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Budgetary efficiency expressed as the interdependence of public expenditures and the Gross Domestic Product in the Republic of Moldova

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Abstract. *We address budget performance in terms of savings, efficiency, and effectiveness. To facilitate a quantitative analysis of budgetary efficiency, we perform a detailed study based on an econometric model of the interdependence of public expenditure, both capital and private, and GDP. We show that an increase in public expenditure, especially current, can significantly accelerate the growth of the productive sectors of the economy. Further, the implementation of performance indicators for public expenditure can lead to accelerated economic growth, both quantitatively as well as qualitatively, in the Republic of Moldova.*

Keywords: current public expenditure, GDP, efficiency, econometric model, budgetary performance.

JEL: C1, E01, H11.

Introduction

To solve the various social problems, public authorities formulate policies, which include a complex presentation of the tackled problems, the decisions approved for solving them, the instruments (laws and normative acts) by which these decisions are implemented, and the ways through which the effects of the implemented decisions will be monitored and evaluated.

Public policy, composed of two distinct components – objectives and tools for achieving these objectives – is transferred onto policy documents – such as strategies, programs, and action plans – to be implemented by the government. They serve to address the issues identified and are included in the agenda of activity. These policy documents clearly define the objectives and actions to be carried out by certain deadlines, set performance indicators, and, unlike public policies, must always have a specific budget.

In countries that implement annual performance-based budgeting, programs, as policy documents, tend to merge with budget programs (Ciubotaru & Hîncu, 2015). The implementation of public policy measures is ensured by connecting budgetary expenditures with the programs and activities of public authorities, ex. institutions.

Melkers and Willoughby, 2001, show that there exists a connection between performance-based budgeting and strategic planning of the institution's mission, goals, objectives, and implementation process that requires quantifiable information and that offers significant information on the effects of the program. Performance-based budgeting is based on strategic planning of public spending, and it subsumes the medium-term expenditure framework as an element of it. Medium-term strategic planning is often seen as a prerequisite for introducing performance-based budgeting. Strategic plans typically involve three years of design, in some states - five years.

In the public sector, especially in the budgetary process and in budgetary documents, in addition to the financial indicators for the budget, the performance or effectiveness information is also included. This is done in accordance with the theoretical methodological approach to the concept of budgetary performance. Such information, called non-financial, indirectly measures future performance. At the same time, it may include direct indicators that explicitly measure the performance of public services (in performance contracts), as well as activity indicators of budgetary entities for some specific sectors (education, health, etc.) (OECD, 2007).

In this context, budgetary performance, by content, measures inputs (resources), activities of budgetary entities, efficiency of budgetary allocations, public services (products) and results of budgetary programs (analysing whether formulated programs meet objectives), effectiveness in achieving targets or objectives.

Literature review

In literature, the efficiency of public expenditure management first is determined by a record of the MTEF (medium-term expenditure framework), the implementation of which was first initiated by donor states to promote fiscal sustainability and implement poverty reduction strategies as the main goal of the Millennium Development Goals. The development of MTEFs has been largely influenced by the high degree of indebtedness (Prakash & Cabezon, 2008).

In the visions of the authors Aristovnik and Seljak, 2009 "the starting point for any purpose of public administration must be the values of society and their evolution". In this context, long-term goals must be based on social indicators that describe the discrepancy between the desired level and the current values of society, the current state of affairs. Long-term goals should be divided into separate programs (sub-programs) with short-term goals.

These sub scopes tend to be better suited for evaluating performance at lower levels. The higher the level of purpose, the more difficult it becomes to evaluate performance. However, measuring public efficiency is relatively complicated largely due to weaknesses in budget classification and cost estimation.

Budgetary performance is interpreted by the OECD in three ways: performance-oriented budgeting, performance-based budgeting (PBB), and budget allocation performance. According to the OECD, budgetary performance is a form of budgeting, which correlates the allocation of funds with measurable results.

In the present day, the concept of budget performance encompasses two notions (or meanings) – that of performance and that of sizing (or evaluating) performance in the public sector. Performance evaluation is about recognizing efforts to set and achieve goals. In literature (Cretu et al. 2010), two models of performance of the allocation of public funds, corresponding to the two budgeting models (traditional and PBB), are approached:

- the saving-efficiency-effectiveness model,
- the input-output-result model.

In the saving-efficiency-effectiveness model approach, performance is defined by saving, efficiency and effectiveness in the process of producing government services. Saving refers to the cost of producing services. As high or low cost does not yet indicate government performance, efficiency is applied, which indicates the ratio of resources (inputs) to outputs (products or services) and effectiveness, which shows the extent to which the government has achieved its goals and objectives.

The input-output-result model notes the link between inputs, immediate results and lasting results or effects - the main components of efficiency and effectiveness indicators. Allocated monetary and non-monetary resources (inputs) produce a certain result.

The analysis of the scientific literature in the field shows that the performance measurement models fall into two categories:

- one-dimensional models - which measure performance through indicators of a financial nature,
- multidimensional models - which, in addition to financial indicators, also include non-financial indicators (Mihaiu, 2014).

In the context of empirical studies on the relationship between public spending and economic growth, literature can be divided as follows: i) Engen and Skinner, 1992, which based on data for the period 1970-1985 for 107 states, found that a balanced growth public spending and taxation leads to a reduction in overall output per economy; ii) Alexiou, 2007, by the method of least squares using data for the years 1970 -2001, concluded the presence, in the case of Greece, of a positive correlation between the increase of public expenditures and the growth of GDP. Based on these studies, we develop an econometric model to study the relationship between capital and current public expenditures on the one hand, and economic growth on the other hand, in the Republic of Moldova.

Methodology
Methodological aspects of the theoretical framework
The theoretical framework reflects extensive research confirming that the increase in public spending over time is a common phenomenon for many states regardless of their level of economic development. Numerous studies have been conducted to assess the extent to which public spending affects economic growth. This imposes the need to determine whether the behaviour of public spending in the Republic of Moldova and the economy as a whole is in accordance with the law of increasing expansion of public activities, enunciated in the previous century by Wagner and Peacock-Wiseman, or in accordance with Keynesian theory and that of Friedman and later developed by many economists.

In most of the countries, the data of public spending, as a component of national production, show that the public sector has an inevitable long-term growth trend, the Republic of Moldova is not an exception. Its public spending has been expanding since the proclamation of independence. For the period 2002-2019, for example, the ratio between the total public expenditure of state budget and the gross domestic product (GDP) was 23.0% in 2002 and in just 17 years it increased to 31.4% in 2019.

It is not conclusive whether the increase in public spending induces economic growth or not since the share of public spending over time is marked by a relative volatility. Thus, in this study, we attempt to investigate the existence of a dependence between the increase of capital and current public expenditures, and economic growth in the Republic of Moldova. This becomes the fundamental objective of the study, while the specific objects are the following:

- establish the impact of capital and current public expenditures on economic growth in the Republic of Moldova,
- establish if there is a long-term causal relationship between capital and current public expenditures, and economic growth in the Republic of Moldova,
- establish the connection between the introduction of performance-based budgeting elements and economic growth in the Republic of Moldova.

Starting from the idea that the relationship between public spending and economic growth is far from clear, and with the aim of identifying the correlation between public spending and GDP in the Republic of Moldova, we analyse the data for the period 2002-2019.

According to the economic classification of public expenditures, these are divided into capital expenditures and current expenditures. The former are public expenditures on administration, such as allowances, salaries, maintenance, etc. The latter covers expenditure on capital projects, such as roads, airports, health, education, telecommunications, electricity generation, etc.

Methodological aspects regarding econometric modelling

The functional form, on which the model we elaborate in this paper is based, implies a multiple regression equation. In an attempt to find the answer to the three questions formulated above, we use the following as variables – GDP, current public expenditure of the state budget (CHCR) and public capital expenditure of the state budget (CHCAP) for the years 2002-2019. The direct sensitivity between GDP and public spending is tested using a multiline function in which GDP is the dependent variable and public expenditures are the explanatory variables.

Methodologically, in order to elaborate the mathematical model that determines the link between the selected variables – GDP, on the one hand, and public expenditures, on the other hand – one has to go through the following stages:

- identification of mathematical relations of the model based on the graphical representation of the correlogram between variables,
- estimating the parameters for the model, in our case – using the ordinary least squares (OLS) method,
- testing the significance of the model and of the coefficients of the functions.

We use the multifactorial linear model $y = f(x_1, x_2, x_3)$.

So, after estimating the multifactorial linear model with two exogenous variables, we obtain:

$$\hat{y} = \hat{b}_0 + \hat{b}_1 x_1 + \hat{b}_2 x_2, \tag{1}$$

Where, $\hat{y}$ - is a dependent variable (resultant variable or explained variable),

$\hat{b}_0$ – constant parameter,

$\hat{b}_1, \hat{b}_2$ – parameters (coefficients, estimators) of independent variables,

x_1 , x_2 – independent variable (explanatory, regressors).

The estimation of the parameters of this model is performed using OLS, which involves minimizing the sum of the squares of the deviations of the empirical values (y) from the estimated values ($\hat{y}$), respectively.

$$\min_{b_0,b_1,b_2} \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 = \min_{b_0,b_1,b_2} \sum_{i=1}^{n} u_i^2, \tag{2}$$

The cancellation of the partial derivatives in relation to $\hat{b}_0, \hat{b}_1, \hat{b}_2$, leads to the following system of linear equations for finding the parameters of the linear equation of the multifactorial regression.

$$\begin{cases} n\hat{b}_0 + \hat{b}_1 \sum x_1 + \hat{b}_2 \sum x_2 + \cdots + \hat{b}_i \sum x_i = \sum y \\ \hat{b}_0 \sum x_1 + \hat{b}_1 \sum x_1^2 + \hat{b}_2 \sum x_1 x_2 + \cdots + \hat{b}_i \sum x_1 x_i = \sum x_1 y, \\ \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \\ \hat{b}_0 \sum x_i + \hat{b}_1 \sum x_i x_1 + \hat{b}_2 \sum x_i x_2 + \cdots + \hat{b}_i \sum x_i^2 = \sum x_i y \end{cases} \tag{3}$$

Next, we move on to the analysis of the parameters obtained in particular, and the model in general. For this, in practice, a series of indicators and criteria are used that are meant to highlight different aspects related to the adequacy and accuracy of the model.

The first aspect of the evolution of the data that we analyse is the stationarity. The Augmented Dickey - Fuller test (ADF) was used as a stationary test, or unit root test, to highlight the stationary or non-stationary nature of our dynamic series by determining the deterministic or random trend. We use the Phillips-Peron (PP) test to provide a nonparametric correction of Dickey-Fuller statistics under the conditions of autocorrelation and/or heteroskedasticity of errors. If the errors are not autocorrelated and are not heteroskedastic, then the Phillips-Perron test will lead to the same results as the simple Dickey-Fuller test.

The ADF tests are based, by the alternative hypothesis $|\phi_1| < 1$, on the estimation of the least square method, where ϕ is the 1st order differentiation operator.

The Dickey-Fuller test verifies the null hypothesis (H_0: $\phi = 0$), according to which the series is non-stationary, against the alternative hypothesis H_1: $\phi < 0$, according to which the series is stationary.

The second aspect of the evolution of the data that was analysed is the co-integration of the data. If there is a stationary linear combination between non-stationary random variables with the same degree of integration, then the combined variables are co-integrated. In the general case, the x_t and y_t series are co-integrated if two conditions are met: the series are affected by a random trend with the same degree of integration d, and the linear combination of these series allows to obtain a series with a lower integration order.

$$\Delta Y = A_0 + \Pi Y_{t-1} + A_1 \Delta Y_{t-1} + A_2 \Delta Y_{t-2} + \cdots + A_{p-1} \Delta Y_{t-p+1} + e, \tag{4}$$

Where: Y_t is the size vector $(k, 1)$, k – the number of variables,

A_0 – the size vector $(k, 1)$,

A_i – the size vector (k, k).

The third aspect of the data evolution includes the VAR analysis, which ends with the Granger causality test. Causality-Granger (CG) tests indicate variables that are useful for predicting other variables. Specifically, it can be stated that X (an independent variable) causes-Granger on Y (a dependent variable), if a prediction of Y formulated on the basis of a set of information comprising the history of X is better than a prediction that ignores the history of X. In the multilinear equation, one can check whether X causes-Granger on Y, by testing whether the coefficient b_i is significantly different from zero.

Results and discussions

The general results of the econometric model show that, in the Republic of Moldova, public spending has a significant positive effect from an economic and statistical point of view on GDP growth. Table 1 presents the results from the econometric model which regresses GDP against the current state expenditure of the state budget (CHCR) and public capital expenditure of the state budget (CHCAP) using the annual data and the basic model described above.

Table 1. The results of estimating the regression equation

Dependent Variable: LOG(PIB)
Method: Least Squares
Sample: 2000 2019
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(CHCAP)	0.071815	0.054282	1.322991	0.2057
LOG(CHCR)	0.577385	0.153573	3.759678	0.0019
Y2008	-0.141573	0.055489	-2.551385	0.0221
T	0.053188	0.016316	3.259903	0.0053
C	4.278104	1.085219	3.942156	0.0013

R-squared	0.996101	Mean dependent var		11.13365
Adjusted R-squared	0.995061	S.D. dependent var		0.817082
S.E. of regression	0.057422	Akaike info criterion		-2.664456
Sum squared resid	0.049460	Schwarz criterion		-2.415523
Log likelihood	31.64456	Hannan-Quinn criter.		-2.615862
F-statistic	958.0085	Durbin-Watson stat		1.659478
Prob(F-statistic)	0.000000			

Source: Authors' estimates based on Eviews7 econometric software (www.eviews.com).

As can be seen, the factor that contributes most to the change in GDP is, as expected, current expenditure. Using the regression equation in Table 1, we find that when coefficient of elasticity of current expenditure to GDP is 0.6%.

Table 2. Testul Dickey-Fuller developed (ADF)

Series	ADF Test Statistic	Critic value 5%	Critic value 10%	Order	Remark
Ln(PIB)	-3.4261	-3.0404	-2.6606	I(1)	Stationary
Ln(CHCAP)	-7.2341	-3.0989	-2.6904	I(1)	Stationary
Ln(CHCR)	-3.5631	-1.9628	-1.6061	I(1)	Stationary

Source: Authors' estimates based on Eviews7 econometric software (www.eviews.com).

Capital expenditure has a less significant influence on GDP. Thus, at a 1% increase in current expenditure, there is a 0.07% increase in GDP. All factor parameters of the regression passed the Student's t-test at different significance levels. The proportion in which the exogenous variables determine the variation of the dependent variable is about 99.6%.

The estimated regression equation of the dependence between public expenditure and GDP, is given by:

ln(PIB)= 0.0718*ln(CHCAP) + 0.5774*ln(CHCR) – 0.1416*y2008 + 0.0532*T +4.2781   (5)
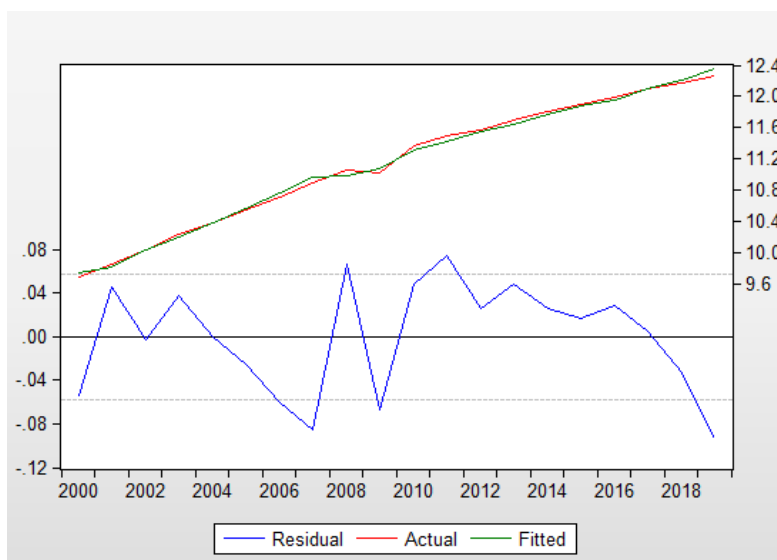

Figure 1. GDP trend: actual vs fitted.
Source: Authors' estimates based on Eviews7 econometric software (www.eviews.com).

In Figure 1, this is visually confirmed by an obvious overlap of the trend line that reflects the evolution of GDP with the trend line that reflects the adjusted evolution of GDP according to the developed model. The F-statistical indicator (based on the Snedecor-Fisher test) has a value much higher than the tabular one, the probability of invalidating the model being 0.00% at 2s.f.

Unit root test. Considering the statistical tests of ADF and PP and the critical values corresponding to the significance thresholds of 5% and 10%, we can see that the test statistics are higher than the critical values. Thus, the data series is considered stationary at this level. The unit root test indicates that the variables - GDP, CHCAP, and CHCR are integrated of the same order: order one. Their level of integration indicates the number of differentiations of the time series before their stationarity is induced. Table 2 and Table 3 summarise the results of the Dickey-Fuller and Phillips-Perron tests. The linear combination of integrated series of the same degree is considered as co-integration.

Table 3. Testul Phillips-Perron (PP)

Series	PP Test Statistic	Critic value 5%	Critic value 10%	Order	Remarcă
Ln(PIB)	-3.3905	-3.0404	-2.6606	I(1)	Stationary
Ln(CHCAP)	-2.4470	-3.0404	-2.6606	I(1)	Stationary
Ln(CHCR)	-3.5700	-1.9628	-1.6061	I(1)	Stationary

Source: Authors' estimates based on Eviews7 econometric software (www.eviews.com).

Co-integration tests. The result shows that there is a long-term relationship between GDP and the explanatory variables, in particular: CHCAP (capital public expenditure) and CHCR (current public expenditure).

The equation with the normalized cointegrating coefficients, based on the data in Table 4, is represented as follows:

$$LOG(PIB) = 0.310544 * LOG(CHCR) - 0.347251 * LOG(CHCAP) \tag{6}$$

Table 4. Normalized cointegrating coefficients

Normalized cointegrating coefficients (standart error in parantheses)		
LOG(PIB)	LOG(CHCR)	LOG(CHCAP)
1.000000	0.310544	-0.347251
	(0.11893)	(0.05413)

Source: Authors' estimates based on Eviews7 econometric software (www.eviews.com).

Applying the (equation 6) with the normalized cointegrating coefficients shows that an increase of 10% in public capital expenditure (CHCR), on average, will lead to an increase of gross domestic product (GDP) with 3.1%. And an increase in current expenditure (CHCAP) by 10%, on average, will lead to an decreasing with 3.5% in gross domestic product (GDP).

Conclusion

The budgetary performance in the legislative approach is represented by "saving, efficiency and effectiveness", while in the doctrinal approach it is further expanded by "quality of services" and "inputs-outputs-results".

The performance-based budgeting model imposes close links between public policies, MTEF and the annual budget, between the structure of budgetary programs/subprograms and the organizational structure of the public authority at the level of central public authorities.

The investigations reveal the dynamic increase, during the analysed period, of the financial size of the public sector. Based on the results obtained based on the econometric model and the interdependence between the analysed variables, it can be concluded that:

- it is opportune to increase the public expenditures, especially the current expenditures in the Republic of Moldova, which will accelerate the development of productive sectors,
- the proper, efficient management of the current public expenditures will allow the raising of the production capacity of the local economy,
- given the positive impact on GDP growth, a strict implementation of performance indicators on public spending, but also their efficient management, can increase economic growth both quantitatively and qualitatively in the Republic of Moldova, providing long-term sustainable prospects.

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