Assessing European Social Fund efficiency in Romania, A Linear Regression Model

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Abstract

As a part of European funding in Romania, the European Social Fund (ESF) has always to be subject of efficient spending. Assessing its efficiency is about how financed budgets are correlated with program's associated indicators for each call of proposal. The managing authority is establishing a set of rules that should allow European Commission as the donor and the general public as last instance beneficiary that funds are spend within selected and reimbursed budgets in an efficient manner. Efficiency in ESF funded projects can be assessed by using a linear regression model to describe applicants behaviours, to conclude about spending budgets and to propose further improvements is possible, as conclusions of this paper shows. Conclusions may be subject of further developments by interested researchers and also by other interested parties in current sound financial implementation of ESF in Romania: managing authority personnel, external public auditors, internal auditors, beneficiaries' financial managers.

Key words: efficiency, linear regression, budget, indicators, performance audit
J.E.L. classification: C58, E17, F37

1. Introduction

European Social Fund (ESF), funded in Romania by the two financed programs in the programming periods 2007 – 2013 and 2014 – 2020 training and related labour market services for tens of thousands individuals, spending hundreds of millions Euros under the rules set up by the managing authority of those programs. Services were delivered mostly by grants implemented by private and public applicants participating at managing authority calls for proposals. Within these calls, applicants proposed budgets, activities and indicators, describing how the public European money will be spend for best results, as managing authority requests. After an assumed evaluation of applicants' proposals, the managing authority concluded financing contracts with applicant entities, and money was paid while services were provided.

Even if the evaluation has been done simultaneously all over the country, for hundreds of applications, nobody thought about discrepancies in budgets and indicators, all focusing in verifying the description of the eligible activities and expenditures proposed by applicants, efficiency aspects seemed completely forgotten.

This paper's aim is to test linear regression on such call for proposal data, drafting conclusions on how efficiency was affected by the managing authority on focusing just on eligibility criteria applied to activities and expenditures, not to relationship that should exist between budgets and indicators, as described in Romanian and European law, what it should have been a subject of testing in performance audit missions to.

The linear regression is tested on a 2010 call for proposals data, on 318 pairs of values, budget and indicators (number of unemployed – Ind1). Even if data is obsolete, the conclusions are current now, because nothing changes in the last decades in managing authority approach towards considering eligibility in ESF financed interventions in Romania.

2. Regulations and literature review

Efficiency in public spending is widely regulated by European Parliament and by Romanian Government as well (Law 672/2002 and Government Decision 1086/2016), as a part of the performance definition, efficiency being described as "principle of efficiency which concerns the best relationship between the resources employed, the activities undertaken and the achievement of objectives" (art. 33 Regulation EU 1046 2018/1046). The same regulation states that "the use of appropriations shall focus on performance and for that purpose: (a) objectives for programmes and activities shall be established ex ante; (b) progress in the achievement of objectives shall be monitored with performance indicators; ... Specific, measurable, attainable, relevant and time-bound objectives as referred to … and relevant, accepted, credible, easy and robust indicators shall be defined where relevant." The Romanian Law describes also efficiency as an action of maximization of one activity results related to the used means (art.2 m, Law 672/2002). A similar definition explains efficiency by the way of maximizing results in the National methodology of organizing public internal audit (art. 3.2.4.b Government Decision 1086/2016).

INTOSAI uses its own definition in the appropriate audit guidance GUID 3910 (page no. 7) correspondent to ISSAI 3000, the 'principle of efficiency means getting the most from the available resources. It is concerned with the relationship between resources employed and outputs delivered in terms of quantity, quality and timing".

The Romanian Court of Accounts, in its Audit performance guidelines explains to auditors that efficiency should be seen as:"the report between obtained results and resources used to obtain these results cost ".

As a conclusion of all regulations' definition, efficiency is described by a report between two values: budgets and result indicators, so, the most appropriate indicator for efficiency could be the unit cost, as divided into variable unit costs multiplied with the number of units (the indicator) and constant fixed costs.

Performance audit of public funding is not only mentioned for programs and national budgets, but it should be also implemented, in the case of EU funding in Romania by the means of audit missions carried out by European Court of Auditors, Romanian Court of Accounts and Internal Audit as well. There is no information about performance audit of EU financed projects conducted by internal public audit.

Audit missions are important and some papers (Caranica and Domnișor 2022) are enhancing the increasing need for performance audit. Others, more applied to performance in ESF implementation

Efficiency in ESF contracts is already studied and some researches results are presented even for modelling efficiency. Some articles were reflecting performance related concerns, investigating qualitative aspects and concluding about: projects internal control environment for performance (Dănescu and Dogar, 2012), management accounting instruments for performance (Dogar, 2012), internal control under the perspective of COSO's convergences with the projects internal controls in some cases of ESF financed projects in Romania (Dănescu et al., 2013). Some articles presented quantitative methods to assist in assessing performance such as: employing public resources related to number of trainees (Dogar and Kelemen, 2010), use of quantitative methods for sound financial management decisions in Romanian ESF implementation (Dogar and Mare, 2014 a), and also a "what if" analysis for sound financial decisions in Romanian ESF grants evaluation (Dogar and Mare, 2014 b).

3. Research methodology

Within this paper, the liner regression model (Cooke, 1985) was used in order to test the connection that should exist in ESF implementation between budget, as the dependent variable, and the most important indicator, number of unemployed, as independent variable, identifying so, by means of linear regression functions, the indicator that model the most the efficiency, as the coefficient of the independent variable, together with the fixed cost of the projects' budgets submitted and reimbursed within the ESF considerate call for proposals.

Data of a call for proposals that took place in 2010 was used to test linear regression as quantitative method in simulating efficiency, as a relation between budget (as a dependent variable) and number of unemployed persons receiving services (Ind1). A total of 318 financed projects data was observed, and some filters were applied and justified to remove the outliers and then to determine valid a statistical regression function of the paper's model. It was determined, for a smaller group of the total population, a linear regression functions:

$$\text{Budget (Ind1)} = A \times \text{Ind1} + C \quad (1)$$

In this function the value of A is seen as the unit cost of Ind1 and the value of C as fixed costs of a budget.

Conclusions were drafted relating the size of the studied group to the all population observed, interpreting constant value of the regression function, and also reviewing the rationale of successive outliers' removal.

The research can be further extended to the services provided within the budgets, as for instance counselling for labour market accession and training. A broader conclusion can be reached if correlating Budget (Ind1) function with the one modelling the dependency between budget and projects' services.

All calculation is in Romanian Leu, having a parity of about 4.37 Leu per Euro at that time. Statistically dedicated software has been used for calculations.

4. Findings

For ESF sound financial management purposes, projects, as appropriations, should be financed only for programs whose achievement should be monitored with the use of SMART performance indicators. This is why in a first step of this paper research a report has been made between budget and the number of unemployed beneficiaries of the same project. The distribution of statistical cloud revealed that there was o clear concentration of projects in the same area, but also an important number of points outside of the area, especially in the area of less indicator (unemployed) and bigger budgets. A linear regression for Budget (Ind1) was tested using the least squares method by eliminating outliers from bigger budgets and less indicators until the number of pairs the regression was statistically valid (probability less than 5%), the number of pairs being so determined is 248 (Table 1).

Table no. 1 Statistical determination of 248 pairs of data for Budget (Ind1)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
IND1	260.7846	130.6362	1.996266	0.047
C	1849901	27117.3	68.21848	0
R-squared	0.015941	Mean dependent var		1884037
Adjusted R-squared	0.011941	S.D. dependent var		333435.6
S.E. of regression	331438.8	Akaike info criterion		28.26831
Sum squared resid	2.70E+13	Schwarz criterion		28.29664
Log likelihood	-3503.27	F-statistic		3.985079
Durbin-Watson stat	1.843766	Prob(F-statistic)		0.047007

Source: own processing of data source

It was so determined a linear function which with o probability of more than 95% describes the formation of budgets correlated to call for proposal target group, the unemployed.

$$\text{Budget (Ind1)} = 260.7846 \times \text{Ind1} + 1849901 \quad (2)$$

As it can be easily observed, this function has a limited representativeness of only 78%. For a broader representativeness, the simulation was restarted for the entire population of 318 pairs, by considering now as outliers also those in the area of very efficient projects (Less budget with more indicator), and also some of those in the area of very inefficient projects (more budget with less indicator). It was so found that 284 pairs of data could be used to determine a linear regression for this population (Table 2)

Table no. 2 Statistical determination of 284 pairs of data for Budget (Ind1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IND1	426.1067	216.1125	1.971689	0.0496
C	1850594	28254.76	65.49671	0
R-squared	0.013598	Mean dependent var		1891652
Adjusted R-squared	0.0101	S.D. dependent var		323471.1
S.E. of regression	321833.4	Akaike info criterion		28.20847
Sum squared resid	2.92E+13	Schwarz criterion		28.23417
Log likelihood	-4003.6	F-statistic		3.887557
Durbin-Watson stat	1.79367	Prob(F-statistic)		0.049622

Source: own processing of data source

The linear function describing with a more representativeness of 89.3% the formation of the budgets in correlation with target group is in this second approach:

$$\text{Budget (Ind1)} = 426.1067x \text{ Ind1} + 1850594 \quad (3)$$

Comparing the two functions above it can be observed that the most representative function send to a more inefficient behaviour in spending, the unit cost in the second function in bigger with up to 60% compared to the first function, that could model a more efficient, but less representative behaviour. A unit cost of services delivered to one average single unemployed for this population is 18009.74 Lei.

A conclusion on this call for proposal is incomplete in the absence of testing the reality of what happened with the expected level of efficiency the donor imposed by programming documents. By dividing the total value of the amount dedicated to improve the unemployed situation to the expected number of unemployed recipients of services, a value of 13045.92 Lei can be determined as the accepted unit value of all services delivered to one unemployed through dedicated section of ESF. Comparing this with the value resulted for the population function (3) was determined, it is clear that even with a very good representativeness function (3) doesn't respond to financial program's efficiency expectations. In this respect, to identify the population behaviour against program efficiency, a further removal of outliers is needed, until reaching the necessary statistical probability. The population of 162 pairs is meeting the described requirement, data being processed for this as described in the table bellow (Table 3).

Table no. 3 Statistical determination of 162 pairs of data for Budget (Ind1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IND1	637.7524	291.2451	2.189744	0.03
C	1796809	49665.72	36.17805	0
R-squared	0.029097	Mean dependent var		1889283
Adjusted R-squared	0.023028	S.D. dependent var		336597.6
S.E. of regression	332699.3	Akaike info criterion		28.28013
Sum squared resid	1.77E+13	Schwarz criterion		28.31825
Log likelihood	-2288.69	F-statistic		4.79498
Durbin-Watson stat	1.733684	Prob(F-statistic)		0.029991

Source: own processing of data source

The function describing the less representative population behaviour of just 50.94% of total population is listed below:

$$\text{Buget (Ind1)} = 637{,}7524 \text{ x Ind1} + 1796809 \quad (4)$$

A comparison of the last two functions allows formulating a set of observations leading to the papers conclusions

Table no. 4 Comparison of data determined for284 and162 pairs for Budget (Ind1)

Scenarios	Efficiency (unit cost) Leu/person	Variable unit cost Leu/person	Fixed costs (C) Lei	Probability		R^2
				F-statistic	Prob (F-statistic)	adjusted R^2
Function 3 (284 pairs)	19631.98	426.1067	1850594	3.887557	0.049622	0.013598
						0.0101
Function 4 (162 pairs)	13045.92	637.7524	1796809	4.79498	0.029991	0.029097
						0.023028

Source: own processing of data source

The model with the biggest representativeness is proposing unit costs for Ind1 with more than 50% of the expected (observation no.1).

The variable unit cost increases with the decrease of number of pairs (observation no. 2).

The fixed costs have values of about 90% of the projects values (observation no. 3).

The values of R^2 and adjusted R^2 are very small for both functions.

5. Conclusions

Removing outliers of about 10% of the number of pairs, a linear regression can be statistically defined to correlate budgets with financing program indicator, the unemployed, meaning that in about 90% of the proposed budgets, a link between sums and indicators can be recognized, so the budgets were, in some extent based on the number of people receiving services, even if the value of services was overvalued with about 50% as the value expected (conclusion no. 1).

As the variable unit cost increases with the decrease of number of pairs, a more clear rule on efficiency stated by the managing authority could induce more elasticity to budgets, making those more dependent of the indicators (conclusion no. 2).

The fixed costs part of the proposed and financed budgets is about 90%, so limited variable costs of only 10%, statistically validated for about 90% of the entire population means that budgets wear a large component that is being hardly explained in correlation with program indicators, financing applicants' needs, not necessary related to the financing program aim, caused by managing authority approach more on eligibility of activities and expenditures and less in indicators and unit costs.

The overall papers conclusion is that efficiency of an ESF call for proposal can be model in some extent, taking into consideration the small values of R^2 and adjusted R^2, with the use of a liner regression function. Adjustments made to total population by removing outliers can provide change of function coefficients and usefully observations and so justified conclusions for the ESF implementation improvement can be drafted.

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