the personnel expenses dynamics from the general consolidated budget depending on the gross domestic product dynamics, based on the two statistical criteria applied, „**Criterion *F***” and „**Criterion χ^2** ” on the auxiliary regression equation of the correlation of the square of the residual levels with the independent variable, the gross domestic product. In these conditions the following assessments can be formulated:

- o - the error dispersion is constant, does not correlate with the independent variable, the gross domestic product;
- o - the application of „**Criterion *t***” for verifying the significance of the parameters of the regression equation has statistical support;
- o - the econometric model gives non-discriminatory importance to all observations related to the residual variable.

The econometric study that aim the elaboration and assessment of the viability of the linear unifactorial model of the dynamics of personnel expenses from the general consolidated budget depending on the dynamics of the gross domestic product of Romania for the period 2010 - 2022 can be finalized by a synthetic conclusion formulated, with full statistical certainty, that the model has a reserved viability but can be a practical support to substantiate macroeconomic policy decisions.

The complexity of the international economic and political conjuncture as well as the emergence of unforeseen situations that propagate changes of the economic growth rates can significantly invalidate the punctual forecasts, but there are sustainable statistical determinations that confirm the inclusion within two guaranteed limits with a certain probability.

The proportion of personnel expenses from the general consolidated budget in the gross domestic product is estimated to register reductions after 2019 when this proportion was 10.0%, the level estimated by the Ministry of Public Finance for 2022 is 9.1%, similar with the estimated level of execution in 2018 (Table 1). It is obvious that in this dynamic context of these expenditures will be applied measures of rationalization and their efficiency.

A calculation of the forecast of personnel expenses from the general consolidated budget in 2023, depending on the probable level of the gross

domestic product, is considered sufficiently safe by extrapolating the model for the period 2010 - 2022, $\hat{y} = -27,265.07 + 0.117270 \cdot x$.

In the conditions of maintaining the average annual growth rate of the gross domestic product from the years 2018 - 2022, based on the estimates of the Ministry of Public Finance, ($Im = 1.07$), the following possible scenario can be constructed, regarding the personnel expenses from the general consolidated budget that will be registered in 2023 depending on the size of the gross domestic product but considering the existence of an economic and political situation not affected by convulsions:

Point value:

$$\hat{y}_{2023} = -27,265.07 + 0.117270 \cdot (1,261,500.0 \cdot 1.07) = 131,026.562$$

millions of lei

and a guaranteed confidence interval with a probability of 95%,

- inferior limit: $il = 131,026.562 - 2.201 \cdot 4,964.756 = 120,099.134$ millions lei

- upper limit: $ul = 131,026.562 + 2.201 \cdot 4,964.756 = 141,953.990$ millions lei

The limit or maximum error allowed for estimating the confidence interval of the forecast of personnel expenditures from the general consolidated budget in 2023, depending on the probable level of the gross domestic product, is the result of the estimation of the standard error of the regression equation, $\hat{\sigma}_{y;\hat{y}} = \pm 4,964.756$ millions lei, with the probability factor (critical value) „ t ” which, in this case, is ± 2.201 , under the conditions of the Student distribution law (bilateral significance threshold $q = 0.05$ and $f = n - k = 13 - 2 = 11$ degrees of freedom).

Estimated boundary error:

$$\hat{\Delta} = \pm t_{q=0.05; f=n-k=13-2=11} \cdot \hat{\sigma}_{y;\hat{y}} = \pm 10,927.428 \text{ millions of lei}$$

It is also noted the existence of a relative error that affects the punctual value of the personnel expenses from the general consolidated budget depending to the gross domestic product of the year 2023 which is positioned at a level considered reasonable of 3.8%, $(4,964.756 / 131,026.562 = 0.038)$.

In the conditions of the amount of personnel expenses from the general consolidated budget of Romania, estimated for 2023, it is considered that a proportion in the gross domestic product of 8.9% - 9.7% will be reached with a predictable tendency to approach the lower limit of estimated range.

Conclusions

The study presented is a rigorous information support, open to decision makers who develop the draft of general consolidated budget on its constituent components. The estimation of the amount of personnel expenses is supported by an economically sound methodology, unanimously considered and accepted, as a logical possibility to harmonize with the economic laws acting in the economy. Under these conditions, the objective of recording a sustainable evolution of personnel expenditures in the general consolidated budget can be achieved by implementing a complex of governmental decisions that will ensure a superior performance of personnel from the public, central and local sector.

Selective Bibliography:

- [1]. **Andrei, T., Bourbonais, R.** (2008) – „*Econometrie*”, Editura Economică, București.
- [2]. **Anghel, M.G.** (2014) – „*Econometric Model Applied in the Analysis of the Correlation between Some of the Macroeconomic Variables*”, Romanian Statistical Review – Supplement/Nr. 1/2014, pp. 88–94.
- [3]. **Anghelache, C., Anghel, M.G., Manole, A.** (2015) – “*Modelare economică, financiar-bancară și informatică*”, Editura Artifex, București.
- [4]. **Burhelea, Cristina** (2014) - „*Macroeconomie*”, Editura Transversal, București.
- [5]. **Mihăilescu, N.** (2014) - „*Statistică și Bazele statistice ale econometriei*”, Editura Transversal, București.
- [6]. **Pagliacci, M., Anghelache G.V., Pocan I.M., Marinescu R.T., Manole A.** (2011) – “*Multiple Regression – Method of Financial Performance Evaluation*”, ART ECO – Review of Economic Studies and Research, Editura Artifex, Vol. 2/No.4/2011.
- [7]. **Stancu, S., Andrei, T., Iacob, A.I., Tusa, E.** (2008) - „*Introducere in econometrie utilizând EvIEWS*”, Editura Economică, București.