SYSTEMATIZATION OF STATISTICAL INDICATORS FOR THE ANALYSIS AND EVALUATION OF THE EFFICENCY OF PUBLIC EXPENDITURE MANAGEMENT

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ABSTRACT

This paper aims to identify statistical indicators that enable the evaluation of the efficiency of public expenditure. This, in turn, allows the improvement of public expenditure management and increases the accountability in the decision-making process. Within this paper, we also tackle the theoretical aspects of the efficiency indicators, which are expressed through the effect-to-effort ratio. This insight is derived from an empirical study on the relationship between public spending and economic growth in the Republic of Moldova between 2002-2019. Given the observed positive impact of public spending on the GDP, a strict implementation of performance indicators on public spending will facilitate both its efficient management, as well as increase economic growth in the Republic of Moldova. We expect the impact to be both quantitative and qualitative, leading to sustainable growth prospects in the long term.

Keywords: public expenditures; GDP; efficiency indicators; effect/effort ratio; empirical study; econometric model.

JEL Classification: E01, B23, C53, B26

1. INTRODUCTION

Statistical indicators enable the measurement of performance and allow assessing the efficiency and effectiveness of programmes or activities related to public expenditure. Statistically, efficiency is the relationship between the goods

and services produced by a programme, or an activity (outputs) and the resources used to produce them (inputs). It is often measured as cost per unit of production.

Effectiveness is that extend to which changes brought about by the programmes (the "outcomes") achieve their expected objectives. The development of a responsive costumer-oriented culture in public service delivery should be on the reform agenda of most countries, which require the development of practical measures for service quality

Performance measurement can serve a variety of purposes – the continuous improvement of management, the supervision of programme implementations, and internal and external accountability. It can provide valuable feedback to decision-making, but it cannot be used directly to make resource allocation decisions.

Performance is measured through a mixture of inputs, outputs, outcomes, and „process" indicators. The selection of concrete performance indicators depends on the specific objectives for which we wish to measure the performance. These indicators should be compared against a reasonable baseline such as planned objectives, or indicators for a similar programme or organisation.

To evaluate the programme, we requires a formal structure or a programme logic which consists of the following elements: (i) a description of the programme; (ii) a clarification of its objectives, and the needs that the programme is aimed at addressing; (iii) the identification of possible causal relationships between programme activities and effects; (iv) the identification of possible outcome values that can be evaluated; (v) the identification of outcome indicators and criteria to assess effectiveness; and (vi) the identification of the factors that may affect outcomes (Ciubotaru, 2014).

There are many evaluation methods; there is no golden rule for deciding which one should be chosen. Any choice should the tailored to the purpose of the study, we present our choices and their justification in this paper.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK ON APPLIED METHODS

The theoretical framework of the present subject draws attention from diverse socio-professional groups, especially regarding efficiency indicators, often presented as effect/effort ratios:

- Considering the meaning, which is frequently used by several economists, economic efficiency includes three aspects: maximum results, minimum efforts and the shortest possible implementation time. This point of view is advanced by the economist Strumilin S. through the question: „how can the maximal number of results be achieved within the national economy with a minimum of expenses and in the shortest time?" (Mureșan, 1986).
- In another opinion, „economic efficiency means obtaining useful economic and social effects, in terms of rational, economical expenditure of technical,

material, labour, and financial resources, using, for this purpose, scientific methods of conducting and organizing the productive activity" (Staicu, 1995).

- At the same time, the authors Matei S. and Băileșteanu Gh. state that „the economic efficiency of an activity is an attribute of it, expressed by the causal relationship between the total effects, in terms of nature and time, and the total resources, also in terms of nature and time, involved in that activity; a positive relationship in and of itself, in contrast to other variants of the activity and with the normalised quantities that express the requirements of the national economy of saving resources" (Matei and Băileșteanu,1986).

Academia and various international organizations have constantly paid special attention to the „costs of public activities" resulting from the increase in the marginal tax burden and the „change in the structure of public spending". Over time, economists have measured outcomes or benefits as a function of budget allocations, under a certain assumption: the higher the expenditures, the greater the benefits. As Tanzi V. argued in 1974, these assumptions can be quite different and may indeed be the opposite (Tanzi, 1974). This is essential for the concept of effectiveness.

Therefore, over time, one can observe the economists' concern about the efficient use of limited resources. An extensive academic literature, (Afonso *et al.*, 2008; Sanchez and Bermejo, 2007; Mandl *et al.*, 2008, etc.) includes investigations on the establishment, allocation and effects of the distribution of public expenditures, as well as the role of rules and institutions, together with the possibilities for the privatization of public sector activities (for example, the works of researchers Rodrik, 2000; Strauch and von Hagen, 2000; Persson and Tabellini, 2001; Drake and Simper, 2001).

In the context of empirical studies regarding the relationship between public spending and economic growth, one can distinguish the following works: i) Engen and Skinner (1992), based on data for the period of 1970-1985, found that, for 107 states, a balanced increase in public spending and taxation leads to a reduction in overall output of the economy; ii) Alexiou (2009), using the ordinarily least squares method on data for the 1970-2001 period, concluded the presence of a positive correlation between the increase of public spending and the growth of GDP in the case of Greece. We use these studies as the basis of the econometric model we develop to study the relationship between public spending and economic growth in the Republic of Moldova.

3. THE MEANING AND SEMANTICS OF "PERFORMANCE"

It is essential to start by underlining the difference between "performance orientation"; "performance indicators"; "performance appraisal" (of personnel); and "performance (or program) budgeting". None of these necessarily implies the

others; yet they are very often confused in practice leading to wasteful or counterproductive results.

It is important, to also underline the difference between "precise" and "quantitative". Vague indicators of performance are, of course, problematic. Still, indicators do not have to be quantitative to be precise. First, qualitative measures can be transformed into quantitative ones by surveys, systematic feedback, and other ways of assessing the opinion of the users. Statistical problems are tricky and may hinder this process, but in principle the possibilities exist. For example, the quality of education can be in part quantified by measuring the percentage of parents who are "fully satisfied" with their children's school. Second, as law-making demonstrates, one can achieve a great degree of precision using clear language. In the end, the objective is not to find purely quantitative indicators. Rather it is accountability – this can be achieved by indicators that have unambiguous meanings for the assessor and the person or group assessed.

Performance is a relative concept

Dictionary definitions of "performance" include such alternative terms as "accomplishment", "achievement", "realization", and "fulfilment". Most of these terms have to do with the objective effect of public actions; but some relate to the subjective notion of satisfaction experienced because of one's action. Naturally, the economic and public management literature emphasizes the former meaning, not only because of its direct implications for the population, but because subjective satisfaction is extremely difficult to measure and impossible to aggregate.

Consequently, performance may be defined in terms of effort or in terms of results. It is a mistake to completely neglect the subjective dimension of "performance", for it is one important determinant of external effectiveness. Consider what happens if the "effort" dimension is neglected, and incentives are tied exclusively to objective results. The more capable underachiever will be rewarded, and the less capable but harder-working will not. The former will therefore receive the message that underachieving carries no negative consequences; the latter – that working hard carries no rewards. Both being rational individuals, the level of effort will decline for both and hence for the entire organization.

Recognizing (maybe even rewarding) genuine individual effort can do much for morale and serve as an example for others, thus fostering the effectiveness of the organizational unit. More fundamentally, most individuals consider "a sense of accomplishment" as a strong motivator of their actions (independent of salaries, penalties, or other material incentives). Thus, if public sector reform programs inadvertently remove that motivation, other things being equal, the efficiency of public personnel is likely to decline and the effectiveness of public action along with it. We remark that this is true only in countries where the public sector and

public employees are guided by an ethos of public service – a key asset which, no less than physical assets, requires proper "maintenance" on its own terms. If, instead, satisfaction is derived from the exercise of public control, emphasis on external results can lessen unwarranted government interference with economic activity and at the same time spur the efficiency of the public sector. It remains true that the normal human drive to do something right should be harnessed, and not disregarded or depreciated (Felipe, 2016).

As such, it is critical to realize that the concept of "performance" is an instrument rather than an end. Further, it is relative: to the economic system, to the size of the country, to the role of the state, to the quality of governance, to the prevailing culture, and, of course, to the specific economic sector.

4. RESULTS AND DISCUTIONS

The measurement of "objective" performance rests on inputs; and/or on one or more of the below results (Furturescu and Mincă, 2010). Using the example of children health services:

- *inputs* are the resources used to produce the service, e.g. doctors, nurses, hospital equipment, medicines. The social value of inputs is measured by their cost. The budgeting performance criterion corresponding to inputs is compliance, i.e. defined as close adherence to budgetary ceilings and exante allocation, as well as a proper but agile procurement process.
- *output* is the service itself, e.g. number of child vaccinations. The social value of outputs is approximated by the market price for the same or the closest equivalent service, or, in its absence, by total unit cost. The performance criterion corresponding to outputs is efficiency, i.e. minimizing total input cost per unit of output, or maximizing the quantity of output in relation to a given total cost of inputs.
- *outcome* is the purpose that is achieved by producing the service, e.g. reduction in child mortality and morbidity. The social value of outcomes is subjective and arbitrary, except as revealed by public reaction. The performance criterion corresponding to outcomes is effectiveness, i.e. maximizing outcomes in relation to the outputs produced.
- *process* is the way inputs are procured, outputs produced, or outcomes achieved. The value of "good" process is undetermined. For inputs, good process consists of intelligent compliance with input acquisition and utilization rules and, of course, integrity. In some areas of public activity, such as law or politics, "due process" has its own independent validity and is a key element of good governance. For example, an increase in arrests achieved by violating civil rights would not constitute "good performance". In other areas, process indicators are a useful proxy for performance when outputs, or more often outcomes, cannot be defined with clarity. Process indicators can be quantitative, e.g. percentage of class time dedicated to

student questions, but are usually qualitative. Even then, as noted earlier, they can be transformed into quantitative indicators by feedback from users: hospital patient satisfaction can be numerically assessed through a patient survey.

Figure 1 is an illustration of the relationships among indicators (Shand *et al.,* 1994), which is also useful for their application to the budget process discussed.
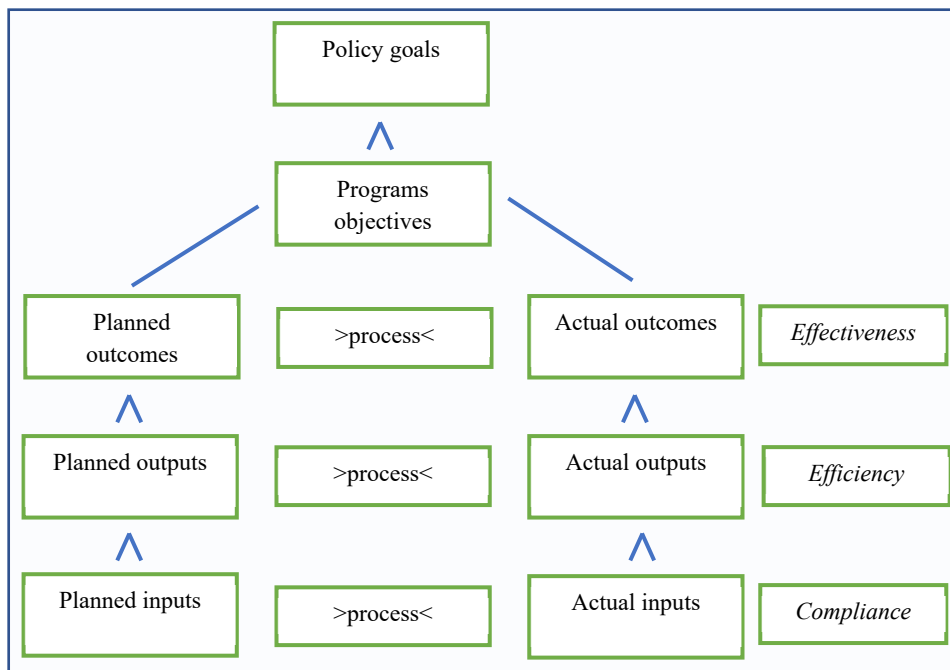
Source: prepared by the authors based on the illustration from OECD report
(Shand *et al.,* 1994)

Figure 1. Hierarchy of Performance Criteria and Indicators

The hierarchy of definitions above suggests a sort of complex production function of public services, whereby the outcome of one stage is an output of the next stage. The "accountability trade-off" noted above states that clearer and more immediate accountability is by definition narrower accountability; and conversely, the link between action and results becomes more ambiguous the broader and the more meaningful the results. Hence, control through outputs is least workable for complex tasks, e.g. mental health, rather more appropriate for simple processes, e.g. trash collection (Laking, 1999).

The above implies an "accountability chain"—with accountability clearest and most immediate by the narrowest performance criterion, i.e. compliance with

input allocations, and most ambiguous and diffuse by the broadest performance criterion, i.e. net impact.

For example, it is fairly easy to hold a village nurse strictly accountable for the output of vaccinations, and to reward or penalize them accordingly; it is difficult to hold them responsible for the outcome of improving the health of the village children. While their affirmative involvement in household sanitary conditions, or nutrition, or other health factors, may have more influence on the outcome of improving the children's health than a greater number of vaccinations; still, such involvement is not motivated by an incentive system that focuses only on the outputs.

Moreover, in the absence of close supervision, it is difficult to prevent immunizations from being performed with less than the recommended quantity of vaccine, with the remaining vaccine "leaking" out of the health delivery system. Therefore, abandoning input and quality controls in favour of output indicators may carry substantial practical risks.

These considerations are not meant to suggest that outcome indicators are "better" than output indicators, nor vice versa. All things being equal, output indicators are closer to the desired outcomes, and hence the more realistic, the closer the activity is to the final user. However, accountability can only be either broad or strict and never both. A greater specificity associated with output indicators comes with a loss of relevance; and, conversely, it would be difficult to hold public servants strictly accountable for outcomes.

The selection of output or outcome indicators is also heavily influenced by data availability and information technology. First, good data and good monitoring permit better definition of outputs and, thus, justify greater reliance on them as a measure of performance. Conversely, when data are lacking, unreliable, or monitoring is weak, measuring performance by outputs causes people to game the measures and self-delude. In such cases, the priority must first be to place compliance on a firm footing and improve both the relevant data and the monitoring capability before considering the introduction of results-based performance elements.

Further, data collection costs, and more generally the transaction costs of introducing performance indicators in a systematic manner can be enormous. These costs must be assessed realistically and weighed against the benefits expected. It is wrong to limit a debate on whether to introduce performance indicators to a single side, that of expected benefits. The introduction of performance indicators is no exception to the basic rule of economics that "there is no free lunch".

Greater attention to performance may be stimulated by a variety of means. As noted earlier, the appropriate choice of performance indicators differs for different countries, times, and sectors. Accordingly, the only valid general rule is when performance measurement is appropriate and cost-effective, performance

should be assessed according to that mix of output, outcome and process indicators that is realistic and suitable for the specific activity, sector, and country.

4.1. Formulating performance indicators

The nature of the problem can be illustrated by reference to the well-known management consulting rule that: "what gets measured, gets done". There are three conditions for this rule to apply: (i) the right thing must be measured; (ii) the thing must be measured in right way; and (iii) there must be consequences if it does not get done. None of these three conditions is easy to meet. A bigger issue is the obvious corollary to the rule: "what does not get measured, does not get done". In the public sector, the least measurable activities may be the most important ones. Finally, one must keep in mind that rule changes entail behavioural changes: in the long-term, these may be beneficial or dysfunctional depending on the modalities and fairness of the performance assessment system. It is never enough to assess the short-term consequences of changes in an organization or in incentives, nor, of course, to limit attention to the benefits expected without consideration of the costs.

The performance indicators in Table 1 are but some examples; however, they should make clear which indicators could be used as a measure of "performance" in each respective sector. We realize there are cases where these indicators are used and can add value to the career for the civil servants involved. Fortunately, as noted earlier, whenever data availability and practical considerations allow, a much fuller understanding of performance can be gained using a combination of indicators (Statutory Instruments No. 896, 2000, annexes 3-15).

Table 1. Systematization of statistical performance indicators

Sector	Type of indicator			
	Input	Output	Outcome	Proces
Administration	No. of staff	No. of policy papers	Better decisions	Openness of debate
Education	Student/teacher ratio	Retention rates	Higher literacy	Encouraging student expression
Judicial system	Bugdet	Cased heard	Low appeal rate	Assistance for indigent defendants
Police	No. of police cars	No. of arrests	Decline in crime rate	Respect for rights
Corrections	Cost/prisoner	No. of prisoners	Recidivism rate	Preventing abuse
Health	Nurses/population	No. of vaccinations	Low morbidity	„Bedside manners"
Social welfare	Social workers	Persons assisted	Exits from system	Dignified treatment

Source: elaborated by the authors based on the UK legislation, 2000 no. 896.

4.2. Evaluating the interdependence of the public expenditures – GDP, econometric model: the case of the Republic of Moldova

In most of the countries, data on public spending as a component of domestic production show that the public sector has an inevitable long-term growth trend. The Republic of Moldova is one of these countries. Based on existing data from the Ministry of Finance of the Republic of Moldova, public expenditures have been mostly expanding since the proclamation of independence, and for the period 2002-2019, for example, the ratio between total public expenditures of the state budget and gross domestic product (GDP) was 23.0% in 2002 and in just 17 years it increased to 31.4% in 2019 (Republic of Moldova Government, 2020; Timus *et al.*, 2011).

It is not conclusive whether the increase in public spending induces economic growth or not since their share over time is marked by a relative volatility. Thus, this study tries to research whether there is a dependence between the increase of public spending and economic growth in the case of the Republic of Moldova. This becomes the fundamental objective of the study, and our specific objectives are: i) establishing the impact of public expenditures on economic growth in the Republic of Moldova; ii) establishing whether there is a long-term causal relationship between public spending and economic growth in the Republic of Moldova; iii) whether there is any link between the introduction of performance-based budgeting elements and economic growth in the Republic of Moldova (Secrieru, 2011).

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 researches 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, later developed by many economists (Friedman, 1978; Killick, 2005).

Starting from the idea that the relationship between public spending and economic growth is far from clear and aiming to identify the correlation between public spending and GDP in the Republic of Moldova, we will analyse the annual data for the period 2002-2019.

The functional form of the model elaborated by us involves a regression equation. In an attempt to find the answer to the three questions, formulated above, as well as based on previous studies, the following were used as variables: GDP (pib) and total public expenditure of the state budget (chelt) for the period 2002-2019. The direct sensitivity between GDP and public spending is tested using a

function, in which GDP is the dependent variable and public spending is the explanatory variable.

Methodologically, in order to develop the mathematical model that determines the link between the selected variables, with the GDP, on the one hand, and public spending, on the other hand, one has to perform the following steps: identifying the mathematical relationships of the model based on the graphical representation of the correlation of variables; estimating the parameters for the model, in our case - using the ordinary least squares method (OLS); testing the significance of the chosen model and the coefficients of the functions found; and finally, economic interpretation of the tested parameters.

So, if we symbolize by $\hat{y}$ the adjusted values, resulting from the application of the unifactorial linear model, then:

$$\hat{y} = \hat{a} + \hat{b}x \tag{1}$$

Where:

$\hat{y}$ – is a dependent variable (resultant variable or explained variable);

$\hat{a}$ – constant parameter;

$\hat{b}$ – parameter (coefficient, estimator) independent variable;

x – independent variable (explanatory, regressor).

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

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

Therefore, the model, in its functional form, is presented as follows:

$$pib = c(1) + c(2)*chelt + eps \tag{3}$$

Where:

pib – gross domestic product (dependent variable);

c(1) – constant coefficient;

c(2) – the regression coefficient of the chelt;

chelt – expenditures of the national public budget (independent variable);

eps – random errors.

To use the linear model, we transform it into a logarithmic model:

$$\log(pib) = c(1) + c(2)*\log(chelt) \tag{4}$$

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

The first aspect of the evolution of the data, which is analysed, 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 a dynamic series. by determining the deterministic or random trend, and the Phillips-Peron (PP) test, constructed so as to achieve a nonparametric correction of the Dickey-Fuller statistics under conditions of autocorrelation and / or heteroskedasticity of errors (Iliadi şi Dodon, 2012).

Another aspect of data evolution includes VAR analysis, which ends with the Granger causality test. Causality-Granger (CG) tests indicate variables that are useful for predicting other variables. Specifically, one can state that X (the independent variable) causes Granger on Y (the 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.

4.3. Data analysis and interpretation

The general results of the econometric model show that, in case of the Republic of Moldova, public spending has a significant positive effect from an economic and statistical point of view on GDP growth. Table 2 shows the results obtained based on the econometric model used, which models the impact of public expenditure on GDP, and was fit to the annual data.

The instantiated econometric model, using the regression equation on the dependence between public expenditure and GDP, is:

$$log(pib)=2.875+0.825*log(chelt) \quad 5)$$

Table 2. Systematization of statistical performance indicators

Dependent Variable: LOG(PIB)
Method: Least Squares
Sample (adjusted): 2002 2018
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2.875203	0.651988	4.409905	0.0005
LOG(CHELT)	0.824840	0.064356	12.81681	0.0000

R-squared	0.916328	Mean dependent var	11.20934
Adjusted R-squared	0.910749	S.D. dependent var	0.656373
S.E. of regression	0.196090	Akaike info criterion	-1.310352
Sum squared resid	0.576771	Schwarz criterion	-1.212327
Log likelihood	4.637991	Hannan-Quinn criter.	-1.760608
Durbin-Watson stat	1.619099		

Source: all regressions and estimations are elaborated by the authors based on the Eviews7 econometric software

As we can see, a key contribution to GDP change, as expected, is the expenditure of the national public budget. Using the regression equation in Table 2, we find that when public expenditure increases by 10%, there is an increase of 8.25% in GDP (0.825 being the coefficient of elasticity).

The coefficient of elasticity satisfies the Student test being within the accepted norms of the limits of its tabular values.

In Figure 2, this is visually confirmed by an obvious overlap of the trend line reflecting the evolution of GDP with the trend line reflecting 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% (3.s.f.).

The Durbin-Watson test recorded a value of 1.691, which rejects the existence of residual autocorrelation.

Source: all regressions and estimations are elaborated by the authors based on the
Eviews7 econometric software

Figure 2. The actual and calculated GDP trend

Unit root tests: Taking into account the statistical tests of ADF and PP and the critical values corresponding to the significance thresholds of 5% and 10% (Table 3 and Table 4), we observe 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 - pib, chelt are integrated of the same order: order one.

Table 3. Dickey-Fuller test developed (ADF)

Series	ADF Test Statistic	Critic value 5%	Critic value 10%	Order	Remarks
GDP (pib)	-4.2262	-3.8289	-3.3629	I(1)	Staţionary
Expenditures (chelt)	-3.8770	-3.9333	-3.4200	I(1)	Staţionary

Source: all regressions and estimations are elaborated by the authors based on the Eviews7 econometric software

Table 4. Phillips-Perron test (PP)

Series	Statistic PP Test	Critic value 5%	Critic value 10%	Order	Remarks
GDP (pib)	-8.1548	-3.7911	-3.2422	I(1)	Staţionary
Expenditures (chelt)	-4.8770	-3.7911	-3.2422	I(1)	Staţionary

Source: all regressions and estimations are elaborated by the authors based on the Eviews7 econometric software

The econometric model used to investigate the impact of public spending growth on GDP growth in the Republic of Moldova for 2002-2019 is satisfactory, the proportion in which the explanatory variable determines the variation of the dependent variable is about 82.48% and coefficient of validation of the model is 91.63% (R-squared).

Following the results generated by the developed model, we conclude that, in the Republic of Moldova, public expenditure has a significant positive effect, from an economic and statistical point of view, on GDP growth. We find that there is a long-term interdependence between public spending and the GDP of the Republic of Moldova.

5. CONCLUSIONS

- To some extent, every measure of performance is a proxy measure. For example, the performance of an economic system should be gauged in terms of human well-being. Since that is impossible, it is measured in terms of goods and services produced; and, because these cannot be physically aggregated, their market value is used as a measure of economic performance.
- Although the issue of quality is ever present, there is no great methodological difficulty in defining and measuring outputs, and even less so, inputs; the issue is their relevance. Similarly, the interpretation of outcomes is rarely in doubt; the issue is their feasibility as a motivator for better performance. Outcome indicators are almost always more meaningful, and output indicators, almost always more feasible. Combining the two factors,

performance indicators are most appropriate for sectors where there is a direct and immediate relationship between the government agency's outputs and the desired outcomes.

- Once the right indicators have been chosen, the specific levels to be achieved need to be set. The general principle for the setting of any performance target is that it must be challenging but achievable. both overambitious and too easy targets lead to underachievement. "Benchmarking" and "league tables" are often used to assist in defining appropriate targets.

- Based on the developed econometric model and the results obtained by validating the model and the determined links, we conclude that: (i) it is appropriate to increase public spending in the Republic of Moldova: this will accelerate the development of productive sectors; (ii) proper, efficient management of the public spending will increase the production capacity of the domestic economy; and (iii) given the positive impact on GDP growth, a strict implementation of performance indicators on public spending, but also their efficient management, will increase economic growth both quantitatively and qualitatively in the Republic of Moldova, providing long-term sustainable prospects.

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